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Overheard in a coffee shop near campus:
‘Hey, Frank, you don’t look too happy’
‘Yeah, I’m mad as hell. Our Dean called a meeting yesterday of all faculty to discuss the university’s new academic plan, and what it means for all the academic departments in the Faculty. I knew there had been meetings earlier in the year, a few of which I’d attended, but it seemed to be the same old waffle about building a university fit for a new age, and revolutionizing the way we teach. But those discussions didn’t seem to affect the courses I’m teaching – it was clear early on that there was no threat to the department being closed down. If anything, it looked like my classes would be getting even bigger, with the usual statements about having to do more with less. My research is going well, and there was no talk this time round about having to take on an increased teaching load. At that point, I’d switched off; I’d been through all this many times before.

But as soon as the dean started yesterday, I sensed trouble. He started talking about the need for the department to be more ‘flexible’ in its teaching. What the hell does that mean – yoga exercises at the beginning of each lecture? Then he went on to talk about ‘defining clear learning outcomes’ and ‘personalizing learning.’ Well, that’s stupid. Anyone knows that you have to internalize what you learn or it doesn’t happen. And my courses are changing all the time – if I set outcomes even at the beginning of a course, they’ll probably be different by the time we get to the end.

But then the real kicker, when I knew things were going to be difficult. ‘We want to have at least 50% of all classes taught in a blended or hybrid manner within the next five years.’ OK, I guess I could handle that – I’ve been using the LMS to back up my lectures already, but when he said that means offering the same content across different courses, and getting rid of most lectures, I really started to worry. He started rambling on about needing to serve all kinds of learners from high school entrants to lifelong learners, and for us all to teach in teams, with the senior faculty member as a teaching consultant. Now if he thinks I’m going to let some of the other idiots in this department decide what I’m going to teach, he’s out of his mind. The scary part is that I think the Dean really believes all this claptrap.

But when I really started to panic is when he said we would all have to start taking courses on how to teach. Now I get pretty good student ratings for my lectures – they just love my jokes – and I’m NOT having anyone telling me how to teach my subject. I’m one of the top people in my area of research in this country, and what the hell does the administration know about how to teach it? And when am I going to find the time, anyway, to take courses? I’m already working flat out. Why don’t they just leave us alone, and trust us to get on with the job we’re paid to do?’

If any of that rings a bell, this is the book for you.

**Why this book?**

In the book, I identify:

- the external developments that are putting pressure on university and college teaching,
- the day to day implications for instructors, teaching assistants, and students themselves
- some of the ways that instructors and institutions are successfully responding to such pressures,
- a set of strategies for redesigning your teaching that will help handle these pressures in a positive way.

Although the book contains many practical examples, it is more than a cookbook on how to teach. It looks closely at

- the nature of knowledge, and how that results in different approaches to teaching
- the science behind how students learn best,
- the features that distinguish between different technologies from an educational perspective, and from this the implications of using different types of technology for teaching
- some alternative ways to design your courses so that they better meet the needs of your students
• some suggestions for managing your teaching work load.

In other words, the book examines the underlying principles that guide effective teaching in an age when everyone, and in particular the students we are teaching, are using technology. I provide you with a framework for making decisions about your teaching, while understanding that every subject is different, and every instructor has something unique and special to bring to their teaching.

In the end, though, the book isn’t really about you. It’s about you helping your students to develop the knowledge and skills they will need in a digital age: not so much the IT skills, but the thinking and attitudes to learning that will bring them success. For that to happen, though, your students need you to be on top of your game. This book is your coach.

To come:

The **format** of the book, modelling what it teaches (each defined):

• open
• interactive
• re-usable
• adaptable
• linked into a community of practice

**Different ways to use the book:**

• straight read through
• read with activities
• as the core reading for a course on how to teach in a digital age.

**Structure of the book**

- Short abstract for each chapter

**Main take-ways**

- Set of goals or outcomes when the book is read: what the reader should be able to do.
Chapter 1: Fundamental Change in Education

Learning Objectives

When you have read this chapter you should be able to:

• describe and discuss some of the structural social and economic changes that are affecting education in a digital age
• describe and discuss some of the key skills that are needed in a digital age
• identify and discuss some of the ways technology is leading to changes in teaching and learning
• discuss the extent to which contemporary developments require changes in how we teach and how students learn

What is covered in this chapter

In this chapter, I will be discussing the pressures that are mounting on post-secondary institutions to change, particularly with regard to the way they deliver one of their core activities, teaching. I will be arguing that although our institutions will need to change if they are to survive, it is important to maintain and strengthen their core values. Thus it’s not a question of throwing out everything and starting afresh, but managing that change in such a way that the core values are protected.

In particular, this chapter covers the following topics:

• 1.1 the nature of a university
• 1.2 structural changes in the economy: the growth of a knowledge society
• 1.3 the skills needed in a digital age
• 1.4 should post-secondary education be tied directly to the labour market?
• 1.5 the impact of expansion on teaching methods
• 1.6 changing students, changing markets for higher education
• 1.7 from the periphery to the center: how technology is changing the way we teach
• 1.8 navigating new developments in technology and online learning

Also in this chapter you will find the following activities:

• Activity 1.1 on the nature of a university
• Activity 1.2 on teaching skills
• Activity 1.3 on the diversity of students and the implications for teaching
• Activity 1.4 on the main conclusions to be drawn from this chapter
Key Takeaways from the Chapter

- Teaching methods need to be used that help to develop and transfer specific skills that serve both the purposes of knowledge development and dissemination, while at the same time preparing graduates for work in a knowledge-based society.
- As student numbers have increased, teaching has regressed for a variety of reasons to a greater focus on information transmission and less focus on questioning, exploration of ideas, presentation of alternative viewpoints, and the development of critical or original thinking. Yet these are the very skills needed by students in a knowledge-based society.
- The wide diversity of the student body is a major challenge for institutions. This requires more focus on teaching methods that provide support for learners, more individualization of learning, and more flexible delivery.
- Online learning is a continuum; every instructor and every institution now needs to decide: where on this continuum of teaching should a particular course or program be?
- As more academic content becomes openly and freely available, students will look increasingly to their local institutions for support with their learning, rather than for the delivery of content. This puts a greater focus on teaching skills and less on subject expertise.
- Faculty and instructors need a strong framework for assessing the value of different technologies, new or existing, and for deciding how or when these technologies make sense for them (and/or their students) to use.
Section 1.1: The nature of a university

Although this book is as much about two year college teaching as about universities, I want to start with the university, because universities are deliberately designed to resist external pressure. There is a widely held belief – even among those who have benefited from fine degrees at prestigious universities – that universities are out of touch, that academic freedom is really about protecting professors in a comfortable career that doesn’t require them to change, and that the entire organization of the academy is better left to its medieval past: in other words, universities are an artifact of the past and something new needs to replace them.

Nevertheless, there are very good reasons why universities have been around for more than 800 years, and are likely to remain relevant well into the future. They have seen kings and popes, governments and business corporations, come and go, without any of these external forces fundamentally changing the nature of the institution. Universities pride themselves on their independence, their freedom, and their contribution to society. So let’s start by looking, very briefly, at these core values, because any change that really threatens these core values will and should be strongly resisted from professors and instructors within the institution.

Universities are fundamentally about the creation, evaluation, maintenance and dissemination of knowledge. This role in society is even more important today than in the past. For universities to perform that role adequately, though, certain conditions are necessary. First they need a good deal of autonomy. The potential value of new knowledge in particular is difficult to predict in advance. Universities provide society with a safe way of gambling on the future, by encouraging innovative research and development that may have no immediate apparent short-term benefits, or may lead to nowhere, without incurring major commercial or social loss. Another critical role is the ability to challenge the assumptions or positions of powerful agencies outside the university, such as government or industry, when these seem to be in conflict with evidence or ethical principles or the general good of society.

Perhaps even more importantly, there are certain principles that distinguish academic knowledge from everyday knowledge, such as rules of logic and reasoning, the ability to move between the abstract and the concrete, ideas supported by empirical evidence or external validation (see for instance, Laurillard, 2001). We expect our universities to operate at a higher level of thinking than we as individuals or corporations can do in our everyday lives.

One of the core values that has helped to sustain universities is academic freedom. Academics who ask awkward questions, who challenge the status quo, who provide evidence that contradicts statements made by government or corporations, are protected from dismissal or punishment within the institution for expressing such views. Academic freedom is an essential condition within a free society. However, it also means that academics are free to choose what they study, and more importantly for this book, how best to communicate that knowledge. University teaching then is bound up with this notion of academic freedom and autonomy, even though some of the conditions that protect that autonomy, such as tenure or a job for life, are increasingly under pressure.

I make this point for one reason and one reason alone. If universities are to change to meet changing external pressures, this change must come from within the organization, and in particular from the professors and instructors themselves. It is the faculty that must see the need for change, and be willing to make those changes themselves. If government or society as a whole tries to enforce changes from outside, especially in a way that challenges the core values of a university such as academic freedom, there is a grave risk that the very thing that makes universities a unique and valuable component of society will be destroyed, thus making them less rather than more valuable to society as a whole.

Two-year colleges are in a somewhat different position. It is easier (although not that easy) to impose change from above or from without the institution. However, as the literature on change management clearly indicates (see, for instance, Weiner, 2009), change occurs more consistently and more deeply when those undergoing change understand the need for it and have a desire to change. Thus in many ways both two year colleges and universities face the same challenge: how to change while preserving the integrity of the institution and what it stands for.
Activity 1.1

You may want to discuss these questions with other readers or compare your response to others. If so, click here to add your comments to the general discussion.

1. Do you think that universities are irrelevant today? Write down your reasons for your answer.
2. Write down your views on the core values of a university. How do they differ from the ones outlined here?
3. Do you think universities and colleges need to change they way they teach? If so, in what way? How could this best be done without interfering with academic freedom or other core values of the university or college?

There are no right or wrong answers to these questions but you may want to return to your answers after reading the whole chapter.
Section 1.2: Structural changes in the economy: the growth of a knowledge society

Many of the challenges that universities and colleges face are in essence good ones. It basically comes down to increased demand. Figure 1.1 below represents the extent to which knowledge has become an increasingly important element of economic development, and above all in job creation.

![Figure 1.1: The knowledge component in the workforce](image)

The figure is symbolic rather than literal. The pale blue circles representing the whole work force in each employment sector may be larger or smaller, depending on the country, as too will be the proportion of knowledge workers in that industry, but at least in developed countries and also increasingly in economically emerging countries, the knowledge component is growing rapidly: more brains and less brawn are required (see OECD, 2013a). Economically, competitive advantage goes increasingly to those companies and industries that can leverage gains in knowledge (OECD, 2013b). Indeed, such workers often create their own jobs, starting up companies to provide new services or products that did not exist before they graduated.

To indicate the kinds of knowledge and skills now needed increasingly in the work-force, see the three short video interviews below with:
There are certain common features of knowledge-based workers:

- they usually work in small companies (less than 10 people)
- they sometimes own their own business, or are their own boss; sometimes they have created their own job, which didn’t exist until they worked out there was a need and they could meet that need
- they often work on contract, so they move around from one job to another fairly frequently
- the nature of their work tends to change over time, in response to market and technological developments and thus the knowledge base of their work tends to change rapidly
- they are digitally smart or at least competent digitally; digital technology is often a key component of their work
- because they often work for themselves or in small companies, they play many roles: marketer, designer, salesperson, accountant/business manager, technical support, for example
- they depend heavily on informal social networks to bring in business and to keep up to date with current trends in their area of work
- they need to keep on learning to stay on top in their work, and they need to manage that learning for themselves
- above all, they need to be flexible, to adapt to rapidly changing conditions around them.

It can be seen then that it is difficult to predict with any accuracy what many graduates will actually be doing ten or so years after graduation, except in very broad terms. Even in areas where there are clear professional tracks, such as medicine, nursing or engineering, the knowledge base and even the working conditions are likely to undergo rapid change and transformation over that period of time. However, we shall see that it is possible to predict the skills they will need to survive and prosper in such an environment.

This is good news for the higher education sector overall as the knowledge and skill levels needed in the workforce increases. It has resulted in a major expansion of higher education to meet the demand for knowledge-based work and higher levels of skill. The province of Ontario in Canada for instance already has a participation rate of almost 60% of high school leavers going on to some form of post-secondary education, and the provincial government wants to increase that participation rate to 70%, partly to offset the loss of more traditional manufacturing jobs in the province (Ontario, 2012). This means more students for universities and colleges.
Section 1.3 The skills needed in a digital age

Knowledge involves two strongly inter-linked but different components: content and skills. Content includes facts, ideas, principles, evidence, and descriptions of processes or procedures. Most faculty, at least in universities, are well trained in content and have a deep understanding of the subject areas in which they are teaching. Expertise in skills development though is another matter. The issue here is not so much that faculty do not help students develop skills – they do – but whether these intellectual skills match the needs of knowledge-based workers, and whether enough emphasis is given to skills development within the curriculum.

The skills required in a knowledge society include the following (adapted from Conference Board of Canada, 2014):

- **communications skills**: as well as the traditional communication skills of reading, speaking and writing coherently and clearly, we need to add social media communication skills. These might include the ability to create a short YouTube video to capture the demonstration of a process or to make a sales pitch, the ability to reach out through the Internet to a wide community of people with one’s ideas, to receive and incorporate feedback, to share information appropriately, and to identify trends and ideas from elsewhere;
- **the ability to learn independently**: this means taking responsibility for working out what you need to know, and where to find that knowledge. This is an ongoing process in knowledge-based work, because the knowledge base is constantly changing. Incidentally I am not talking here necessarily of academic knowledge, although that too is changing; it could be learning about new equipment, new ways of doing things, or learning who are the people you need to know to get the job done;
- **ethics and responsibility**: this is required to build trust (particularly important in informal social networks), but also because generally it is good business in a world where there are many different players, and a greater degree of reliance on others to accomplish one’s own goals;
- **teamwork and flexibility**: although many knowledge workers work independently or in very small companies, they depend heavily on collaboration and the sharing of knowledge with others in related but independent organizations. In small companies, it is essential that all employees work closely together, share the same vision for a company and help each other out. The ‘pooling’ of collective knowledge, problem-solving and implementation requires good teamwork and flexibility in taking on tasks or solving problems that may be outside a narrow job definition but necessary for success;
- **thinking skills** (critical thinking, problem-solving, creativity, originality, strategizing): of all the skills needed in a knowledge-based society, these are some of the most important. Businesses increasingly depend on the creation of new products, new services and new processes to keep down costs and increase competitiveness. Universities in particular have always prided themselves on teaching such intellectual skills, but we have seen that the increased move to larger classes and more information transmission, especially at the undergraduate level, challenges this assumption. Also, it is not just in the higher management positions that these skills are required. Trades people in particular are increasingly having to be problem-solvers rather than following standard processes, which tend to become automated. Anyone dealing with the public needs to be able to identify needs and find appropriate solutions;
- **digital skills**: most knowledge-based activities depend heavily on the use of technology. However the key issue is that these skills need to be embedded within the knowledge domain in which the activity takes place. This
means for instance real estate agents knowing how to use geographical information systems to identify sales trends and prices in different geographical locations, welders knowing how to use computers to control robots examining and repairing pipes, radiologists knowing how to use new technologies that ‘read’ and analyze MRI scans. Thus the use of digital technology needs to be integrated with and evaluated through the knowledge-base of the subject area;

• **knowledge management**: this is perhaps the most over-arching of all the skills. Knowledge is not only rapidly changing with new research, new developments, and rapid dissemination of ideas and practices over the Internet, but the sources of information are increasing, with a great deal of variability in the reliability or validity of the information. Thus the knowledge that an engineer learns at university can quickly become obsolete. There is so much information now in the health area that it is impossible for a medical student to master all drug treatments, medical procedures and emerging science such as genetic engineering, even within an eight year program. The key skill in a knowledge-based society is knowledge management: how to find, evaluate, analyze, apply and disseminate information, within a particular context. This is a skill that graduates will need to employ long after graduation.

We know a lot from research about skills and skill development (see, for instance, Fischer, 1980, Fallow and Steven, 2000):

• skills development is relatively context-specific. In other words, these skills need to be embedded within a knowledge domain. For example, problem solving in medicine is different from problem-solving in business. Different processes and approaches are used to solve problems in these domains (for instance, medicine tends to be more deductive, business more intuitive; medicine is more risk averse, business is more likely to accept a solution that will contain a higher element of risk or uncertainty);
• learners need practice – often a good deal of practice – to reach mastery and consistency in a particular skill;
• skills are often best learned in relatively small steps, with steps increasing as mastery is approached;
• learners need feedback on a regular basis to learn skills quickly and effectively; immediate feedback is usually better than late feedback;
• although skills can be learned by trial and error without the intervention of a teacher, coach, or technology, skills development can be greatly enhanced with appropriate interventions, which means adopting appropriate teaching methods and technologies for skills development.
• although **content** can be transmitted equally effectively through a wide range of media, **skills development** is much more tied to specific teaching approaches and technologies.

The teaching implications of the distinction between content and skills will be discussed in more detail in Chapter 2.

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| 1. Write down a list of skills you would expect students to develop as a result of studying your courses.  
2. Compare these skills to the ones listed above. How well do they match?  
3. What do you do as an instructor that enables students to practice or develop the skills you have identified?  
Again, there is no correct answer to this question. The aim is to get you to think about how what you teach is... |
helping or would help students in a knowledge-based society after they have graduated, and whether you could do more.
Section 1.4: Should post-secondary education be tied directly to the labour market?

This focus on the skills needed in a digital age raises questions about the purpose of universities in particular, but also two year community colleges to some extent. Is their purpose to provide ready-skilled employees for the work-force? Certainly the rapid expansion in higher education is largely driven by government, employers and parents wanting a work-force that is employable, competitive and if possible affluent. Indeed, this has always been one role for universities, which started as preparation and training for the church, law and much later, government administration.

However, there is a real danger in tying university and college programs too closely to immediate labour market needs. Labour market demand can shift very rapidly, and in particular, in a knowledge-based society, it is impossible to judge what kinds of work, business or trades will emerge in the future. For instance, who would have predicted 20 years ago that one of the largest companies in the world in terms of stock market valuation would emerge from finding ways to rank the hottest girls on campus (which is how Facebook started).

Second, focusing on the skills required for a knowledge-based society (often referred to as 21st century skills) merely reinforces the kind of learning, especially the development of intellectual skills, for which universities have taken great pride in the past. Indeed in this kind of labour market, it is critical to serve the learning needs of the individual rather than specific companies or employment sectors. To survive in the current labour market, learners need to be flexible and adaptable, and should be able to work just as much for themselves as for corporations that increasingly have a very short operational life. The challenge then is not re-purposing post-secondary education, but making sure it meets that purpose more effectively.
Section 1.5: The impact of expansion on teaching methods

Governments in different provinces, states and countries have varied in their response to the need for more highly educated people. Some (as in Canada) have increased state funding to institutions that matches or even exceeds the increase in student numbers (see Usher, 2009). Others (particularly in the USA, Australia and England and Wales) have relied mainly on steep cuts in direct state funding for operating budgets, combined with massive increases in tuition fees.

Whatever the government strategy, in every university and college I visit, I am told instructors have more students to teach, class sizes are getting larger, and as a result, more and more classes are just lectures with little interaction. Indeed, statistics support this argument. According to Usher (2013), the overall full-time faculty:full time student ratio in Canadian universities increased from 1:18 in 1995 to 1:22 by 2011, despite a 40 per cent increase in per student funding (after inflation). In fact, a 1:22 ratio means much larger class sizes, because in universities faculty spend only a notional 40 per cent of their time on teaching, and students may take up to 10 different courses a year. The fact is that especially in first and second year classes, class sizes are extremely high. For instance, one Introductory Psychology class in a mid-sized Canadian university has one full-time professor responsible for over 3,000 students.

Tuition fees though are very visible, so many institutions or government jurisdictions have tried to control increases in tuition fees, despite cuts in operating grants, resulting in increased full time instructor:student ratios. Also, as a result of higher tuition fees and increased student debt to finance university and college education, students and parents are becoming more demanding, more like customers than scholars in an academic community. Poor teaching in particular is both visible and less and less acceptable to students.

The general complaint from faculty is that government or the institutional administration has not increased funding for faculty in proportion to the increase in student numbers. In fact, the situation is much more complicated than that. Most institutions that have expanded in terms of student numbers have handled the expansion through a number of strategies:

• hiring more contract/sessional lecturers at lower salaries than tenured faculty
• greater use of teaching assistants who themselves are students
• increasing class sizes
• increasing faculty workload.

All of these strategies tend to have a negative impact on quality, if the methods of teaching otherwise remain unchanged.

Contract instructors are cheaper to employ than full time professors but they do not usually have the same roles such as choice of curriculum and reading materials as tenured faculty, and although often well qualified academically, the relatively temporary nature of their employment means that their experience and knowledge of students are lost when their contracts end. However, of all the strategies, this is likely to have the least negative impact on quality. Unfortunately though it is also the most expensive for institutions.

Teaching assistants may be no more than a couple of years ahead in their studies than the students they are teaching, they are often poorly trained or supervised with regard to teaching, and sometimes, if they are foreign students (as is often the case), their English language skills are poor. They tend to be used to instruct parallel sections of the same course, so that students studying the same course may have widely different levels of instruction. Employing and paying teaching assistants can be directly linked to the way that post-graduate research is being funded by government agencies.

The increase in class size has tended to result in much more time being devoted to lectures and less time to small group work. Lectures are in fact a very economical way of increasing class size (provided that the lecture halls are large enough to accommodate the extra students). The marginal cost of adding an extra student to a lecture is small, since all students
are receiving the same instruction. However, as numbers increase, faculty resort to more quantitative and less flexible forms of assessment, such as multiple-choice questions and automated assessment. Perhaps more importantly, student interaction with faculty decreases rapidly as numbers increase, and the nature of the interaction tends to flow between the instructor and an individual student rather than between students interacting as a group. Research (Bligh, 2000) has shown that in lectures with 100 or more students, less than ten students will ask questions or provide comments over the course of a semester. The result is that lectures tend to focus more heavily on the transmission of information as class size increases, rather than on exploration, clarification or discussion.

Increasing faculty teaching load (more courses to be taught) is the least common of the four strategies, partly because of faculty resistance, sometimes manifesting itself in collective agreement negotiations. Where increased faculty teaching load does occur, quality again is likely to suffer, as faculty put in less preparation time per class and less time for office hours, and resort to quicker and easier methods of assessment. This inevitably results in larger classes if full-time faculty are teaching less but doing more research. However, increased research funding results in more post-graduate students, who can supplement their income as teaching assistants. As a result there has been a major expansion in the use of teaching assistants for delivering lectures. However, in many Canadian universities, full-time faculty teaching load has been going down (Usher, 2013), leading to even larger class sizes per full-time instructor.

In other employment sectors, increased demand does not necessarily result in increased cost if that sector can be more productive. Thus government is increasingly looking for ways to make higher education institutions more productive: more and better students for the same cost or less (see Ontario, 2012). Up to now, this pressure has been met by institutions over a fairly long period of time by gradually increasing class size, and using lower cost labour, such as teaching assistants, but there becomes a point fairly quickly where quality suffers unless changes are made to the underlying processes, by which I mean the way that teaching is designed and delivered.

Another side effect of this gradual increase in class size without changes in teaching methods is that faculty and instructors end up having to work harder. In essence they are processing more students, and without changing the ways they do things, this inevitably results in more work. Faculty usually react negatively to the concept of productivity, seeing it as industrializing the educational process, but before rejecting the concept it is worth considering the idea of getting better results without working as hard but more smartly. Could we change teaching to make it more productive so that both students and instructors benefit?
Section 1.6: Changing students, changing markets for higher education

Probably nothing has changed more in higher education over the last 50 years than the students themselves. In ‘the good old days’, when less than a third of students from high schools went on to higher education, most came from families who themselves had been to university or college. They usually came from wealthy or at least financially secure backgrounds. Universities in particular could be highly selective, taking students with the best academic records, and thus those most likely to succeed. Class sizes were smaller and faculty had more time to teach and less pressure to do research. Expertise in teaching, while important, was not as essential then as now; good students were in an environment where they were likely to succeed, even if the prof was not the best lecturer in the world. This ‘traditional’ model still holds true for most elite private universities such as Harvard, MIT, Stanford, Oxford and Cambridge, and for a number of smaller liberal arts colleges. But for the majority of publicly funded universities and two year community colleges in most developed countries, this is no longer the case (if it ever was).

In Canada, with 45 per cent of high school graduates going on to university and another 20 per cent going to two year community colleges, the student base has become much more diverse. As state jurisdictions push institutions to participation rates of around 70 per cent going on to some form of post-secondary education, institutions must reach out to previously underserved groups, such as ethnic minorities (particularly Afro-American and Latinos in the USA), new immigrants (in most developed countries), aboriginal students in Canada, and students with English as a second language. Governments are also pushing universities to take more international students, who can be charged full tuition fees or more, which in turn adds to the cultural and language mix. In other words, post-secondary institutions are expected to represent the same kind of socio-economic and cultural diversity as in society at large, rather than being institutions reserved for an elite minority.

We shall also see that in many developed countries, university and college students are older than they used to be and are no longer full-time students dedicated only to lots of study and some fun (or vice versa). The increasing cost of tuition fees and living expenses forces many students now to take part-time work, which inevitably conflicts with regular classroom schedules, even if the students are formally classified as full-time students. As a result students are taking longer to graduate. In the USA, the average completion time for a four year bachelors degree is now seven years (Lumina Foundation, 2014).

Perhaps more significantly, many graduates are returning later in their careers to take further courses or programs, in order to keep up in their ever-changing knowledge domain. Many of these students are working full-time, have families and are fitting their studies around their other commitments. Yet it is economically critical to encourage and support such students, who need to remain competitive in a knowledge-based society, especially as with falling birthrates and longer lives, in some jurisdictions lifelong learners, i.e. students who have already graduated but are coming back for more study, will soon exceed the number of students coming directly from high school. Thus at the University of British Columbia in Canada, the average age of all its 60,000 students is now 27, and has been steadily increasing each year over the last fifteen years. There is also an increase in students transferring from two year colleges to universities – and vice versa. For instance, in Canada, the British Columbia Institute of Technology estimates that now more than half of its new enrollments each year already have a university degree.

Another factor that makes students somewhat different today is their immersion in and facility with social media: instant messaging, Twitter, video games, Facebook, and a whole host of applications (apps) that run on a variety of mobile devices such as iPads and mobile phones. Such students are constantly ‘on’. Most students come to university or college immersed in social media, and much of their life evolves around such media. Some commentators such as Mark Prensky (2001) argue that digital natives think and learn fundamentally differently as a result of their immersion in digital media. They expect to use social media in the rest of their life. Why should their learning experience be different? We shall explore this further in Chapter 2.

Many older faculty still pine for the good old days when they were students. Even in the 1960s, when the Robbins’
Commission recommended an expansion of universities in Britain, the Vice-Chancellors of the existing universities moaned ‘More means worse.’ However, for public universities, the Platonic ideal of a professor sharing their knowledge with a small group of devoted students under the linden tree no longer exists, except perhaps at graduate level, and is unlikely ever to return to public post-secondary institutions (except perhaps in Britain, where the Cameron government seems to be dialling back the clock to the 1950s.) The massification of higher education has, to the alarm of traditionalists, opened up the academy to the great unwashed. However, we have seen that this is being done as much for economic reasons as for social mobility.

The implications of these changes in the student body for university and college teaching are profound. At one time, German math professors used to pride themselves that only five to ten per cent of their students would succeed in their exams. The difficulty level was so high that only the very best passed. A tiny completion rate showed how rigorous their teaching was. It was the students’ responsibility, not the professors’, to reach the level required. That may still be the goal for top level research students, but we have seen that today universities and colleges have a somewhat different purpose, and that is to ensure, as far as possible, that as many students as possible leave university appropriately qualified for life in a knowledge-based society. We can’t afford to throw away the lives of 95 per cent of students, either ethically or economically. In any case, governments are increasingly using completion rates and degrees awarded as key performance indicators that influence funding.

To enable as many students as possible to succeed given the wide diversity of the student body is a major challenge for institutions. More focus on teaching methods that lead to student success, more individualization of learning, and more flexible delivery are all needed. These developments put much more responsibility on the shoulders of instructors (as well as students), and require from instructors a much higher level of skill in teaching. Fortunately, over the last 100 years there has been a great deal of research into how people learn, and a lot of research into teaching methods that lead to student success. Unfortunately, that research is not known or applied by the vast majority of university and college instructors, who still rely mainly on teaching methods that were perhaps appropriate when there were small classes and elite students, but are no longer appropriate today (see, for instance, Christensen Hughes and Mighty, 2010). Thus a different approach to teaching, and a better use of technology to help instructors increase their effectiveness across a diverse student body, are now needed.

### Activity 1.3

What changes if any have you noticed in the students you are teaching? How does this differ from my analysis?

Whose responsibility is it to ensure students succeed? To what extent does the diversity of students place more responsibility on instructors?

Does more mean worse? If so, what’s the alternative?

Does your country/state have the balance right between higher and vocational education?

Need to find some way to link to comments/a discussion forum for this activity.
Section 1.7: From the periphery to the center: how technology is changing the way we teach

We shall see in Chapter 3 that technology has always played an important role in teaching from time immemorial, but until recently, it has remained more on the periphery of post-secondary education. Technology has been used mainly to support regular classroom teaching, or operated in the form of distance education, for a minority of students or in specialized departments (often in continuing education or extension). Indeed, institutions that specialize in distance education or open learning, such as the Open University in the United Kingdom, Athabasca University in Canada, and Western Governors University in the USA, have been deliberately created outside the conventional post-secondary system, and have had little direct impact on the work of most instructors in conventional universities.

However, in the last ten to fifteen years, technology has been increasingly influencing the core teaching activities of a university. Some of the ways technology is moving from the periphery to the centre can be seen from the following trends.

1.7.1. More fully online learning

Credit-based online learning is now becoming a major and central activity of most academic departments. Enrollments in fully online courses (i.e. distance education courses) now constitute between a quarter and a third of all post-secondary enrollments (Allen and Seaman, 2014). Online learning enrollments have been increasing by between 10-20 per cent per annum for the last 15 years or so in North America, compared with an increase in campus-based enrollments of around 2-3 per cent per annum. There are now at least seven million students in the USA taking at least one fully online course, with almost one million online course enrollments in just the California Community College System (Johnson and Mejia, 2014).
fully online courses from institution to institution (or even within an institution), just as in face-to-face teaching, of course.

Although online learning is expanding rapidly, research (see for instance Dabbagh, 2007) has shown that fully online courses suit some types of student better than others: older, more mature students; students with already high levels of education; part-time students who are working or with families. In general, online students need more self-discipline in studying and a greater motivation to study to succeed. This does not mean that other kinds of students can’t benefit from online learning, but extra effort needs to go into the design and support of such students online.

1.7.2. More blended and hybrid learning

As more instructors have become involved in online learning, they have realised that much that has traditionally been done in class can be done equally well or better online (a theme that will be explored more in Chapter 4). As a result, instructors have been gradually introducing more online study elements into their classroom teaching. So learning management systems may be used to store lecture notes in the form of slides or PDFs, links to online readings may be provided, or online forums for discussion may be established. Thus online learning is gradually blended with face-to-face teaching, but without changing the basic classroom teaching model.

Here online learning is being used as a supplement to traditional teaching. Although this provides students with a richer or perhaps more accurately a more convenient source of resources, using technology in this way becomes extra work both for the instructor and for the students, especially if new materials are added each time the course is offered. Although there is no standard or commonly agreed definitions in this area, I will use the term ‘blended learning’ for this use of technology.

More recently, though, lecture capture has resulted in instructors realising that if the lecture is recorded, students could view this in their own time, and then the classroom time could be used for more interactive sessions. This model has become known as the ‘flipped classroom’. Again, the more traditional model has been changed only to the extent that this allows, even in large classes, for more student interaction with the instructor. Notice also that there is a slight increase in work, both for the instructor and for the students. I therefore see it as a progression on the blended learning model.

There is though a third stage of development, and that is the total re-design of campus-based classes that takes greater advantage of the potential of technology. This means rethinking the whole experience, with a transformation of teaching on campus built around the use of technology. A process created and managed by Carol Twigg at the National Center for Academic Transformation involves going into universities and colleges and redesigning programs through the use of technology to improve learning and reduce costs. This program has been running successfully since 1999. Virginia Tech many years ago created a successful program for first and second year math teaching built around 24 x 7 computer-assisted learning supported by ‘roving’ instructors and teaching assistants (Robinson and Moore, 2006).

However, more recently, institutions with a strong history of instructional design in their online or distance courses, are beginning to look at other models for transforming classroom teaching, combining online learning with small group face-to-face interactions or mixing online and physical lab experiences. In such designs, the amount of face-to-face contact time is usually reduced, for instance from three classes a week to one, to allow more time for students to study online. There are many possible variations on this. Some institutions, such as Royal Roads University in Victoria, Canada, use a model where students spend the equivalent of one semester on campus and two semesters fully online. These designs will discussed in more detail in Chapters 2 and 4, but I use the term ‘hybrid learning’ for courses where there is a deliberate re-design of teaching to incorporate the best elements of technology and face-to-face teaching.

Some institutions are now developing plans to move a substantial part of their teaching into more hybrid or flexible modes. For instance the University of Ottawa is planning to have at least 25 per cent of its courses blended or hybrid within five years (University of Ottawa, 2013). The University of British Columbia is planning to redesign most of its first and second year large lecture classes into hybrid classes (Bates, 2013 and 2014).

These developments open up a whole new range of decisions for instructors. Online learning can be seen as a continuum (see Figure 1.4).
At one end we have teaching with no technology at all (which is very rare these days). Then there is technology used as classroom aids, which may involve the use of a learning management system to support classroom teaching, or the use of lecture capture for flipped classrooms. Hybrid learning involves a larger re-design of teaching. Finally there is fully online learning with no classroom teaching, which is one form of distance education.

This means that every instructor and every institution now needs to decide: where on this continuum of teaching should a particular course or program be? In Chapter 4 I will give some guidelines and a framework for making such decisions.

1.7.3. Open learning

Another increasingly important development linked to online learning is the move to more open education. The Open University in the United Kingdom opened in 1971 and today has over 200,000 students. There are other open universities around the world, particularly in developing countries. However, these large open universities have existed somewhat separately from the rest of the formal higher education systems. They have been used to increase access to those unable to otherwise afford post-secondary or higher education or without the necessary entry qualifications for conventional universities, or for those students, particularly adults, that want the convenience of fully distance learning.

However, over the last 10 years there have been developments in open learning that are beginning to impact directly on conventional institutions. The most immediate is open textbooks – such as what you are reading now. Open textbooks are digital textbooks that can be downloaded in a digital format by students (or instructors) for free, thus saving students considerable money on textbooks. For instance, in Canada, the three provinces of British Columbia, Alberta, and Saskatchewan have agreed to collaborate on the production and distribution of peer-reviewed open textbooks for the 40 high-enrollment subject areas in their university and community college programs.

Open educational resources (OER) are another recent development in open education. These are digital educational materials freely available over the Internet that can be downloaded by instructors (or students) without charge, and if necessary adapted or amended, under a Creative Commons license that provides protections for the creators of the
material. Probably the best known source of OER is the Massachusetts Institute of Technology OpenCourseWare project. With individual professors' permission, MIT has made available for free downloading over the Internet video lectures recorded with lecture capture as well as supporting materials such as slides.

Even more importantly, governments in some countries such as the USA and the United Kingdom are requiring all research published as a result of government funding to be openly accessible in some format. In Canada, recent Supreme Court decisions and new legislation means that it is much easier to access and use free of charge online materials for educational purposes, although there are still some restrictions.

The significance of these developments has not really been fully understood by most instructors. What it means is that eventually most content will be easily accessible and freely available through the Internet – for anyone. This could well mean a shift in power from instructors to students. Students will no longer be dependent on instructors as their primary source of information. Already some students are skipping lectures at their local institution because the teaching of the topic is better and clearer on iTunesU or the Khan Academy. If students can access the best lectures or learning materials from anywhere in the world, including the leading Ivy League universities, why would they want to get content from a middling instructor at Midwest State University?

If content is available anywhere, what students will look for increasingly from their local institutions is support with their learning, rather than the delivery of content. Furthermore, if we look at knowledge management as one of the key skills needed, it may be better to enable students to find, analyze, evaluate and apply content than for instructors to do it for them. Thus for most students within their university or college the quality of the learning support will matter more than the quality of content delivery, which they can get from anywhere. Developments in open education and the implications for the design of teaching will be discussed in greater detail in Chapter 4.

1.7.4. MOOCs

One of the main developments in online learning has been the rapid growth of Massive Open Online Courses (MOOCs). In 2008, the University of Manitoba in Canada offered the first MOOC with just over 2,000 enrollments, which linked webinar presentations and/or blog posts by experts to participants' blogs and tweets. The courses were open to anyone and had no formal assessment. In 2012, two Stanford University professors launched a lecture-capture based MOOC on artificial intelligence, attracting more than 100,000 students, and since then MOOCs have expanded rapidly around the world.

Although the format of MOOCs can vary, in general they have the following characteristics:

- open to anyone to enroll and simple enrollment (just an e-mail address)
- very large numbers (from 1,000 to 100,000)
- free access to video-recorded lectures, often from the most elite universities in the USA (Harvard, MIT, Stanford in particular)
- computer-based assessment, usually using multiple-choice questions and immediate feedback, combined sometimes with peer assessment
- a wide range of commitment from learners: up to 50 per cent never do more than register, 25 per cent never take more than the first assignment, less than 10 per cent complete the final assessment.

There has been a great deal of 'hype' and extravagant claims for MOOCs. Some have argued that they will revolutionize higher education, offering free, high quality university education to all (Ng, 2013); others have suggested that MOOCs are the answer to providing higher education to the poor in developing countries (Koller, 2012); others that MOOCs are identifying radically new ways to improve learning (Agarwal, 2013). The main benefits claimed by institutions offering MOOCs (Hollands and Tirthali, 2014) are:

- extending reach by offering high quality courses to millions of people free of charge
- building and maintaining brand
• reducing costs or increasing revenues
• improving educational outcomes
• innovation in teaching and learning
• research on teaching and learning.

However, there is no evidence to date to support any other than the first claim, of extending reach, and others point to:

• the very high non-completion rates,
• the difficulties of assessing accurately very large numbers of students, especially in the non-quantitative subjects,
• lack of learner support (compared, for instance, to that offered in credit-based online learning)
• the weakness of peer assessment given the very wide range of abilities and prior knowledge of participants,
• the difficulty for learners of navigating and evaluating a massive number of online discussion comments and posts,
• poor pedagogy,
• the colonial or imperialist notion of offering programs from the United States as a replacement for indigenous degrees and qualifications, and
• the lack of sustainable business models, especially for the institutions offering MOOCs.

The future of MOOCs is difficult to forecast. They will certainly evolve over time, and will probably find some kind of niche in the higher education market. However, MOOCs are merely the latest example of the rapid evolution of technology, the over-enthusiasm of early adopters, and the need for careful analysis of the strengths and weaknesses of new technologies for teaching. This means that faculty and instructors need a strong framework for assessing the value of different technologies, new or existing, and for deciding how or when these technologies make sense for them and their students to use.
Section 1.8 Navigating new developments in technology and online learning

Instructors in both universities and colleges now face the following challenges:

- the rapid rate of change in new technologies,
- the pressure to become more productive through the use of technology,
- the need to develop teaching methods that are appropriate for an increasingly diverse student body,
- to teach in ways that help develop the knowledge and skills needed in today's society.

However, in general, university instructors have little or no training in teaching, pedagogy or the research on learning. We wouldn’t expect pilots to fly a modern jet without any training, yet that is exactly what we are doing with our instructors in post-secondary education.

This book then aims to provide a framework for making decisions about how to teach, and how best to use technology, in ways that are true to the core values of universities and colleges, while building on the large amount of research into learning and teaching that has been done over the last 50 years or so.

The next chapter deals with the most important question of all: how do you want to teach in a digital age?

Key Takeaways

- Teaching methods need to be used that help to develop and transfer specific skills that serve both the purposes of knowledge development and dissemination, while at the same time preparing graduates for work in a knowledge-based society
- As student numbers have increased, teaching has regressed for a variety of reasons to a greater focus on information transmission and less focus on questioning, exploration of ideas, presentation of alternative viewpoints, and the development of critical or original thinking. Yet these are the very skills needed by students in a knowledge-based society.
- The wide diversity of the student body is a major challenge for institutions. This requires more focus on teaching methods that provide support for learners, more individualization of learning, and more flexible delivery.
- Online learning is a continuum; every instructor and every institution now needs to decide: where on this continuum of teaching should a particular course or program be?
- As more academic content becomes openly and freely available, students will look increasingly to their local institutions for support with their learning, rather than for the delivery of content. This puts a greater focus on teaching skills and less on subject expertise.
- Faculty and instructors need a strong framework for assessing the value of different technologies, new or existing, and for deciding how or when these technologies make sense for them (and/or their students) to use.
Activity 1.4

Write down at least five conclusions you would draw as an instructor from this chapter (besides the Key Takeaways).

Click here to compare your answers with mine (don’t look until AFTER you’ve done the activity!).
Feedback on Activity 1.4

Activity 1.4

Write down at least five conclusions you would draw as an instructor from this chapter (besides the Key Takeaways)

There are many possible conclusions one could draw, but here are mine:

1. Universities and colleges have a broader purpose than just meeting short-term labour market demands. On the other hand, there is a 'hidden contract' between the expansion of post-secondary education, and the need to create a work-force that is skilled, adaptable and competitive. I don't see a necessary conflict here. Many of the activities we consider to be central to the purpose of a university can fulfill these work-force needs with relatively little tweaking.

2. The diversity of the student body and the easy availability of content raises the importance of good quality teaching based on sound pedagogical principles and research in learning. This means professionalizing teaching in post-secondary education.

3. Technology change is constant. Indeed if anything it is accelerating. New technologies that could be applied in education are being developed all the time. So technology is not going away. It’s no use shutting your eyes and hoping that you can manage without making some decisions about whether to use technology or not in your teaching. The pressure to use technology is going to increase, not go away.

4. Relatively few technologies are designed specifically for education. There is more push from manufacturers and technology advocates than pull from instructors. Nevertheless it is clear that over time, many technologies have proved valuable educational tools.

5. There’s a lot to choose from, and there are some major differences between tools. What are the educational differences, if any, between different technologies?

6. It is only in the last few years that technology has started to make major changes to the way we deliver education. Distance education and online learning were more of a fringe or peripheral activity to the main provision of learning, which was in classrooms and on campus. But this is definitely beginning to change. Technology is forcing us to examine more fundamentally the purpose and process of teaching, what constitutes valid knowledge, and how best to acquire it.

7. All this means you need some kind of framework for making decisions about whether or not to use a technology, and how best to use it. Th
Chapter 2: The nature of knowledge and the implications for teaching

Purpose of the chapter

This chapter discusses the relationship between our views on the nature of knowledge and the way we decide to teach.

After reading this chapter you should be able to:

- recognize your own epistemological/philosophical position that determines the way you are currently teaching
- reflect on the similarities or differences between academic and everyday knowledge
- decide whether technology changes the nature of knowledge, and consider the implications for teaching
- decide on whether or not to change your overall approach to teaching in the light of the issues raised in this chapter.

What is covered in this chapter

In this chapter, I will be discussing different beliefs about the nature of knowledge, and how that influences teaching and learning.

In particular, this chapter covers the following topics:

- 2.1. Art, theory, research and best practices in teaching
- 2.2 Epistemology and why it’s important
  - 2.2.1. The nature of knowledge: a brief introduction to epistemology
  - 2.2.2 Academic knowledge
  - 2.2.3 Implications for teaching
  - 2.2.4 Conclusions
- 2.3 Does technology change the nature of knowledge?
  - 2.3.1 Knowledge as a commodity
  - 2.3.2 Academic vs applied knowledge
  - 2.3.3 The relevance of academic knowledge in the knowledge society
  - 2.3.4 Academic knowledge and other forms of knowledge
- 2.4 Knowledge and new technology

Also in this chapter you will find the following activities:

- Activity 2.1 How good a teacher are you?
- Activity 2.2 More on epistemology and teaching
- Activity 2.3 Epistemology and academic knowledge
### Key Takeaways

1. Teaching is a highly complex occupation, which needs to adapt to a great deal of variety in context, subject matter and learners. It does not lend itself to broad generalizations. Nevertheless it is possible to provide guidelines or principles based on best practices, theory and research, that must then be adapted or modified to local conditions.

2. Our underlying beliefs and values, usually shared by other experts in a subject domain, shape our approach to teaching. These underlying beliefs and values are often implicit and are often not directly shared with our students, even though they are seen as essential components of becoming an 'expert' in a particular subject domain.

3. It is argued that academic knowledge is different from other forms of knowledge, and is even more relevant today in a digital age.

4. However, academic knowledge is not the only kind of knowledge that is important in today's society, and as teachers we have to be aware of other forms of knowledge and their potential importance to our students, and make sure that we are providing the full range of contents and skills needed for students in a digital age.


Scenario B: A pre-dinner party discussion

List of characters.

- Peter and Ruth (hosts)
- Stephen (a mechanical engineer and Peter’s brother)
- Caroline (a writer and Ruth’s friend)

Peter to Stephen. I think Caroline’s arrived. Now I know you’ve not met Caroline before, but for goodness sake, do try to be polite and sociable this time. The last time you were here, you hardly said a word.

Stephen. Well, nobody said anything that interested me. It was all about books and art. You know I’m not interested in that sort of thing.

Peter. Well, just try. Here she is. Caroline – lovely to see you again. Come and sit down. This is Stephen, my brother. I don’t think you’ve met, although I’ve told you about him – he’s a professor of mechanical engineering at the local university. But first, what would you like to drink?

Caroline. Hi, Stephen. No, I don’t think we have met. Nice to meet you. Peter, I’ll have a glass of white wine, please.

Peter. While you’re introducing yourselves, I’ll go and get the drinks and give Ruth a hand in the kitchen.

Stephen. Peter says you’re a writer. What do you write about?

Caroline (laughing). Well, you do like to get straight to the point, don’t you? It’s a bit difficult to answer your question. It depends on what I’m interested in at the time.

Stephen. And what are you interested in at the moment?

Caroline. I’m thinking about how someone would react to the loss of someone they love due to the action of someone else they also love deeply. It was prompted by an item on the news of how a father accidentally killed his two year old daughter by running her over when he was backing the car out of the garage. His wife had just let the girl out to play in the front garden and didn’t know her husband was getting the car out.

Stephen. God, that’s awful. I wonder why the hell he didn’t have a rear view video camera installed.

Caroline. Well, the horrible thing about it is that it could happen to anyone. That’s why I want to write something around such everyday tragedies.

Stephen. But how can you possibly write about something like that if you haven’t experienced that kind of thing yourself? Or have you?

Caroline. No, thank goodness. Well, I guess that’s the art of a writer – the ability to embed yourself in other people’s worlds, and to anticipate their feelings, emotions and consequent actions.

Stephen. But wouldn’t you need a degree in psychology or experience as a grief counsellor to do that in that situation?

Caroline. Well, I might talk to people who’ve undergone similar kinds of family tragedies, to see what kind of people they are afterwards, but basically it’s about understanding how I might react in such a situation and projecting that and modifying that according to the kind of characters I’m interested in.

Stephen. But how do you know it would be true, that people really would react the way you think they would?

Caroline. Well, what is ‘truth’ in a situation like that? Different people are likely to act differently. That’s what I want to explore in the novel. The husband reacts one way, the wife another, and then there’s the interaction between the two, and all those around them. I’m particularly interested in whether they could actually grow and become better people, or whether they disintegrate and destroy each other.

Stephen. But how can you not know that before you start?
Caroline. Well, that’s the point, really. I don’t. I want the characters to grow in my imagination, and the outcome will inevitably be determined by that.

Stephen. But if you don’t know the truth, how those two people actually responded to that tragedy, how can you help them or others like them?

Caroline. But I’m a novelist, not a therapist. I’m not attempting to help anyone in such an awful situation. I’m trying to understand the general human condition, and to do that, I have to start with myself, what I know and feel, and project that into another context.

Stephen. But that’s nonsense. How can you possibly understand the human condition just by looking inwards at yourself, and making up a fictional situation, that probably has nothing to do with what actually happened?

Caroline (sighs). Stephen, you’re a typical bloody scientist, with no imagination.

Peter (arriving with the drinks). Well, how are you two getting along?

Obviously at this point, not very well. The problem is that they have different world views on truth and how it can be reached. They start from very different views about what constitutes knowledge, how knowledge is acquired, and how it is validated. As always, the ancient Greeks had a word for thinking about the nature of knowledge: epistemology. We shall see that this is an important driver of how we teach.
2.1: Art, theory, research, and best practices in teaching

All teaching is a mix of art and science. It is an art because any teacher or instructor is faced with numerous and constantly changing variables, which require rapid judgement and decision-making. Good teachers usually have a passion for teaching so the emotional as well as the cognitive side is important. In many cases, it’s also about personal relationships, the extent to which an instructor can empathise with students or appreciate their difficulties in learning, and the extent to which the instructor can communicate effectively.

There is also a science of teaching, based on theory and research. We shall see in fact there are many, often conflicting theories, driven primarily by epistemological differences about the nature of knowledge, and by different value systems. Then over the last 100 years there has been a great deal of empirical research into how students learn, and effective teaching methods, which at its best is driven by a strong, explicit theoretical base, and at its worse by mindless data-collection (rankings, anyone?).

Lastly, there are what are known as best practices, based on teachers’ experience of teaching. While in many cases these have been validated by research or are driven by theories of learning, this is not always the case. As a result, what some people see as best practices are not always universally shared by others, even if best practices are seen in general as current accepted wisdom.

As a result, the most extensively trained teachers don’t always make good teachers if they don’t have the talent and emotional connection with learners, and untrained teachers (which covers virtually all university instructors), sometimes succeed, even with little experience, because they have a knack or in-born talent. However, although such instructors are often held up as the triumph of art over science in teaching, they are in practice very rare. Many of these untutored, brilliant instructors have learned rapidly on the job by trial and error, with the inevitable casualties along the way.

For all these reasons, there is no one best way to teach that will fit all circumstances, which is why arguments over ‘modern’ or ‘traditional’ approaches to teaching reading or math, for example, are often so sterile. Good teachers usually have an arsenal of tools, methods and approaches that they can draw on, depending on the circumstances. Also teachers and instructors will differ over what constitutes good teaching, depending on their understandings of what knowledge is, what matters most in learning, and their priorities in terms of desirable learning outcomes.

Nevertheless, these apparent contradictions do not mean that we cannot develop guidelines and techniques to improve the quality of teaching, or that we have no principles or evidence on which to base decisions about teaching, even in a rapidly changing digital age. The aim of this book is to provide such guidelines, while recognizing that one size will not fit all, and that every teacher or instructor will need to select and adapt the suggestions in this book to their own unique context. For this approach to work, though, we need to explore some fundamental issues about teaching and learning, some of which are rarely addressed in everyday discussions about education. The first and probably most important is epistemology.

Activity 2.1: How Good a Teacher Are You?

1. Write down, in order of priority, what you consider to be the three most important characteristics of a good teacher.
2. When you’ve done that, go to the comment section, add your contribution under the heading 2.1, then compare your answers with those of others who have done this. You can also compare it with my answer in the comment section.
3. Add your explanation of why your answer differs from others (and mine!).
2.2: Epistemology and why it's important

We saw in the dinner party scenario that Stephen and Caroline had quite different beliefs about the nature of knowledge. The issue here is not who was right, but that we all have implicit beliefs about the nature of knowledge, what constitutes truth, how that truth is best validated, and, from a teaching perspective, how best to help people to acquire that knowledge. The basis of that belief will vary, depending on the subject matter, and, in some areas, such as social sciences, even within a common domain of knowledge. It will become clear that our choice of teaching approaches and even the use of technology are absolutely dependent on beliefs and assumptions we have about the nature of knowledge, about the requirements of our subject discipline, and about how we think students learn. We will also see that there are some common, shared beliefs about academic knowledge that transcend disciplinary boundaries, but which separate academic knowledge from general, 'every day' knowledge.

2.2.1 The nature of knowledge: a brief introduction to epistemology

The way we teach in higher education will be driven primarily by our beliefs or even more importantly, by the commonly agreed consensus within an academic discipline about what constitutes valid knowledge in the subject area. The nature of knowledge centres on the question of how we know what we know. What makes us believe that something is 'true'? Questions of this kind are epistemological in nature. Hofer and Pintrich (1997) state: 'Epistemology is a branch of philosophy concerned with the nature and justification of knowledge.'

The famous argument at the British Association in 1860 between Thomas Huxley and the Bishop of Oxford, Samuel Wilberforce, over the origin of species is a classic example of the clash between beliefs about the foundations of knowledge. Wilberforce argued that Man was created by God; Huxley argued that Man evolved through natural selection. Bishop Wilberforce believed he was right because 'true' knowledge was determined through faith and interpretation of holy scripture; Professor Huxley believed he was right because 'true' knowledge was derived through empirical science and rational skepticism.

An important part of higher education is aimed at developing students' understanding, within a particular discipline, of the criteria and values that underpin academic study of that discipline, and these include questions of what constitutes valid knowledge in that subject area. For many experts in a particular field, these assumptions are often so strong and embedded that we may not even be openly conscious of them unless challenged. But for novices, such as students, it often takes a great deal of time to push down through the immediate content to see the underlying value systems that drive choice of content and methods of teaching. Two dominant epistemological positions in education today are objectivism and constructivism.

2.2.1.1 Objectivism

Objectivists believe that there exists an objective and reliable set of facts, principles and theories that either have been discovered and delineated or will be over the course of time. This position is linked to the belief that truth exists outside the human mind, or independently of what an individual may or may not believe. Thus the laws of physics are constant, although our knowledge of them may evolve as we discover the 'truth' out there.

2.2.1.2 Constructivism

Constructivists believe that knowledge is essentially subjective in nature, constructed from our perceptions and mutually agreed upon conventions. According to this view, we construct new knowledge rather than simply acquire it via
memorization or through transmission from those who know to those who don’t know. Constructivists believe that meaning or understanding is achieved by assimilating information, relating it to our existing knowledge, and cognitively processing it (i.e., thinking about it). Social constructivists believe that this process works best through discussion and social interaction, allowing us to test and challenge our own understandings with those of others. For a constructivist, even physical laws exist because they have been constructed by people from evidence, observation, and deductive or intuitive thinking, and, most importantly, because certain communities of people (in our example, scientists) have mutually agreed what constitutes valid knowledge.

### 2.2.1.3 Connectivism

A third epistemological position, connectivism, has emerged in recent years that is particularly relevant to a digital society. In connectivism it is the collective connections between all the ‘nodes’ in a network (and some of the nodes may be databases or non-human appliances such as servers) that result in new forms of knowledge.

For Siemens (2004, p. 121), it is the connections and the way information flows that result in knowledge existing beyond the individual. He argues that:

‘Connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity….Learning (defined as actionable knowledge) can reside outside of ourselves (within an organization or a database).’

In particular, new knowledge is created based on the flow and patterns of information and communications over the Internet, and learning is the ability to recognize and interpret such flows. According to Siemens, knowledge is created beyond the level of individual human participants, and is constantly shifting and changing. Knowledge in networks is not controlled or created by any formal organization, although organizations can and should ‘plug in’ to this world of constant information flow, and draw meaning from it.

Downes (2007) makes a clear distinction between constructivism and connectivism:

‘In connectivism, a phrase like “constructing meaning” makes no sense. Connections form naturally, through a process of association, and are not “constructed” through some sort of intentional action. …Hence, in connectivism, there is no real concept of transferring knowledge, making knowledge, or building knowledge. Rather, the activities we undertake when we conduct practices in order to learn are more like growing or developing ourselves and our society in certain (connected) ways.’

Knowledge in connectivism is a chaotic, shifting phenomenon as nodes come and go and as information flows across networks that themselves are inter-connected with myriad other networks. The significance of connectivism is that its proponents argue that the Internet changes the essential nature of knowledge. ‘The pipe is more important than the content within the pipe,’ to quote Siemens again.

### 2.2.2 Academic knowledge

Academic knowledge is a specific form of knowledge that has characteristics that differentiate it from other kinds of knowledge, and particularly from knowledge or beliefs based solely on direct personal experience. In summary, academic knowledge is a second-order form of knowledge that seeks abstractions and generalizations based on reasoning and evidence.

Fundamental components of academic knowledge are transparency, codification (written or recorded in some format), reproduction, and communicability. Transparency means that the source of the knowledge can be traced and verified. Codification means that the knowledge can be consistently represented in some form (words, symbols, video). Knowledge can be reproduced or have multiple copies, necessary for communication. Lastly, knowledge must be in a form such that it can be communicated and challenged by others.

Laurillard (2001) recognizes the importance of relating the student’s direct experience of the world to an understanding of academic concepts and processes, but she argues that teaching at a university level must go beyond direct experience to reflection, analysis and explanations of those direct experiences. Because every academic discipline has a specific
set of conventions and assumptions about the nature of knowledge within its discipline, students in higher education need to change the perspectives of their everyday experience.

As a result, Laurillard argues that university teaching is 'essentially a rhetorical activity, persuading students to change the way they experience the world’ (p.28). This means that the student has to acquire knowledge of the teacher’s way of experiencing the world (or, more accurately, the agreed conventions within a discipline about how the subject area should be approached). Laurillard then goes on to make the point that because academic knowledge has this second-order character, it relies heavily on symbolic representation, such as language, mathematical symbols, ‘or any symbol system that can represent a description of the world, and requires interpretation’ (p.27) to enable this mediation to take place. If academic knowledge requires mediation, then this has major significance for the use of technology. Language (i.e. reading and speaking) is only one channel for mediating knowledge. Media such as video, audio, and computing can also provide teachers with alternative channels of mediation.

Laurillard’s reflections on the nature of academic knowledge are a counter-balance to the view that students can automatically construct knowledge through argument and discussion with their peers, and self-directed study. For academic knowledge, the role of the teacher is to help students understand not just the facts or concepts in a subject discipline, but the rules and conventions for acquiring and validating knowledge within that subject discipline. Irrespective of the discipline or subject domain, though, academic knowledge shares common values or criteria, making academic knowledge itself a particular epistemological approach.

2.2.3 Implications for teaching

Our epistemological position has direct practical consequences for how we teach.

2.2.3.1 Objectivist approaches to teaching

A teacher operating from a primarily objectivist view is more likely to believe that a course must present a body of knowledge to be learned. This may consist of facts, formulas, terminology, principles, theories and the like. The effective transmission of this body of knowledge becomes of central importance. Lectures and textbooks must be authoritative, informative, organized, and clear. The student’s responsibility is accurately to comprehend, reproduce and add to the knowledge handed down to him or her, within the guiding epistemological framework of the discipline. Course assignments and exams would require students to find ‘right answers’ and justify them. Original or creative thinking must still operate within the standards of an objectivist approach – in other words, new knowledge development must meet the rigorous standards of empirical testing within agreed theoretical frameworks. An ‘objectivist’ teacher has to be very much in control of what and how students learn, choosing what is important to learn, the sequence, the learning activities, and how learners are to be assessed.

2.2.3.2 Constructivist approaches to teaching

Contrast this approach to the constructivist one in which students are presented with a problem, and can choose how to go about solving that problem. The level of teacher guidance can vary, from none at all, to providing some guidelines on how to solve the problem, to directing students to possible sources of information that may be relevant to solving that problem. If the teacher is a social constructivist, students will probably work in groups, help each other and compare solutions to the problem. There may not be considered one ‘correct’ solution to the problem, but the group may consider some solutions better than others, depending on the agreed criteria of success for solving the problem. It can be seen that there can be ‘degrees’ of constructivism, since in practice the teacher may well act as first among equals, and help direct the process so that ‘suitable’ outcomes are achieved. The fundamental difference is that students have to work towards constructing their own meaning, testing it against ‘reality’, and further constructing meaning as a result. Learning is a constantly dynamic process, in which understanding changes and becomes deeper over time.
2.2.3.3 Connectivist approaches to learning

Learning becomes the ability to tap into significant flows of information, and to follow those flows that are significant. Siemens (2004) identifies the principles of connectivism as follows:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known.
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision.

Downes (2007) states that:

‘at its heart, connectivism is the thesis that knowledge is distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks. [Connectivism] implies a pedagogy that (a) seeks to describe ‘successful’ networks (as identified by their properties, which I have characterized as diversity, autonomy, openness, and connectivity) and (b) seeks to describe the practices that lead to such networks, both in the individual and in society (which I have characterized as modeling and demonstration (on the part of a teacher) and practice and reflection (on the part of a learner)).

2.2.4 Conclusions

I have chosen just three epistemological approaches that influence teaching and learning, but I could have chosen many others. For instance, in medieval times, scholasticism was a driving force in European universities.

Scholasticism places a strong emphasis on dialectical reasoning to extend knowledge by inference, and to resolve contradictions. Scholastic thought is also known for rigorous conceptual analysis and the careful drawing of distinctions. In the classroom and in writing, it often takes the form of explicit disputation: a topic drawn from the tradition is broached in the form of a question, opponents’ responses are given, a counterproposal is argued and opponent’s arguments rebutted. (Wikipedia, accessed 13 July, 2014)

Elements of scholasticism can still be found at undergraduate level in elite universities such as Oxford and Cambridge, and at graduate level in other universities, within their tutorial systems or small seminars.

It can be seen then that there are different epistemologies that influence teaching today. Furthermore, much to the consternation and confusion of many students, teachers themselves will have different epistemological positions, not just across different disciplines, but sometimes within the same discipline. For instance, subject areas such as psychology and economics may contain different epistemological foundations in different parts of the curriculum: statistics is validated differently from Freudian analysis or behavioural factors that influence investor behaviour. Epistemological positions are often not always explicitly discussed with students, are not always consistent even within a subject discipline, and are not mutually exclusive. Thus a teacher may deliberately choose to use a more objectivist approach with novice students, then move to a more constructivist approach with more experienced students. Even within the same lesson, the teacher may shift epistemological positions, but this may cause confusion for students if not explained.

At this point, I’m not taking sides (although it will become clear that I favour in general a more constructivist philosophy). Arguments can be made for or against any of these epistemological positions. However, we need to be aware that knowledge and consequently teaching is not a pure, objective concept, but driven by different values and beliefs about
the nature of knowledge. Furthermore, there is an added wrinkle, because in Western societies, academic knowledge is considered by many to be different from everyday knowledge. This will be discussed in the next section.

Activity 2.2 More on epistemology and teaching

I’ve really just touched on highly complex topics here. No matter how objective I’ve tried to be in summarizing these epistemological positions, I have done scant justice to them. So I strongly recommend that you do further reading on these topics.

**Epistemology in general**

**The knowledge society and implications for teaching**

**Objectivism and constructivism**

**Connectivism**
Section 2.4: Does technology change the nature of knowledge?

Connectivists such as Siemens and Downes argue that the Internet has changed the nature of knowledge. They argue that ‘important’ or ‘valid’ knowledge now is different from prior forms of knowledge, particularly academic knowledge. Jane Gilbert’s book, ‘Catching the Knowledge Wave’ (2005), directly addresses the assumption that the nature of knowledge is changing. Drawing on publications by Manuel Castells (2000) and Jean-François Lyotard (1984), she writes (p. 35):

- ‘Castells says that…knowledge is not an object but a series of networks and flows…the new knowledge is a process not a product…it is produced not in the minds of individuals but in the interactions between people…..
- According to Lyotard, the traditional idea that acquiring knowledge trains the mind would become obsolete, as would the idea of knowledge as a set of universal truths. Instead, there will be many truths, many knowledges and many forms of reason. As a result… the boundaries between traditional disciplines are dissolving, traditional methods of representing knowledge (books, academic papers, and so on) are becoming less important, and the role of traditional academics or experts are undergoing major change.’

One way knowledge is certainly changing is in the way it is represented. It should be remembered that Socrates criticised writing because it could not lead to ‘true’ knowledge which came only from verbal dialogue and oratory. Writing however is important because it provides a permanent record of knowledge. The printing press was important because it enabled the written word to spread to many more people. As a consequence, scholars could challenge and better interpret, through reflection, what others had written, and more accurately and carefully argue their own positions. Many scholars believe that one consequence of the development of mass printing was the Renaissance and the age of enlightenment, and modern academia consequently came to depend very heavily on the print medium.

Now we have other ways to record and transmit knowledge that can be studied and reflected upon, such as video, audio, animations, and graphics, and the Internet does expand enormously the speed and range by which these representations of knowledge can be transmitted. We shall also see in Chapter 3 that that media are not neutral, but represent meaning in different ways. Maybe this will eventually lead to a ‘knowledge revolution’ equivalent to the age of enlightenment. But I do not believe we are there yet, for the following reasons.

2.4.1 Knowledge as a commodity

All the above authors agree that the ‘new’ knowledge in the knowledge society is about the commercialisation or commodification of knowledge: ‘it is defined not through what it is, but through what it can do.’ (Gilbert, p.35). ‘The capacity to own, buy and sell knowledge has contributed, in major ways, to the development of the new, knowledge-based societies.’ (p.39)

I have no argument with the point of view that knowledge is the driver of most modern economies, and that this represents a major shift from the ‘old’ industrial economy, where natural resources (coal, oil, iron), machinery and cheap manual labour were the predominant drivers. I do though challenge the idea that the nature of knowledge, or at least academic knowledge, has undergone radical changes.

The difficulty I have with the broad generalisations about the changing nature of knowledge is that there have always been different kinds of knowledge. I am reminded of my first job in a brewery in the East End of London in 1959. I was one of several students hired during our summer vacation. One of my fellow student workers was a brilliant
mathematician. Every lunch hour the regular brewery workers played cards (three card brag) for what seemed to us large sums of money, but they would never let us play. My student friend was desperate to get a game, and eventually, on our last week, they let him in. They promptly won all his wages. He knew the numbers and the odds, but there was still a lot of non-academic knowledge he didn’t know about playing cards for money, especially against a group of friends playing together rather than against each other. Gilbert’s point is that in education academic knowledge has always been more highly valued in education than ‘everyday’ knowledge. However, in the ‘real’ world, all kinds of knowledge are valued, depending on the context. Thus while values regarding what constitutes ‘important’ knowledge may be changing, this does not mean that the nature of academic knowledge is changing.

In a knowledge-based society, knowledge that leads to innovation and commercial activity is now recognised as critical to economic development. Again, there is a tendency to argue that this kind of knowledge – ‘commercial’ knowledge – is different from academic knowledge. I would argue that sometimes it is and sometimes it isn’t.

2.4.2 Academic versus applied knowledge

Gilbert makes the distinction between academic knowledge and applied knowledge (p. 159), and argues that in a knowledge society, there has been a shift in valuing applied knowledge over academic knowledge in the broader society, but this has not been recognised or accepted in education (and particularly the school system). She sees academic knowledge as associated with narrow disciplines such as mathematics and philosophy, whereas applied knowledge is knowing how to do things, and hence by definition tends to be multi-disciplinary. Gilbert argues (p. 159-160) that academic knowledge is:

• ‘authoritative, objective, and universal knowledge. It is abstract, rigorous, timeless – and difficult. It is knowledge that goes beyond the here and now knowledge of everyday experience to a higher plane of understanding…..In contrast, applied knowledge is practical knowledge that is produced by putting academic knowledge into practice. It is gained through experience, by trying things out until they work in real-world situations.’

Other kinds of knowledge that don’t fit the definition of academic knowledge are those kinds built on experience, traditional crafts, trial-and-error, and quality improvement through continuous minor change built on front-line worker experience – not to mention how to win at three card brag.

I agree that academic knowledge is different from everyday knowledge, but I challenge the view that academic knowledge is ‘pure’, not applied. It is too narrow a definition, because it thus excludes all the professional schools and disciplines, such as engineering, medicine, law, business, education that ‘apply’ academic knowledge. These are just as accepted and ‘valued’ parts of universities and colleges as the ‘pure’ disciplines of humanities and science, and their activities meet all the criteria for academic knowledge set out by Gilbert.

In a knowledge-based society, particular emphasis is placed on the utility of knowledge for commercial purposes. This may result in putting more emphasis on certain types of immediately practical knowledge over longer term research, for instance, but because of the strong relationship between pure and applied knowledge, this would probably be a mistake, even in terms of economic development. The issue is not so much the nature of knowledge, but how students or learners come to acquire that knowledge and learn how it can be used. This requires a movement away from a focus on merely teaching content, and more emphasis on developing and learning skills of how best to apply knowledge. Since knowledge is dynamic, expanding and constantly changing, learners need to develop the skills and learn to use the tools that will enable them to continue to learn.

Making a distinction between academic and applied knowledge misses the real point about the kind of education needed in a knowledge society. It is not just knowledge – both pure and applied – that is important, but also IT literacy, skills associated with lifelong learning, and attitudes/ethics and social behaviour. Gilbert surprisingly plays down the importance of both developing learning skills and the role of information and communications technologies (ICTs) in
teaching and learning, in the latter case, arguing that they are not properly integrated into teaching. Again, I don’t disagree that this is often a problem, but integrating ICTs into the curriculum needs to be part of the solution.

Knowledge is not just ‘stuff’, as Jane Gilbert puts it, but it is dynamic. However, I also believe that knowledge is also not just ‘flow’. Content or ‘stuff’ does matter as well as the discussions or interpretations we have about content. Where does the ‘stuff’ come from that ebbs and flows over the discussions on the internet? It may not originate or end in the heads of individuals, but it certainly flows through them, where it is interpreted and transformed. Here we get into the differences between learning, thinking and knowledge. Knowledge may be dynamic and changing, but at some point each person does settle, if only for a brief time, on what they think knowledge to be, even if over time that knowledge changes, develops or becomes more deeply understood. At this point it does become ‘stuff’ or content. I still contend then that ‘stuff’ or content does matter, though recognising that what we do with the stuff is even more important.

My point is that it is not sufficient just to teach academic content (applied or not). It is equally important also to enable students to develop the ability to know how to find, analyse, organise and apply information/content within their professional and personal activities, to take responsibility for their own learning, and to be flexible and adaptable in developing new knowledge and skills. All this is needed because of the explosion in the quantity of knowledge in any professional field that makes it impossible to memorise or even be aware of all the developments that are happening in the field, and the need to keep up-to-date within the field after graduating.

To do this learners must have access to appropriate and relevant content, know how to find it, and must have opportunities to apply and practice what they have learned. Thus learning has to be a combination of content, skills and attitudes, and increasingly this needs to apply to all areas of study. This does not mean that there is no room to search for universal truths, or fundamental laws or principles, but this needs to be embedded within a broader learning environment. This should include the ability to use ICTs as an integral part of their learning, but tied to appropriate content and skills within their area of study.

Again, though, I don’t want to downplay also the importance of non-academic knowledge in the growth of knowledge-based industries. These other forms of knowledge have proved just as valuable, and there is a significant shift in business in trying to manage the every-day knowledge of employees within a company through better internal communication, encouraging external networking, and rewards for collaboration and participation in improving products and services.

### 2.4.3 The relevance of academic knowledge in the knowledge society

My concern about the purely functional rationale for the value of knowledge is that ‘academic knowledge’ is implicitly seen in these arguments as not relevant to the knowledge society – it is only applied knowledge now that matters. However, it has been the explosion in academic knowledge that has formed the basis of the knowledge society. It was academic development in sciences, medicine and engineering that led to the development of the Internet, biotechnology, digital financial services, computer software and telecommunication, etc. Indeed, it is no coincidence that those countries most advanced in knowledge-based industries were those that have the highest participation rates in university education.

Although I accept that academic knowledge is not ‘pure’ or timeless or objectively ‘true’, it is the principles or values that drive academic knowledge that are important. Although it often falls short, the goal of academic studies is to reach for deep understanding, general principles, empirically-based theories, timelessness, etc., even if knowledge is dynamic, changing and constantly evolving. Academic knowledge is not perfect, but does have value because of the standards it requires. Nor do I think academic knowledge or methods have run out of steam. We see evidence all around us that suggests academic knowledge is generating new drug treatments, new understandings of climate change, better technology, and certainly new knowledge generation.

Indeed, more than ever, we need to sustain the elements of academic knowledge, such as rigour, abstraction, evidence-based generalisation, empirical evidence, and rationalism. It is these elements of education that have enabled the rapid economic growth both in the industrial and the knowledge societies. The difference now is that these elements alone are not enough; they need to be combined with new approaches to teaching and learning.
I make this point because I am deeply skeptical of claims made about ‘new’ knowledge resulting from the use of the Internet making academic knowledge outdated or irrelevant. Downes (2007) has argued that new technologies now allow for the de-institutionalisation of learning. James Surowiecki (2004) in his book, ‘The Wisdom of Crowds’, argues that the aggregation of information in groups through diverse collections of independently-deciding individuals can result in decisions that are often better than could have been made by any single member of the group. Chris Anderson, the editor of Wired Magazine, has argued (2008) that massive meta-data correlations can replace ‘traditional’ scientific approaches to creating new knowledge:

- ‘Google’s founding philosophy is that we don’t know why this page is better than that one: If the statistics of incoming links say it is, that’s good enough. No semantic or causal analysis is required. …This is a world where massive amounts of data and applied mathematics replace every other tool that might be brought to bear. Out with every theory of human behavior, from linguistics to sociology. Forget taxonomy, ontology, and psychology. Who knows why people do what they do? The point is they do it, and we can track and measure it with unprecedented fidelity. With enough data, the numbers speak for themselves.

- The big target here isn’t advertising, though. It’s science. The scientific method is built around testable hypotheses. These models, for the most part, are systems visualized in the minds of scientists. The models are then tested, and experiments confirm or falsify theoretical models of how the world works. This is the way science has worked for hundreds of years. Scientists are trained to recognize that correlation is not causation, that no conclusions should be drawn simply on the basis of correlation between X and Y (it could just be a coincidence). Instead, you must understand the underlying mechanisms that connect the two. Once you have a model, you can connect the data sets with confidence. Data without a model is just noise. But faced with massive data, this approach to science — hypothesize, model, test — is becoming obsolete.’

It should be noted this was written before derivative-based investments caused financial markets to collapse, mainly because those using them didn’t understand the underlying logic that created the data. My concern about much of the discussion of the ‘new’ knowledge is that it seems to depend on what I might call majority voting – it is the number of hits that matter, not the quality of the content. Because Al-Qaeda’s web site gets a lot of hits, does it make them ‘right’?

2.4.4 Academic knowledge and other forms of knowledge

As mentioned earlier, there are many other forms of knowledge that are useful or valued besides academic knowledge. There is increasing emphasis from government and business on the development of vocational or trades skills. Teachers or instructors are responsible for developing these areas of knowledge as well. In particular, skills that require manual dexterity, performance skills in music or drama, production skills in entertainment, skills in sport or sports management, are all examples of forms of knowledge that have not traditionally been considered ‘academic’.

However, one feature of a digital society is that increasingly these vocational skills are now requiring a much higher proportion of academic knowledge as well as performance skills. For example higher levels of ability in math and/or science are now demanded of many trades and professions such as network engineers, power engineers, auto mechanics, nurses and other health professionals such as physiotherapists, as the ‘knowledge’ component of their work has increased over recent years.

The nature of the job is also changing. For instance, auto mechanics are now increasingly focused on diagnosis and problem-solving as the value component of vehicles becomes increasingly digitally based and components are replaced rather than repaired. Nurse practitioners now are undertaking areas of work previously done by doctors or medical specialists. Many workers now also need strong inter-personal skills, especially if they are in front-line contact with the public. At the same time, as we saw in Chapter 1, more traditionally academic areas are needing to focus more on skills development, so the somewhat artificial boundaries between pure and applied knowledge are beginning to break down.

In summary, a majority of jobs now require both academic and skills-based knowledge. Academic and skills-based
knowledge also need to be integrated and contextualised. As a result, the demands on those responsible for teaching and instruction have increased, but above all, these new demands of teachers in a digital age mean that their own skills level needs to be increased to cope with these demands.

### Activity 2.3 Epistemology and academic knowledge

Use the comment box, with the title 2.3, to answer the following:

1. Can you state the epistemological position that drives your teaching? (State your subject discipline). Does it fit with any of three epistemological positions described in this chapter? How does that work out in practice in terms of what you do?

2. Can you justify the role of ‘teacher’ in a digital society where individuals can find all they need on the Internet and from friends or even strangers? How do you think that the role of the teacher might, could or should change as a result of the development of a digital society? Or are there ‘constants’ that will remain?

3. Briefly define the subject area or speciality in which you are teaching. Do you agree that academic knowledge is different from everyday knowledge? If so, to what extent is academic knowledge important for your learners? Is its importance growing or diminishing? Why? If it is diminishing, what is it being replaced with – or what should replace it?
Section 2.5: Knowledge and new technology

To come to the crux of my argument, knowledge is being rapidly enhanced and expanded by electronic networks, but there is still a critical need in a knowledge-based society for some form of educational process that focuses on the standards and ways of thinking that are associated with academic knowledge.

The argument is whether learning can be better developed through unstructured electronic networking alone, through more structured methods, such as teacher-led group work either in a face-to-face context or online, or through a combination of both structured and unstructured learning environments. I believe there are various ways in which academic knowledge can be developed, but the most effective way seems to me to be a combination of structured and unstructured activities. The freedom and serendipity of electronic networks can add immense value to the development of academic knowledge, but only if those contributing to the network share or learn the values of academic knowledge. (I am not disputing that other forms of valuable knowledge can be created by random electronic networks without this necessity – my focus here is on academic knowledge).

What is changing then is not necessarily the nature of academic knowledge, but the nature of everyday knowledge, which is very much influenced by the explosion in communications and networking through the Internet. Also we now have many more and better ways of developing and sharing academic knowledge because of this explosion in communications.

We need then to broaden our understanding of how best to help students acquire knowledge in ways that will be useful for them, but that does not necessarily mean rejecting academic knowledge as now being irrelevant. All these methods or approaches may help create new knowledge, and should be considered carefully in terms of their implications for teaching and learning, but in my view they are still dependent on the individuals contributing to such aggregated data being educated in rationalistic, evidence-based decision-making, which requires some form of academic education, and we have seen that this is, as Laurillard puts, a rhetorical activity, that requires guidance and ‘persuasion’ from experts in their fields. The danger is that if knowledge is created by the actions of individuals without such an education, or networks based purely on ‘flows’ of opinions or data, the world becomes a slave to irrationality, prejudice, ignorance and corporate and state manipulation.

The real change then is not to do with moving from academic to applied ‘knowledge’, or abandoning academic knowledge in favour of looking solely at what happens on the Internet, but with moving away from a sole focus on teaching content, and instead on creating learning environments that enable learners to develop skills and networks within their area of study. Content is still crucial, and academic values even more so, but they are only part of the requirements now for preparing people for a digital society.

In the next chapter, I discuss different theories of learning and their underlying epistemology, and how this translates into different approaches to teaching and learning in a digital age.

Key Takeaways

1. Teaching is a highly complex occupation, which needs to adapt to a great deal of variety in context, subject matter and learners. It does not lend itself to broad generalizations. Nevertheless it is possible to provide guidelines or principles based on best practices, theory and research, that must then be adapted or modified to local conditions.

2. Our underlying beliefs and values, usually shared by other experts in a subject domain, shape our approach
to teaching. These underlying beliefs and values are often implicit and are often not directly shared with our students, even though they are seen as essential components of becoming an ‘expert’ in a particular subject domain.

3. It is argued that academic knowledge is different from other forms of knowledge, and is even more relevant today in a digital age.

4. However, academic knowledge is not the only kind of knowledge that is important in today’s society, and as teachers we have to be aware of other forms of knowledge and their potential importance to our students, and make sure that we are providing the full range of contents and skills needed for students in a digital age.
Chapter 3: Theories of learning in a digital age

Purpose of the chapter

When you have read this chapter, you should be able to:

• describe in broad terms the main theories of learning and discuss their implications for teaching
• identify different levels and types of learning and decide which is most appropriate for your subject area/students
• integrate these ideas into a personal strategy or philosophy for the teaching of your subject.

What is covered in this chapter

An understanding of theories about how students learn offers teachers a foundation on which to base their approach to teaching. The chapter covers:

• 3.1 Why an understanding of theories of learning is important
• 3.2 Behaviourism
• 3.3 Cognitivism
• 3.4 Constructivism
  — 3.4.1 Online collaborative learning
• 3.5 Learning by doing
• 3.6 Connectivism
• 3.7 Conclusion

Also in this chapter you will find the following activity:

• Activity 3.1 Choosing a theory of learning

Key Takeaways

• Different theories of learning reflect different views on the nature of knowledge.
• Every teacher starts from some epistemological or theoretical position, even if it is not explicit, or even if the teacher is not fully aware of their beliefs
• With the possible exception of connectivism, there is some form of empirical evidence to support each of the theories of learning outlined here. The difference then is as much about values and beliefs about knowledge as it is about the effectiveness of each theory.
• Although the theories suggest different ways in which all people learn, they do not automatically tell teachers or instructors how to teach.
• Thus teachers have to work out how to move from the theoretical position to the practical one of applying these theories within an educational experience (the subject of the next chapter.)
• Nevertheless, with an understanding of alternative theoretical approaches, teachers and instructors are in a better position to make choices about how to approach their teaching in ways that will best fit the perceived needs of their students, within the very many different learning contexts that teachers and instructors face.
Section 3.1: Why an understanding of theories of learning is important

Most teachers in the k-12 sector will be familiar with the main theories of learning, but because instructors in post-secondary education are hired primarily for their subject experience, or research or vocational skills, it is essential to introduce and discuss, if only briefly, these main theories. In practice, even without formal training or knowledge of different theories of learning, all teachers and instructors will approach teaching within one of these main theoretical approaches, whether or not they are aware of the educational jargon surrounding these approaches. Also, as online learning, technology-based teaching, and informal digital networks of learners have evolved, new theories of learning are emerging.

With a knowledge of alternative theoretical approaches, teachers and instructors are in a better position to make choices about how to approach their teaching in ways that will best fit the perceived needs of their students, within the very many different learning contexts that teachers and instructors face. This is particularly important when addressing many of the requirements of learners in a digital age that are set out in Chapter 1. Furthermore, the choice of or preference for one particular theoretical approach will have major implications for the way that technology is used to support teaching.

In fact, there is a huge amount of literature on theories of learning, and I am aware that the treatment here is cursory, to say the least. Those who would prefer a more detailed introduction to theories of learning could, for an obscene price, purchase Schunk (2011), or for a more reasonable price Harasim (2012). The aim of my book though is not to be comprehensive in terms of in-depth coverage of all learning theories, but to provide a basis on which to suggest and evaluate different ways of teaching to meet the diverse needs of learners in a digital age.
Section 3.2: Behaviourism

Although initially developed in the 1920s, behaviourism still dominates approaches to teaching and learning in many places, particularly in the USA.

Behaviourist psychology is an attempt to model the study of human behaviour on the methods of the physical sciences, and therefore concentrates attention on those aspects of behaviour that are capable of direct observation and measurement. At the heart of behaviourism is the idea that certain behavioural responses become associated in a mechanistic and invariant way with specific stimuli. Thus a certain stimulus will evoke a particular response. At its simplest, it may be a purely physiological reflex action, like the contraction of an iris in the eye when stimulated by bright light.

However, most human behaviour is more complex. Nevertheless behaviourists have demonstrated in labs that it is possible to reinforce through reward or punishment the association between any particular stimulus or event and a particular behavioural response. The bond formed between a stimulus and response will depend on the existence of an appropriate means of reinforcement at the time of association between stimulus and response. This depends on random behaviour (trial and error) being appropriately reinforced as it occurs.

This is essentially the concept of operant conditioning, a principle most clearly developed by Skinner (1968). He showed that pigeons could be trained in quite complex behaviour by rewarding particular, desired responses that might initially occur at random, with appropriate stimuli, such as the provision of food pellets. He also found that a chain of responses could be developed, without the need for intervening stimuli to be present, thus linking an initially remote stimulus with a more complex behaviour. Furthermore, inappropriate or previously learned behaviour could be extinguished by withdrawing reinforcement. Reinforcement in humans can be quite simple, such as immediate feedback for an activity or getting a correct answer to a multiple-choice test.

Figure 3.1 YouTube video/film of B.F. Skinner demonstrating his teaching machine, 1954
You can see a fascinating five minute film of B.F. Skinner describing his teaching machine in a 1954 on YouTube either by clicking on the picture above or at: [http://www.youtube.com/watch?v=jTH3ob1IRFo](http://www.youtube.com/watch?v=jTH3ob1IRFo)

Underlying a behaviourist approach to teaching is the belief that learning is governed by invariant principles, and these principles are independent of conscious control on the part of the learner. Behaviourists attempt to maintain a high degree of objectivity in the way they view human activity, and they generally reject reference to unmeasurable states, such as feelings, attitudes, and consciousness. Human behaviour is above all seen as predictable and controllable. Behaviourism thus stems from a strongly objectivist epistemological position.

Skinner’s theory of learning provides the underlying theoretical basis for the development of teaching machines, measurable learning objectives, computer-assisted instruction, and multiple choice tests. Behaviourism’s influence is still strong in corporate and military training, and in some areas of science, engineering, and medical training. It can be of particular value for rote learning of facts or standard procedures such as multiplication tables, for dealing with children or adults with limited cognitive ability due to brain disorders, or for compliance with industrial or business standards or processes that are invariant and do not require individual judgement.

Finally, it should be noted that behaviourism, with its emphasis on rewards and punishment as drivers of learning, and on pre-defined and measurable outcomes, is the basis of populist conceptions of learning among many parents, politicians, and, it should be noted, computer scientists interested in automating learning. It is not surprising then that there has also been a tendency until recently to see technology, and in particular computer-aided instruction, as being closely associated with behaviourist approaches to learning, although we shall see that this is not necessarily true.
Section 3.3: Cognitivism

An obvious criticism of behaviourism is that it treats humans as a black box, where inputs into the black box, and outputs from the black box, are known and measurable, but what goes on inside the black box is ignored or not considered of interest. However, humans have the ability for conscious thought, decision-making, emotions, and the ability to express ideas through social discourse, all of which may be highly significant for learning. Thus we will likely get a better understanding of learning if we try to find out what goes on inside the black box.

Cognitivists therefore have focused on identifying mental processes – internal and conscious representations of the world – that they consider are essential for human learning. Fontana (1981) summarises the cognitive approach to learning as follows:

‘The cognitive approach ... holds that if we are to understand learning we cannot confine ourselves to observable behaviour, but must also concern ourselves with the learner’s ability mentally to re-organize his psychological field (i.e. his inner world of concepts, memories, etc) in response to experience. This latter approach therefore lays stress not only on the environment, but upon the way in which the individual interprets and tries to make sense of the environment. It sees the individual not as the somewhat mechanical product of his environment, but as an active agent in the learning process, deliberately trying to process and categorize the stream of information fed into him by the external world.’ (p. 148)

Thus the search for rules, principles or relationships in processing new information, and the search for meaning and consistency in reconciling new information with previous knowledge, are key concepts in cognitive psychology. Cognitive psychology is concerned with identifying and describing mental processes that affect learning, thinking and behaviour, and the conditions that influence those mental processes.

Figure 3.2: Some of the areas covered by cognitivism, based on Bloom’s taxonomy (1956). Note that this becomes a reductionist exercise, as psychologists delve deeper into each of these cognitive activities to understand the underlying mental processes. Bloom’s taxonomy will be discussed in more detail later (Section 3...)

Cognitive approaches to learning cover a very wide range. At one end, the objectivist end, cognitivists consider basic mental processes to be genetic or hard-wired, but can be programmed or modified by external factors, such as new experiences. Early cognitivists in particular were interested in the concept of mind as computer, and more recently brain research has led to a search for linking learning to the development and reinforcement of neural networks in the brain. In terms of practice this concept of mind as computer has led to several technology-based developments in teaching, including:

- intelligent tutoring systems, a more refined version of teaching machines, based on analysing student responses to questions and redirecting them to the appropriate next steps in learning. Adaptive learning is the latest extension of such developments;
- artificial intelligence, which seeks to represent in computer software the mental processes used in human learning (which of course if successful would result in computers replacing many human activities – such as teaching, if learning is considered in an objectivist framework.)
- pre-determined learning outcomes, based on an analysis and development of different kinds of cognitive activities, such as comprehension, analysis, synthesis, and evaluation
- certain instructional design approaches that attempt to manage the design of teaching to ensure successful achievement of pre-determined learning outcomes or objectives.
On the other hand, many other cognitivists, coming from a more constructivist epistemological perspective, would argue that mental states or even processes are not fixed but constantly evolving as new information is integrated with prior knowledge, and new strategies for seeking meaning are developed by the individual. Thus teachers who place a strong emphasis on learners developing personal meaning through reflection, analysis and construction of knowledge through conscious mental processing would represent much more of a constructivist epistemological position. It is here that the boundaries between cognitivist and constructivist learning begin to break down.

Cognitive approaches to learning, with a focus on comprehension, abstraction, analysis, synthesis, generalization, evaluation, decision-making and creative thinking, seem to fit much better with higher education than behaviourism, but even in k-12 education, a cognitivist approach would mean for instance focusing on teaching learners how to learn, on developing stronger or new mental processes for future learning, and on developing deeper and constantly changing understanding of concepts and ideas.

Put simply, brains have more plasticity, adaptability and complexity than current computer software programs, and other factors, such as emotion, motivation, self-determination, values, and a wider range of senses, make human learning very different from the way computers operate, at least at the moment. Education would be much better served if computer scientists tried to make software to support learning more reflective of the way human learning operates, rather than trying to fit human learning into the current restrictions of behaviourist computer programming.

Nevertheless, cognitivists have increased our understanding of how humans process and make sense of new information, how we access, interpret, integrate, process, organize and manage knowledge, and have given us a better understanding of the conditions that affect learners’ mental states.
Section 3.4 Constructivism

Both behaviourist and some elements of cognitive theories of learning are deterministic, in the sense that behaviour and learning are believed to be rule-based and operate under predictable and constant conditions over which the individual learner has no or little control. However, constructivists emphasise the importance of consciousness, free will and social influences on learning. Carl Rogers (1969) stated that: ‘every individual exists in a continually changing world of experience in which he is the center.’ The external world is interpreted within the context of that private world. The belief that humans are essentially active, free and strive for meaning in personal terms has been around for a long time.

Constructivists argue that individuals consciously strive for meaning to make sense of their environment in terms of past experience and their present state. It is an attempt to create order in their minds out of disorder, to resolve incongruities, and to reconcile external realities with prior experience. The means by which this is done are complex and multi-faceted, from personal reflection, seeking new information, to testing ideas through social contact with others. Problems are resolved, and incongruities sorted out, through strategies such as seeking relationships between what was known and what is new, identifying similarities and differences, and testing hypotheses or assumptions. Reality is always tentative and dynamic.

For many educators, the social context of learning is critical. Ideas are tested not just on the teacher, but with fellow students, friends and colleagues. Furthermore, knowledge is mainly acquired through social processes or institutions that are socially constructed: schools, universities, and increasingly these days, online communities. Thus what is taken to be ‘valued’ knowledge is also socially constructed. Thus knowledge is not just about content, but also values. One set of values are those around the concept of a liberal education. According to this ideology, one of the principal aims of education is that it should develop a critical awareness of the values and ideologies that shape the form of received knowledge. This then suggests a constant probing and criticism of received knowledge.

One consequence of constructivist theory is that each individual is unique, because the interaction of their different experiences, and their search for personal meaning, results in each person being different from anyone else. Thus behaviour is not predictable or deterministic, at least not at the individual level. The key point here is that learning is seen as essentially a social process, requiring communication between learner, teacher and others. This social process cannot effectively be replaced by technology, although technology may facilitate it.
It can be seen that although constructivist approaches can be and have been applied to all fields of knowledge, it is more commonly found in approaches to teaching in the humanities, social sciences, education, and other less quantitative subject areas.
Learning by doing is another theory of learning that is important not only for vocational education but also for other fields of education. In fact, there are a number of different theories within this broad heading, such as experiential learning, co-operative learning, adventure learning and apprenticeship. There are many different theorists in this area, such as John Dewey, Jean Piaget, Kurt Lewin and more recently David Kolb (1984).

Simon Fraser University has defined experiential learning as follows:

"the strategic, active engagement of students in opportunities to learn through doing, and reflection on those activities, which empowers them to apply their theoretical knowledge to practical endeavours in a multitude of settings inside and outside of the classroom."

Learning by doing is particularly common in teaching motor skills, such as learning to ride a bike or play a sport, but examples can also be found in higher education, such as teaching practice, medical internships, and laboratory studies. Individuals can learn by doing without an instructor, but generally performance is enhanced under the guidance of a more experienced instructor or an expert in the activity.

Apprenticeships are a good example of a form of learning by doing, where a more experienced tradesman or journeyman models behaviour, the apprentice attempts to follow the model, and the journeyman provides feedback.

Experiential learning focuses on learners reflecting on their experience of doing something, so as to gain conceptual insight as well as practical expertise. Kolb’s experiential learning model suggest four stages in this process:
• active experimentation;
• concrete experience;
• reflective observation;
• abstract conceptualization.

This process can often be found in the training of nurses, teachers, and business students. Technology can also be used to enhance or speed up learning by doing. For example, flight simulators allow trainee pilots to learn how to fly expensive aeroplanes within the safety of a simulated environment and without having to take expensive planes out of service for long periods for training purposes. Video can be used to demonstrate correct or expert procedures in apprenticeship programs. Remote labs can be used to enable learners access to and the operation of distant, expensive or rare scientific equipment, such as powerful microscopes.

Learning by doing is an important method for developing many of the skills needed in a digital age, but it should be noted that in many vocational areas that depend increasingly on digital technologies, conceptual learning often needs to be combined with learning by doing.
Section 3.6 Connectivism

Connectivism is a relatively new theory of learning or epistemology (there’s not even agreement about which it is), it is still being refined and developed, and it is currently highly controversial, with many critics.

Siemens, Downes and Cormier constructed the first massive open online course (MOOC), Connectivism and Connective Knowledge 2011, partly to explain and partly to model a connectivist approach to learning. More recently, Downes (2014) has spelled out, in a presentation called The MOOC of One, some of the relationships between individual learning, the contribution of individuals to knowledge and its flow, and networks of learners, within a broad interpretation of connectivist theory. In this presentation Downes sets out some design principles for connectivist ‘courses’ or cMOOCs, such as:

- learner autonomy, in terms of choice of content and how they choose to learn
- openness, in terms of access to the course, content, activities and methods of assessment
- diversity: varied content, individual perspectives and multiple tools, especially for networking learners and creating opportunities for dialogue and discussion
- interactivity: ‘massive’ communication between learners and co-operative learning, resulting in emergent knowledge

Figure 3.1: A map of connectivism, © Stephen Downes, 2011 (accessed via pkab.wordpress.com)
Connectivists such as Siemens and Downes tend to be somewhat vague about the role of teachers or instructors, as the focus of connectivism is more on individual participants, networks and the flow of information and the new forms of knowledge that result. The main purpose of a teacher appears to be to provide the initial learning environment and context that brings learners together, and to help learners construct their own personal learning environments to enable them to connect to ‘successful’ networks, with the assumption that learning will automatically occur as a result, through exposure to the flow of information and the individual’s autonomous reflection on its meaning. There is no need for formal institutions to support this kind of learning, especially since such learning often depends heavily on social media readily available to all participants.

There are numerous criticisms of the connectivist approach to teaching and learning, which include:

- there is no control on the quality of content, or on contributions from participants;
- assessment strategies, such as peer assessment, are primitive and unreliable, thus making reliable or valid recognition of achievement more difficult;
- the kinds of learning that take place in connectivist MOOCs or courses are not necessarily academic, in the sense of meeting the requirements for academic knowledge, as defined in Chapter 2;
- many participants struggle with the lack of structure and are overwhelmed by the volume of content generated by other learners;
- most students need a high level of explicit support in learning from an ‘expert’ teacher and this is lacking in connectivist courses
- this kind of learning requires learners already to have at least some level of more formal or traditional education before they participate if they are to fully benefit from this kind of learning experience (and there is substantial evidence that MOOC participants tend to have an already high level of post-secondary education).
- thus this kind of learning is more appropriate for non-formal learning or communities of practice than for formal education.

Some of these criticisms may be overcome as practice improves, as new tools for assessment, and for organizing co-operative and collaborative work with massive numbers, are developed, and as more experience is gained. More importantly, connectivism is really the first theoretical attempt to radically re-examine the implications for learning of the Internet and the explosion of new communications technologies.
Section 3.7: Conclusion

Different theories of learning reflect different positions on the nature of knowledge. With the possible exception of connectivism, there is some form of empirical evidence to support each of the theories of learning outlined here.

However, while the theories suggest different ways in which all people learn, they do not automatically tell teachers or instructors how to teach. Indeed, theories of behaviourism, cognitivism and constructivism were all developed outside of education, in experimental labs, psychology, neuroscience, and psychotherapy respectively. Educators have had to work out how to move from the theoretical position to the practical one of applying these theories within an educational experience. In other words, they have had to develop teaching methods that build on such learning theories. The next chapter examines a range of teaching methods that have been developed, their epistemological roots, and their implications for teaching in a digital age.

Activity 3.1 Choosing a theory of learning

Entwistle (2010) states:

‘There are some important questions to ask when considering how much weight to place on evidence or how valuable a theory will be for pedagogy. For example:

- Is the theory derived from data or observations in an educational context?
- Is the theory presented in language that is readily intelligible to teachers?
- Can the aspects identified as affecting learning be readily changed (by the teacher)?
- Does the theory have direct implications for teaching and learning (in the particular context in which you are working)?
- How realistic and practical are the suggestions?
- Will the theory spark off new ideas about teaching?

It is not sufficient for a pedagogical theory simply to explain how people learn; it also has to provide clear implications about how to improve the quality and efficiency of learning.’

Using Entwistle’s criteria and your own knowledge and experience of teaching, use the comment function at the end of this chapter to answer the questions below and then compare your answers with answers from other readers.

1. Which theory do you like best, and why? State what main subject you are teaching.
2. Does your preferred way of teaching match any of these theoretical approaches? Write down some of the activities you do when teaching that ‘fit’ with this theory. Can you think of other possible activities you now could use within this theoretical framework for teaching?
3. Does your teaching generally combine different theories – sometimes behaviourist, sometimes cognitive, etc.? If so, what are the reasons or contexts for taking one specific approach rather than another?
4. How useful are these theories in terms of teaching practice? In your view, are they just jargon or useless theorising, or ‘labelling’ of commonly understood practice, or do they provide strong guidelines for how you should teach?
5. How do you think new digital technologies, such as social media, affect these theories? Does it make them...
redundant? Does connectivism replace other theories or merely add another way of looking at teaching and learning?
Chapter 4: Methods of teaching

Purpose of the chapter

When you have read this chapter you should be able to:

- describe several different approaches to methods of teaching
- discuss the general strengths and weaknesses of each approach
- identify the extent to which each approach meets the needs of learners in a digital age
- choose an appropriate teaching method (or mix of methods) for your teaching context

What is covered in this chapter

Five perspectives on teaching are examined and related to epistemologies and theories of learning, with a particular emphasis on their relevance to a digital age. In particular this chapter covers the following topics:

- Scenario B: A stats lecturer fights the system
- 4.1 Five perspectives on teaching
- 4.2 Transmissive lectures
  - 4.2.1 What does research tell us about the effectiveness of lectures?
  - 4.2.2 Does new technology make lectures more relevant?
  - 4.2.3 Is there then no role for lectures in a digital age?
  - 4.2.4 Why are lectures still the main form of educational delivery?
  - 4.2.5 Is there a future for lectures in a digital age?
- 4.3 Interactive lectures, seminars, and tutorials
  - 4.3.1 The theoretical and research basis for social learning
  - 4.3.2 Interactive lectures
  - 4.3.3 Seminars and tutorials
  - 4.3.4 Are seminars a practical method in a massive education system?
- 4.4 Models for teaching by doing
  - 4.4.1 Lab or workshop teaching
  - 4.4.2 Apprenticeship
- 4.5 The nurturing and social reform models of teaching
  - 4.5.1 The nurturing approach
  - 4.5.2 The social reform model
  - 4.5.3. History, and the relevance for connectivism
  - 4.5.4 The role of learners and teachers
  - 4.5.5 Strengths and weaknesses of these two approaches
- 4.6 Conclusions
— 4.6.1 Relating epistemology, learning theories and teaching methods
— 4.6.2 Relating teaching methods to the knowledge and skills needed in a digital age

Also in this chapter you will find the following activities:

• Activity 4.1 The future of lectures
• Activity 4.2 Developing conceptual learning
• Activity 4.3 Benefits and limitations of learning by doing
• Activity 4.4 Nurturing, social reform and connectivism
• Activity 4.5 Choosing a teaching method

**Key Takeaways**

This list of teaching methods covered in this chapter is not meant to be exhaustive or comprehensive. The aim is to show that there many different ways to teach, and all are in some ways legitimate in certain circumstances. Most instructors will mix and match different methods, depending on the needs of both the subject matter and the needs of their students at a particular time (a topic covered in Chapter 5.). There are though some core conclusions to be drawn from this comparative review of different approaches to teaching.

1. No single method is likely to meet all the requirements teachers face in a digital age.
2. Nevertheless, some forms of teaching fit better with the development of the skills needed in a digital age. In particular, methods that focus on conceptual development, such as dialogue and discussion, and knowledge management, rather than information transmission, and experiential learning in real-world contexts, are more likely to develop the high level conceptual skills required in a digital age.
3. It is not just conceptual skills though that are needed. It is the combination of conceptual, practical and personal and social skills in highly complex situations that are needed. This again means combining a variety of teaching methods.
4. Nearly all of these teaching methods are media or technology independent. In other words, they can be used in classrooms or online. What matters from a learning perspective is not so much the choice of technology as the efficacy and expertise in appropriately choosing and using the teaching method.
5. Nevertheless, we shall see later in this book that new technologies offer new possibilities for teaching, including offering more practice or time on task, reaching out to new target groups, and increasing the productivity of both teachers and the system as a whole.
6. In order though to fully exploit the benefits of new technologies, changes to the way we teach will be necessary, making some methods, such as transmissive lectures, almost redundant, at least as far as developing skills for a digital age are concerned.
7. It is not enough to look just at teaching methods; we need to look at designing an appropriate learning environment to help foster and develop the knowledge and skills that students will need. We shall see that technology can be particularly helpful in providing such rich learning contexts.
Scenario C: A stats lecturer fights the system

Clive (looking carefully at his partner, Jean): So what went wrong at work today?

Jean: So you noticed – nice.

Clive: Now don't take it out on me. How could I have avoided the slamming of the door, the shouting at the cat, and the almost instant demand for a large glass of wine – which incidentally is sitting on your desk?

Jean (grabbing the wine). Well, today was the last straw. I got the results of the student end-of-term evaluation of my new class I’ve been teaching.

Clive: Bad, eh?

Jean: Well, first the rankings are odd: about 30 per cent As, about 5 per cent Bs, 15 per cent Cs, 15 per cent D’s and 35 per cent E’s – NOT a normal curve of distribution! They either loved me or hated me, but the average – which is all Harvey, the stupid head of department, looks at – came out as a D, which means any chance of a promotion next year just went straight out the window. I’m now going to have to explain myself to that old buffoon who last taught a class when slate tablets were the latest technology.

Clive: I’m not going to say I told you so, but…..

Jean: DON’T go there. I know I’m bloody mad to have stopped lecturing and tried to engage the students more. I’m could kill that faculty development guy who persuaded me to change how I teach. I didn’t mind all the extra work, not even the continual fighting with the guy from Facilities who kept telling me to put all the tables and chairs back properly – he was just a jerk – and I loved the actual teaching, which was stimulating and deeply satisfying, but what really finished me was when the department wouldn’t change the exam. I’ve been trying to get the kids to question what is meant by a sample, discuss alternative ways of looking at significance, solve problems, and then they go and give the poor kids multiple-choice questions that just assessed their memory of statistical techniques and formulae. No wonder most of the students were mad at me.

Clive: But you’ve always claimed that the students enjoyed your new way of teaching.

Jean: Well, I was fooled by them. From the student comments on the evaluation, it seemed that about a third of them really did like the lessons and some even said it opened up their eyes to what statistics is all about, but apparently what the rest wanted was just a crib sheet they could use to answer the exam questions.

Clive: So what are you going to do now?

Jean: I honestly don’t know. I know what I’m doing is right, now I’ve been through all the changes. Those kids won’t have crib sheets when they start work, they will have to interpret data, and when they get into advanced level science and engineering courses they won’t be able to use statistics properly if I just teach to the exam. They will know a bit about statistics but not how to do it properly.

Clive: So you’ll have to get the department to agree to changing the exam.

Jean: Yeah, good luck with that, because everyone else will have to change how they teach if we do that.

Clive: But I thought the whole reason for you changing your teaching was that the university was worried it wasn’t producing graduates with the right kind of skills and knowledge needed today.

Jean: You’re right, but the problem is Harvey won’t support me – he’s old school down to his socks and underpants and thinks that what I am doing is just trendy – and without his support there’s no way the rest of the department is going to change.

Clive: OK, so just relax for now and have a glass of wine and we’ll go out somewhere nice for dinner. That will help clear my mind of the thought of Harvey in his socks and underpants. Then you can hear about my day.
The first thing to be said about teaching methods is that there is no law or rule that says teaching methods are driven by theories of learning. Especially in post-secondary education, most instructors would be surprised if their teaching was labelled as behaviourist or constructivist. On the other hand, it would be less than accurate to call such teaching ‘theory-free’. We have seen how views about the nature of knowledge are likely to impact on preferred teaching methods. But it would be unwise to press this too hard. A great deal of teaching, at least at a post-secondary level, is based on an apprenticeship model of copying the same methods used by one’s own teachers, then gradually refining them from experience, without a great deal of attention being paid to theories of how students actually learn.

Dan Pratt (1998) studied 253 teachers of adults, across five different countries, and identified ‘five qualitatively different perspectives on teaching... presenting each perspective as a legitimate view of teaching’:

- transmission: effective delivery of content (an objectivist approach)
- apprenticeship: modelling ways of being (learning by doing)
- developmental: cultivating ways of thinking (constructivist/cognitivist)
- nurturing: facilitating self-efficacy (a fundamental tenet of connectivist MOOCs)
- social reform: seeking a better society.

It can be seen that each of these perspectives relates to theories of learning to some extent, and they help to drive methods of teaching. So in practical terms, let’s start by looking at some common methods of teaching, and assessing their appropriateness for developing the knowledge and skills outlined in Chapter 1.
4.2 Transmissive lectures

First, a definition:

[Lectures] are more or less continuous expositions by a speaker who wants the audience to learn something.

Bligh, 2000

This definition is important as it excludes contexts where an exposition or lecture is deliberately interrupted, either intermittently or constantly, by questions, and/or by discussion between instructor and students. This form of more interactive lecturing will be included in the next section (4.3) on seminars and tutorials.

Transmissive lectures can be traced back as far as ancient Greece and Roman times, and certainly from at least the start of the European university, in the 13th century. The term 'lecture' comes from the Latin to read. This was because in the 13th century, most books were extremely rare. They were painstakingly handcrafted and illustrated by monks, often from fragments or collections of earlier and exceedingly rare and valuable scrolls remaining from more than 1,000 years earlier from ancient Greek or Roman times, or were translated from Arabic sources, as much documentation was destroyed in Europe during the Dark Ages following the fall of the Roman empire. As a result, a university would often have only one copy of a book, and it may have been the only copy available in the world. The library and its collection therefore became critical to the reputation of a university, and professors had to borrow the only text from the library and literally read from it to the students, who dutifully wrote down their own version of the lecture.

Lectures themselves belong to an even longer oral tradition of learning, where knowledge is passed on by word of mouth from one generation to the next. In such contexts, accuracy and authority (or power in controlling access to knowledge) are critical for 'accepted' knowledge to be successfully transmitted. Thus accurate memory, repetition and a reference to authoritative sources become exceedingly important in terms of validating the information transmitted. The great sagas of the ancient Greeks and much later, of the Vikings, and even today, the oral myths and legends of many indigenous communities, are examples of the power of the oral transmission of knowledge.
This illustration from a thirteenth-century manuscript shows Henry of Germany delivering a lecture to university students in Bologna, Italy, in 1233. What is striking is how similar the whole context is to lectures today, with students taking notes, some talking at the back, and one clearly asleep. Certainly, if Rip Van Winkle awoke in a modern lecture theatre from his 800 years of sleeping, he would know exactly where he was and what was happening.

Nevertheless, the lecture format has been questioned for many years. Samuel Johnson (1709-1784) over 200 years ago said of lectures:

‘People have nowadays...got a strange opinion that everything should be taught by lectures. Now, I cannot see that lectures can do as much good as reading the books from which the lectures are taken...Lectures were once useful, but now, when all can read, and books are so numerous, lectures are unnecessary.’

What is remarkable is that even after the invention of the printing press, radio, television, and the Internet, the transmissive lecture, characterised by the authoritative instructor talking to a group of students, still remains the dominant methodology for teaching in many institutions, even in a digital age, where information is available at a click of a button.
It could be argued that anything that has lasted this long must have something going for it. On the other hand, we need to question whether the transmissive lecture is still the most appropriate means of teaching, given all the changes that have taken place in recent years, and in particular given the kinds of knowledge and skills needed in a digital age.

### 4.2.1 What does research tell us about the effectiveness of lectures?

Whatever you may think of Samuel Johnson’s opinion, there has indeed been a great deal of research into the effectiveness of lectures, going back to the 1960s, and continued through until today. The most authoritative analysis of the research on the effectiveness of lectures remains Bligh’s (2000). He summarized a wide range of meta-analyses and studies of the effectiveness of lectures compared with other teaching methods and found consistent results:

1. The lecture is as effective as other methods for transmitting information (the corollary of course is that other methods – such as video, reading, independent study, or Wikipedia – are just as effective as lecturing for transmitting information)
2. Most lectures are not as effective as discussion for promoting thought
3. Lectures are generally ineffective for changing attitudes or values or for inspiring interest in a subject
4. Lectures are relatively ineffective for teaching behavioural skills.

It should be noted that many studies that suggest that it makes little difference to the learning effectiveness of a lecture if it is live (with the lecturer and the audience together at the same place and time), if it is transmitted in real time across distance (such as via a webcast or video-conference) or is viewed once on a recording as a continuous event. Thus merely by transmitting a MOOC in the form of a video lecture makes it no more or less effective in terms of an individual’s learning than if it was delivered in a classroom (although of course the MOOC will reach a lot more learners). Thus the medium of transmission makes no difference to an individual’s learning if the form of the lecture remains the same.

However, Bates and his research colleagues at the U.K. Open University, as early as 1984, established that making a lecture available in a recorded format (either on video or audio) increased the learning effectiveness, because it increased students’ time on task, by enabling them to review and repeat the material. Bates (1984, p.205) also found that recorded video or audio was even more effective than a recorded lecture if the program was re-designed to break the transmission of information into small chunks, and if the stop-start facility of recordings was used to build in student activities and feedback following each chunk of information. Proponents of instructionist MOOCs are just beginning to rediscover this thirty years later.

Bligh also examined research on student attention, on memorizing, and on motivation, and concluded (p.56):

> ‘We see evidence... once again to suppose that lectures should not be longer than twenty to thirty minutes – at least without techniques to vary stimulation.’

These research studies have shown that in order to understand, analyze, apply, and commit information to long-term memory, the learner must actively engage with the material. In order for a lecture to be effective, it must include activities that compel the student to mentally manipulate the information. Many lecturers of course do this, by stopping and asking for comments or questions throughout the lecture – but many do not.

Again, although these findings have been available for a long time, and You Tube videos now last approximately eight minutes and TED talks 20 minutes at a maximum, teaching in many educational institutions is still organized around a standard 50 minute lecture session, with, if students are lucky, a few minutes at the end for questions or discussion. Indeed in some institutions it is not uncommon to find even longer lecture sessions.

There are two important conclusions from the research:

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1. Even for the sole purpose for which lectures may be effective – the transmission of information – the 50
minute lecture needs to be well organized, with frequent opportunities for student questions and discussion.
(Bligh provides excellent suggestions on how to do this in his book.)
2. For all other important learning activities, such as developing critical thinking, deep understanding, and
application of knowledge – the kind of skills needed in a digital age – lectures are ineffective. Other forms of
teaching and learning – such as opportunities for discussion and student activities – are necessary.

4.2.2 Does new technology make lectures more relevant?

Over the years, institutions have made massive investments in ‘technologising’ the lecture. Powerpoint presentations,
multiple projectors and screens, clickers for recording student responses, even ‘back-chat’ channels on Twitter, enabling
students to comment on a lecture – or more often, the lecturer – in real time (surely the worse form of torture), have
all been tried. Students have been asked to bring tablets or lap-tops to class, and universities in particular have invested
millions of dollars in state of the art lecture theatres.

Nevertheless, all this is just lipstick on a pig. The essence of a lecture remains the transmission of information, all of
which is now readily available, in most cases, freely available in other media and in more learner-friendly formats.

I worked in a college where in one program all students had to bring laptops to class. At least in these classes, there
were some activities to do related to the lecture that required the students to use the laptops during class time. However,
in most classes this took less than 25 per cent of the lesson time. Most of the other time, students were talked at, and as
a result used their laptops for other, mainly non-academic activities, especially playing online poker.

Faculty often complain about students use of technology such as mobile phones or tablets, for ‘non-relevant’ mul-
titasking in class, but this misses the point. If most students have mobile phones or laptops, why are they still having
physically to come to a lecture hall? Why can’t they get a podcast of the lecture? Second, if they are coming, why are the
lecturers not requiring them to use their mobile phones, tablets, or laptops for study? Why not break them into small
groups and get them to do some online research then come back with group answers to share with the rest of the class?
If lectures are to be offered, the aim should be to make the lecture engaging in its own right, so the students are not dis-
tracted by their online activity. If lecturers can’t do this, perhaps they should give up lecturing and find more interactive
ways of engaging students.

4.2.3 Is there then no role for lectures in a digital age?

I do believe that lectures have their uses. As an example, I have attended an inaugural lecture for a newly appointed
research professor. In this lecture, he summarised all the research he and his team had done, resulting in treatments for
several cancers and other diseases. This was a public lecture, so he had to satisfy not only other leading researchers in
the area, but also a lay public with often no science background. He did this by using excellent visuals and analogies. The
lecture was followed by a small wine and cheese reception for the audience.

The lecture worked for several reasons:

• first of all, it was a celebratory occasion bring together family, colleagues and friends.
• second, it was an opportunity to pull together nearly 20 years of research into a single, coherent narrative or
  story.
• third, the lecture was well supported by an appropriate use of graphics and video.
• lastly, he put a great deal of work into preparing this lecture and thinking about who would be in the
  audience – much more preparation than would be the case if this was just one of many lectures in a course.

More importantly, though, that lecture is now publicly available via You Tube for anyone to view.
McKeachie and Svinicki (2006, p. 58) believe that lecturing is best used for:

• providing up-to-date material that can’t be found in one source
• summarizing material found in a variety of sources.
• adapting material to the interests of a particular group.
• initially helping students discover key concepts, principles or ideas
• modelling expert thinking.

The last point is important. Faculty often argue that the real value of a lecture is to model for students how the faculty member, as an expert, approaches a topic or problem. Thus the important point of the lecture is not the transmission of content (facts, principles, ideas), which the students could get from just reading, but an expert way of thinking about the topic. The trouble with this argument for lectures is three-fold:

• students are rarely aware that this is the purpose of the lecture, and therefore focus on memorizing the content, rather than the ‘modelling’ of expert thinking
• faculty themselves are not explicit about how they are doing the modelling (or fail to offer other ways in which modelling could be used, so students can compare and contrast)
• students get no practice themselves in modelling this skill, even if they are aware of the modelling.

So, yes, there are a few occasions when lectures work very well. But they should not be the default model for regular teaching. We shall see that there are much better ways to teach that will result in better learning over the length of a course or program, and that lectures, whether live, or on MOOCs, YouTube videos or TED talks, are a poor way to prepare learners for a digital age.

4.2.4 Why are lectures still the main form of educational delivery?

Given all of the above, some explanation needs to be offered for the persistence of the lecture into the 21st century. Here are my suggestions

1. in fact, in many areas of education, the lecture has been replaced, particularly in many elementary or primary schools (although parents often are unhappy about this, because a lecture represents their understanding of what teaching is all about).
2. architectural inertia: a huge investment has been made by institutions in facilities that support the lecture model. What is to happen to all that real estate if it is not used? (As Winston Churchill said, ‘We shape our buildings and buildings shape us.’)
3. the Carnegie unit of teaching, which is based on a notion of one hour per week of classroom time per credit over a 13 week period. It is easy then to divide a three credit course into 39 one hour lectures over which the curriculum for the course must be covered. It is on this basis that teaching load and resources are decided.
4. faculty in post-secondary education have no other model for teaching. This is the model they are used to, and because appointment is based on training in research or work experience, and not on qualifications in teaching, they have no knowledge of how students learn or confidence or experience in other methods of teaching.
5. many experts prefer the oral tradition of teaching and learning, because it enhances their status as an expert and source of knowledge: being allowed an hour of other people’s time to hear your ideas without major interruption is very satisfying on a personal level (at least for me).
6. see the scenario at the start of this chapter.

4.2.5 Is there a future for lectures in a digital age?

That depends on how far into the future one wants to look. Given the inertia in the system, I suspect that lectures will still predominate for another ten years, but after that, in most institutions, courses based on three lectures a week over 13 weeks will have disappeared. There are several reasons for this.

- the first is that all content can be easily digitalized and made available on demand at very low cost.
- second, institutions will be making greater use of dynamic video (not talking heads) for demonstration, simulations, animations, etc. Thus most content modules will be multi-media.
- third, open textbooks incorporating multi media components and student activities will provide the content, organization and interpretation that are the rationale for most lectures.
- lastly, and most significantly, the priority for teaching will have changed from information transmission and organization to knowledge management, where students have the responsibility for finding, analyzing, evaluating, sharing and applying knowledge, under the direction of a skilled subject expert. Project-based learning, collaborative learning and situated or experiential learning will become much more widely prevalent. Also many instructors will prefer to use the time they would have spent on a series of lectures in providing more direct, individual and group learner support, thus bringing them into closer contact with learners.

This does not mean that lectures will disappear altogether, but they will be special events, and probably multi-media, synchronously and asynchronously delivered. Special events might include a professor’s summary of his latest research, the introduction to a course, a point mid-way through a course for taking stock and dealing with common difficulties, or the wrap-up to a course. A lecture will provide a chance for an instructor to makes themselves known, to impart their interests and enthusiasm, and to motivate learners, but this will be just one, relatively small, but important component of a much broader learning experience for students.

Activity 4.1 The future of lectures

1. Do you agree that lectures are dead – or soon will be?
2. Look at the skills needed in a digital age described in Chapter 1. Which of these skills could lectures help develop? Would they need to be redesigned or modified to do this and if so, how?
   Write down your answers in the comment section at the end of this chapter.
4.3 Interactive lectures, seminars, and tutorials

In this section, I will examine a number of different ways in which teaching can help develop conceptual knowledge. There is a particular emphasis on conceptual learning at a post-secondary level, but in recent years conceptual learning has become an increasing focus in the school or k-12 systems in many jurisdictions. We have also seen in Chapter 1 that in a digital age there is a heavy focus on the development of conceptual skills such as critical thinking, analysis, synthesis, evaluation and above all, knowledge management.

4.3.1 The theoretical and research basis for social learning

In Chapter 3, I said that research on lectures showed that:

‘in order to understand, analyze, apply, and commit information to long-term memory, the learner must actively engage with the material. In order for a lecture to be effective, it must include activities that compel the student to mentally manipulate the information.’

This is a cognitive approach to learning, but constructivists believe that:

‘individuals consciously strive for meaning to make sense of their environment in terms of past experience and their present state. It is an attempt to create order in their minds out of disorder, to resolve incongruities, and to reconcile external realities with prior experience. Problems are resolved, and incongruities sorted out, through strategies such as seeking relationships between what was known and what is new, identifying similarities and differences, and testing hypotheses or assumptions...knowledge is mainly acquired through social processes or institutions that are socially constructed.’ (Chapter 3)

Researchers have identified a distinction, often intuitively recognised by instructors, between meaningful and rote learning (Asubel, 1978). Meaningful learning involves the learner going beyond memorization or even surface comprehension of facts, ideas or principles, to a deeper understanding of what those facts, ideas or principles mean to them. Marton and Saljö, who have conducted a number of studies that examined how university students actually go about their learning, make the distinction between deep and surface approaches to learning (see, for instance, Marton and Saljö, 1997).

Students who adopt a deep approach to learning tend to have a prior intrinsic interest in the subject. Their motivation is to learn because they want to know more about a topic. Students with a surface approach to learning are more instrumental. Their interest is primarily driven by the need to get a pass grade or qualification.

Subsequent research (e.g. Entwistle and Peterson, 2004) showed that as well as students’ initial motivation for study, a variety of other factors also influence students’ approaches to learning. In particular, certain learning environments, such as an emphasis in the teaching on information transmission, tests that rely mainly on memory, and a lack of interaction and discussion, encourage surface approaches to learning, while a focus on analytical or critical thinking or problem-solving, in-class discussion, and assessment based on analysis, synthesis, comparison and evaluation tends to drive students more to a deeper approach to learning. It should also be noted that approaches to learning are not always consistent or stable, even for the same student in the same course. Nevertheless, the teaching environment is critical in establishing expectations and methods that are more likely to engage students and hence lead to more conceptual and deeper learning.

In addition, others, such as Laurillard (2001) and Harasim (2010), have emphasised that academic knowledge requires students to move constantly from the concrete to the abstract and back again, and to build or construct knowledge based on academic criteria such as logic, evidence and argument. This in turn requires a strong teacher presence within
a dialectical environment, in which argument and discussion within the rules and criteria of the subject discipline are encouraged and developed by the instructor or teacher. Laurillard calls this a rhetorical exercise, an attempt to get learners to think about the world differently.

Lastly, connectivist approaches to learning place heavy emphasis on networking learners, with all participants learning through interaction and discussion between each other, driven both by their individual interests and the extent to which these interests connect to the interests of other participants. The very large numbers participating means that there is a high probability of converging interests for all participants, although those interests may vary considerably over the whole group.

The combination of theory and research here suggests the need for frequent interaction between students, and between teacher and students, for the kinds of learning needed in a digital age. This interaction usually takes the form of semi-structured discussion. I will now examine the very wide range of ways in which this kind of learning is facilitated by educators.

### 4.3.3 Seminars and tutorials

Definitions:

- **A seminar** is a group meeting (either face-to-face or online) where a number of students participate at least as actively as the teacher, although the teacher may be responsible for the design of the group experience, such as choosing topics and assigning tasks to individual students.

- **A tutorial** is either a one-on-one session between a teacher and a student, or a very small group (five or less) of students and an instructor, where the learners are at least as active in discussion and presentation of ideas as the teacher.

Seminars can range from six or more students, up to 30 students in the same group. Because the general perception is that seminars work best when numbers are relatively small, they tend to be found more at graduate level or the last year of undergraduate programs.

Seminars and tutorials again have a very long history, going back at least to the time of Socrates and Aristotle. Both were tutors to the aristocracy of ancient Athens. Aristotle was the private tutor to Alexander the Great when Alexander was young. Socrates was the tutor of Plato, the philosopher, although Socrates denied he was a teacher, rebelling against the idea common at that time in ancient Greece that ‘a teacher was a vessel that poured its contents into the cup of the student’. Instead, according to Plato, Socrates used dialogue and questioning ‘to help others recognize on their own what is real, true, and good.’ (Stanford Encyclopedia of Philosophy.) Thus it can be seen that seminars and tutorials reflect a strongly constructivist approach to learning and teaching.

The format can vary a great deal. One common format, especially at graduate level, although similar practices can be found at the school/k-12 level, is for the teacher to set advance work for a selected number of students, and then have the selected students present their work to the whole group, for discussion, criticism and suggestions for improvement. Although there may be time for only two or three student presentations in each seminar, over a whole semester every student gets their turn. Another format is to ask all the students in a group to do some specified advanced reading or study, then for the teacher to introduce questions for general discussion within the seminar that requires students to draw on their earlier work.

Tutorials are a particular kind of seminar that are identified with Ivy League universities, and in particular Oxford or Cambridge. There may be as few as two students and a professor in a tutorial and the meeting often follows closely the Socratic method of the student presenting his or her findings and the professor rigorously questioning every assumption made by the student – and also drawing in the other student to the discussion.

Both these forms of dialogical learning can be found not only in classroom contexts, but also online. Online discussion forums go back to the 1970s, but really took off after the introduction of the WorldWide Web and high band telecommunications enabled the development of learning management systems, most of which now include an area for online discussions. These online discussion forums have some differences though with classroom seminars:
first, they are text based, not oral
second, they are asynchronous: participants can log in at any time, and from anywhere with an Internet connection, but this can cause some difficulties in following or participating in a particular argument or discussion
thus, third, many discussion forums allow for ‘threaded’ connections, enabling a response to be attached to the particular comment which prompted the response, rather than just displayed in chronological order. This allows for dynamic sub-topics to be developed, with sometimes more than ten responses within a single thread of discussion. This enables participants to follow multiple discussion topics over a period of time.

However, in general, the pedagogical similarities between online and face-to-face discussions are much greater than the differences. For academic and conceptual development, discussions need to be well organized by the teacher, and the teacher needs to provide the necessary support to enable the development of ideas and the construction of new knowledge for the students. There are several ways this can be done:

- set clear goals for the discussions that are understood by the students, such as: ‘to explore gender and class issues in selected novels’ or ‘to compare and evaluate alternative methods of coding.’
• set clear guidelines about expectations of students, such as 'you should log in at least once a week to each
discussion topic and make at least one substantive contribution to each topic each week.'
• set clear, written codes of conduct for participating in discussions, and ensure that they are enforced
• set topics for discussion that complement and expand issues in the study materials, and are relevant to
answering assessment questions
• provide the appropriate scaffolding or support, such as comments that help students develop their thinking
around the topics, refer them back to study materials if necessary, or explain issues when students seem to be
confused or misinformed
• monitor the discussions to prevent them getting off topic or too personal
• provide encouragement for those that are making real contributions to the discussion, head off those that
are trying to hog or dominate the discussions, and track those not participating, and help them to participate.

4.3.5 Are seminars a practical method in a massive education system?

For many faculty, the ideal teaching environment is Socrates sitting under the linden tree, with a small group of dedicat-
ed and interested students. Unfortunately, the reality of mass higher education makes this impossible for all but the most
elite and expensive institutions. However, seminars for 25–30 students are not unrealistic, even in public undergraduate
education. More importantly, they enable the kind of teaching and learning that are most likely to facilitate the types of
skills needed from our students in a digital age. Seminars are flexible enough to be offered in class or online, depending
on the needs of the students. They are probably best used when students have done individual work before the seminar.
Of upmost importance, though, is the ability of teachers to teach successfully in this manner, which requires different
skills from transmissive lecturing. Lastly, in Chapter 7, I will examine more closely the role of discussion in massive open online courses (MOOCs), but will ultimately conclude that there are equally massive challenges for MOOCs in
developing the kind of discussion that leads to deep, conceptual learning and the intellectual skills needed in a digital age.

We saw in Chapter 1 that although expansion of student numbers in higher education is part of the problem, it’s not
the whole problem. Other factors, such as senior professors teaching less, and focusing mainly on graduate students,
lead to larger classes at undergraduate level that use transmissive lecturing. These classes are often taught by teaching
assistants who have scarcely more knowledge than the students they are teaching. And if more senior or experienced
instructors switched from transmissive lectures, and instead required students to find and analyse content for them-

Activity 4.2 Developing conceptual learning

1. What kind of teacher interventions in group discussions can you suggest that could help learners develop deep,
conceptual learning?
2. How could you reorganise a lecture class of 200 or more students to develop group work and the develop-
ment of conceptual learning?

Write down your responses in the comment section at the end of this chapter.
4.4 Models for teaching by doing

There are a number of different models that focus on helping learners to learn by doing things, such as co-op or workplace programs, field trips or internships, usually under the supervision of more experienced mentors or instructors. Here I will touch briefly on only two, the use of laboratory classes/workshops/studios, and apprenticeship programs.

4.4.1 Lab or workshop teaching

Today, we take almost for granted that laboratory classes are an essential part of teaching science and engineering. Workshops and studios are considered critical for many forms of trades training or the development of creative arts. Labs, workshops and studios serve a number of important functions or goals, which include:

- to give students hands-on experience in choosing and using common scientific, engineering or trades equipment appropriately,
- to develop motor skills in using scientific, engineering or industrial tools or creative media
- to give students an understanding of the advantages and limitations of laboratory experiments
- to enable students to see science, engineering or trade work ‘in action’
- to enable students to test hypotheses or to see how well concepts, theories, procedures actually work when tested under laboratory conditions
- to teach students how to design and/or conduct experiments
- to enable students to design and create objects or equipment in different physical media.
An important pedagogical value of laboratory classes is that they enable students to move from the concrete (observing phenomena) to the abstract (understanding the principles or theories that are derived from the observation of phenomena). Another is that the laboratory introduces students to a critical cultural aspect of science and engineering, that all ideas need to be tested in a rigorous and particular manner for them to be considered ‘true’.

One major criticism of traditional educational labs or workshops is that they are limited in the kinds of equipment and experiences that scientists, engineers and trades people need today. As scientific, engineering and trades equipment becomes more sophisticated and expensive, it becomes increasingly difficult to provide students in schools especially but increasingly now in colleges and universities direct access to such equipment. Furthermore traditional teaching labs or workshops are capital and labour intensive and hence do not scale easily, a critical disadvantage in rapidly expanding educational opportunities.

Because laboratory work is such an accepted part of science teaching, it is worth remembering that teaching science through laboratory work is in historical terms a fairly recent development. In the 1860s neither Oxford nor Cambridge University were willing to teach empirical science. Thomas Huxley therefore developed a program at the Royal School of Mines (a constituent college of what is now Imperial College, of the University of London) to teach school-teachers how to teach science, including how to design laboratories for teaching experimental science to children, a method that is still the most commonly used today, both in schools and universities.

At the same time, scientific and engineering progress since the nineteenth century has resulted in other forms of scientific testing and validation that take place outside at least the kind of ‘wet labs’ so common in schools and universities. Examples are nuclear accelerators, nanotechnology, quantum mechanics and space exploration. It is also important to be clear about the objectives of lab, workshop and studio work. There may now be other, more practical, more economic, or more powerful ways of achieving these objectives through the use of new technology, such as remote labs, simulations, and experiential learning. These will be examined in more detail in later chapters.

4.4.2 Apprenticeship

‘It is useful to remember that apprenticeship is not an invisible phenomenon. It has key elements: a particular way of viewing learning, specific roles and strategies for teachers and learners, and clear stages of development, whether for traditional or cognitive apprenticeship. But mostly it’s important to remember that in this perspective, one cannot learn from afar. Instead, one learns amid the engagement of participating in the authentic, dynamic and unique swirl of genuine practice.’

Pratt and Johnson, 1998

Apprenticeship is a particular way of enabling students to learn by doing. It is often associated with vocational training but it should be pointed out that apprenticeship is the most common method used to train post-secondary education instructors in teaching (at least implicitly), so there is a wide range of applications for an apprenticeship approach to teaching.

A key feature of apprenticeship is that it operates in ‘situations of practice that...are frequently ill-defined and problematic, and characterized by vagueness, uncertainty and disorder’ (Schön, 1983). Learning in apprenticeship is not just about learning to do (active learning), but also requires an understanding of the contexts in which the learning will be applied. In addition there is a social and cultural element to the learning, understanding and embedding the accepted practices, customs and values of experts in the field.

Pratt and Johnson (1998) identify the characteristics of a master practitioner, whom they define as ‘a person who has acquired a thorough knowledge of and/or is especially skilled in a particular area of practice’. Master practitioners:

1. possess great amounts of knowledge in their area of expertise, and are able to apply that knowledge in difficult practice settings
2. have well-organized, readily accessible schemas (cognitive maps) which facilitate the acquisition of new information
3. have well-developed repertoires of strategies for acquiring new knowledge, integrating and organizing their schemas, and applying their knowledge and skills in a variety of contexts.

4. ...are motivated to learn as part of the process of developing their identities in their communities of practice. They are not motivated to learn simply to reach some external performance goal or reward.

5. frequently display tacit knowledge in the form of:
   - 5.1 spontaneous action and judgements
   - 5.1 being unaware of having learned to do these things
   - 5.1 being unable or having difficulty in describing the knowing which their actions reveal

Pratt and Johnson further distinguish two different but related forms of apprenticeship: traditional and cognitive. A traditional apprenticeship experience, based on developing a motor or manual skill, involves learning a procedure and gradually developing mastery, during which the master and learner go through several stages:

- observation of both the master and other learners performing the same procedure: this helps provide a conceptual model for the apprentice to follow and an 'advanced organizer for their initial attempts at performing skills'
modelling: explicit demonstration by the master of what to do, followed by the learner copying/practising the task
scaffolding: the support and feedback provided to the learner by the master as the learner works on a task
coaching: an overall approach of the master in choosing appropriate tasks, evaluating work and diagnosing problems.

An intellectual or cognitive apprenticeship model is somewhat different because this form of learning is less easily observable than learning motor or manual skills. Pratt and Johnson argue that in this context, master and learner must say what they are thinking during applications of knowledge and skills, and must make explicit the context in which the knowledge is being developed, because context is so critical to the way knowledge is developed and applied. Pratt and Johnson suggest five stages for cognitive and intellectual modelling (Figure 5.1, p. 99):
1. modelling by the master and development of a mental model/schema by the learner
2. learner approximates replication of the model with master providing support and feedback (scaffolding/coaching)
3. learner widens the range of application of the model, with less support from master
4. self-directed learning within the specified limits acceptable to the profession
5. generalizing: learner and master discuss how well the model might work or would have to be adapted in a range of other possible contexts.

Pratt and Johnson provide a concrete example of how this apprenticeship model might work for a novice university professor (pp. 100-101).

The apprenticeship model of teaching can work in both face-to-face and online contexts, but if there is an online component, it usually works best in a hybrid format. For instance, Vancouver Community College in Canada offers a 13 week semester course for car body repair apprentices that delivers 10 weeks of the program online for unqualified workers across the province who are already working in the industry. VCC uses online learning for the theoretical part of the program, plus a large number of simply produced video clips of practices and procedures in car body repairs. Because all the students are apprentices already working under supervision of a master journeyman, they can practice some of the video procedures in the workplace under supervision. The last three weeks of the program requires students to come to the college for specific hands-on training for the last three weeks of the course. They are tested, and those that have already acquired the skills are sent back to work, so the instructor can focus on those that need the skills most. The partnership with industry that enables the college to work with ‘master’ tradespeople in the workplace is critical for this semi-distance program, and is particularly useful where there are severe skills shortages, helping to bring unskilled workers up to the level of full craftspeople.

The main advantages of an apprenticeship model of teaching can be summarised as follows:

- teaching and learning are deeply embedded within complex and highly variable contexts, allowing rapid adaptation to real-world conditions
- it makes efficient use of the time of experts, who can integrate teaching within their regular work routine
- it provides learners with clear models or goals to aspire to
- it acculturates learners to the values and norms of the trade or profession

On the other hand, there are some serious limitations with an apprenticeship approach, particularly in non-traditional apprenticeship:

- much of a master’s knowledge is tacit, partly because their expertise is built slowly through a very wide range of activities,
• experts often have difficulty in expressing consciously or verbally the schema and 'deep' knowledge that they have built up and taken almost for granted, leaving the learner often to have to guess or approximate what is required of them to become experts themselves,

• experts often rely solely on modelling with the hope that learners will pick up the knowledge and skills from just watching the expert in action, and don’t follow through on the other stages that make an apprenticeship model more likely to succeed.

• there is clearly a limited number of learners that one expert can manage, given that the experts themselves are fully engaged in applying their expertise in often demanding work conditions which may leave little time for paying attention to the needs of novice learners in the trade or profession

• vocational apprenticeship programs have a very high attrition rate: for instance, in British Columbia, more than 60 per cent of those that enter a formal campus-based vocational apprenticeship program withdraw before successful completion of the program. As a result, there are large numbers of experienced tradespeople in the workforce without full accreditation, limiting their career development and slowing down economic development where there are shortages of fully qualified skilled workers

• in trades or occupations undergoing rapid change in the workplace, the apprenticeship model can slow adaptation or change in working methods, because of the prevalence of traditional values and norms being passed down by the ‘master’ that may no longer be as relevant in the new conditions facing workers. This limitation of the apprenticeship model can be clearly seen in the post-secondary education sector, where traditional values and norms around teaching are increasingly in conflict with external forces such as new technology and the massification of higher education.

Nevertheless, the apprenticeship model, when applied thoroughly and systematically, is a very useful model for teaching in highly complex, real-world contexts.

Activity 4.3 Benefits and limitations of learning by doing

1. If you use labs or workshops for teaching, do you feel constrained by the equipment or context in which you have to work? If so, what are the main issues and what could be done to alleviate these issues?

2. Do you agree that ‘apprenticeship is the most common method used to train post-secondary education instructors in teaching? If so, what are the benefits and what are the limitations? If you don’t think apprenticeship is the main method, what is?

Write down your responses in the comment section at the end of this chapter.
4.5 The nurturing and social reform models of teaching

What both these models, identified by Pratt (1998), have in common is a focus on the individual rather than on the teacher, the institution, or state. They are both in a sense attempts at liberating learners from the restrictions of formal and institutional types of education.

4.5.1 The nurturing approach

A nurturing approach to teaching can best be understood in terms of the role of a parent. Pratt (1998) states:

‘We expect ‘successful’ parents to understand and empathize with their child; and that they will provide kind, compassionate, and loving guidance through content areas of utmost difficulty....The nurturing educator works with other issues...in different contexts and different age groups, but the underlying attributes and concerns remain the same. Learners’ efficacy and self-esteem issues become the ultimate criteria against which learning success is measured, rather than performance-related mastery of a content body.’

A counsellor and student at Empire State College, New York, which has a mentoring approach to adult education.

There is a strong emphasis on the teacher focusing on the interests of the learner, on empathizing with how the learner approaches learning, of listening carefully to what the learner is saying and thinking when learning, and providing appropriate, supportive responses in the form of ‘consensual validation of experience’. This theory is driven partly by the
observation that people learn autonomously from a very early age, so the trick is to create an environment for the learner that encourages rather than inhibits their ‘natural’ tendency to learn, and directs it into appropriate learning tasks, decided by an analysis of the learner’s needs.

4.5.2 The social reform model

Pratt (1998, p. 173) states:

‘Teachers holding a social reform perspective are most interested in creating a better society and view their teaching as contributing to that end. Their perspective is unique in that it is based upon an explicitly stated ideal or set of principles linked to a vision of a better social order. Social reformers do not teach in one single way, nor do they hold distinctive views about knowledge in general...these factors all depend on the particular ideal that inspires their actions.’

This then in some ways is less a theory of teaching as an epistemological position, that society needs change, and the social reformer knows how to bring about this change.

4.5.3 History, and relevance for connectivism

These approaches to teaching again have a long history, with echoes of

- Jean-Jacques Rousseau (1762) ‘education should be carried out, so far as possible, in harmony with the development of the child’s natural capacities by a process of apparently autonomous discovery’ (Stanford Encyclopedia of Philosophy)
- Malcolm Knowles (1984) ‘As a person matures his self concept moves from one of being a dependent personality toward one of being a self-directed human being.’
- Paulo Freire (2004) ‘education makes sense because women and men learn that through learning they can make and remake themselves, because women and men are able to take responsibility for themselves as beings capable of knowing—of knowing that they know and knowing that they don’t.’
- Ivan Illich (1971) in his criticism of the institutionalization of education ‘The current search for new educational funnels must be reversed into the search for their institutional inverse: educational webs which heighten the opportunity for each one to transform each moment of his living into one of learning, sharing, and caring.’

The reason why the nurturing and social reform approaches to teaching are important is because they reflect many of the assumptions or beliefs around connectivism. Indeed, as early as 1971, Illich made this remarkable statement for the use of advanced technology to support ‘learning webs.”

‘The operation of a peer-matching network would be simple. The user would identify himself by name and address and describe the activity for which he sought a peer. A computer would send him back the names and addresses of all those who had inserted the same description. It is amazing that such a simple utility has never been used on a broad scale for publicly valued activity.’

Well, those conditions certainly exist today. Learners do not necessarily need to go through institutional gateways to access information or knowledge, which is increasing available and accessible through the Internet. MOOCs help to identify those common interests and connectivist MOOCs in particular aim to provide the networks of common interests and the environment for self-directed learning. The digital age provides the technology infrastructure and support needed for this kind of learning.
4.5.4 The roles of learners and teachers

Of all the models of teaching these two are the most learner centred. They are based on an overwhelmingly optimistic view of human nature, that people will seek out and learn what they need, and will find the necessary support from caring, dedicated educators and from others with similar interests and concerns, and that individuals have the capacity and ability to identify and follow through with their own educational needs. It is also a more radical view of education, because it seeks to escape the political and controlling aspects of state or private education.

Within each of these two models, there are differences of view about the centrality of teachers for successful learning. For Pratt, the teacher plays a central role in nurturing learning; for others such as Illich or Freire, professionally trained teachers are more likely to be the servant of the state than of the individual learner. Volunteer mentors or social groups organised around certain ideals or social goals provide the support for learners.

4.5.5 Strengths and weaknesses of these two approaches

There are, as always, a number of drawbacks to these two approaches to teaching:

- The teacher in a nurturing approach needs to adopt a highly dedicated and unselfish approach, putting the demands and needs of the learner first. This often means for teachers who are experts in their subject holding back the transmission and sharing of their knowledge until the learner is ‘ready’, thus denying to many subject experts their own identity and needs to a large extent;
- Pratt argues that ‘although content is apparently neglected, children taught by nurturing educators do continue to master it at much the same rate as children taught by curriculum-driven teaching methodologies’, but no empirical evidence is offered to support this statement, although it does derive in Pratt’s case from strong personal experience of teaching in this way;
- like all the other teaching approaches the nurturing method is driven by a very strong belief system, which will not necessarily be shared by other educators (or parents or even students, for that matter);
- a nurturing approach is probably the most labour-intensive of all the teaching models, requiring a deep understanding on the part of the teacher of each learner and that learner’s needs; every individual learner is different and needs to be treated differently, and teachers need to spend a great deal of time identifying learners’ needs, their readiness to learn, and building or creating supportive environments or contexts for that learning;
- there is likely to be a conflict between what the learner identifies as their personal learning needs, and the demands of society in a digital age. Dedicated teachers may be able to help a learner negotiate that divide, but in situations where learners are left without professional guidance learners may end up just talking to other individuals with similar views that do not progress their learning (remembering that academic teaching is a rhetorical exercise, changing the way learners view the world.)
- social reform depends to a large extent on learners and teachers embracing similar belief systems, and can easily descend into dogmatism without challenges from outside the ‘in-community’ established by self-referential groups

Nevertheless, there are aspects of both models that have significance for a digital age:

- both nurturing and social reform approaches seems to work well for many adults in particular, and the nurturing approach also works well for younger children.
• nurturing is an approach that has been adopted as much in advanced corporate training in companies such as Google as in informal adult education.
• connectivist MOOCs strongly reflect both the nurturing approach and the ability to create webs of connections that enables the development of self-efficacy and attempts at social reform
• both methods seem to work well when learners are already fairly well educated and already have good prior knowledge and conceptual development.
• such approaches that focus on the needs of individuals rather than institutions or state bureaucracies can liberate thinking and learning and thus make the difference between ‘good’ and ‘excellent’ in creative thinking, problem-solving, and application of knowledge in complex and variable contexts.

Activity 4.4 Nurturing, social reform and connectivism

1. Do you have experience of teaching in one or both of these ways? If so, do you agree with the analysis of the strengths and weaknesses of each component?
2. Do you think that connectivism is a modern reflection of either of these models of teaching – or is connectivism a distinct and unique method of teaching in itself? If so, what distinguishes it as a teaching method from all the other methods I have covered?

Write down your responses in the comment section at the end of this chapter.
4.6 Main conclusions

4.6.1. Relating epistemology, learning theories and teaching methods

Although there is often a direct relationship between a method of teaching, a learning theory and an epistemological position, this is by no means always the case. It is tempting to try to put together a table and neatly fit each teaching method into a particular learning theory, and each theory into a particular epistemology, but unfortunately education is not as tidy as computer science, so it would be misleading to try to do a direct ontological classification. For instance a transmissive lecture might be structured so as to further a cognitivist rather than a behaviourist approach to learning, or a lecture session may combine several elements, such as transmission of information, learning by doing, and discussion.

Purists may argue that it is logically inconsistent for a teacher to use methods that cross epistemological boundaries (and it may certainly be confusing for students) but teaching is essentially a pragmatic profession and teachers will do what it takes to get the job done. If students need to learn facts, principles, standard procedures or ways of doing things, before they can start an informed discussion about their meaning, or before they can start solving problems, then a teacher may well consider behaviourist methods to lay this foundation before moving to more constructivist approaches later in a course or program.

Similarly we have seen that technology applications such as MOOCs or video recorded lectures may replicate exactly a particular teaching method or approach to learning used in the classroom. In many ways these methods of teaching, theories of learning and epistemologies are independent of a particular technology or medium of delivery, although we shall see in Chapter 6 that technologies can be used to transform teaching, and a particular technology will in some cases further one method of teaching more easily than others, depending on the characteristics or ‘affordances’ of that technology.

Thus, teachers who are aware of not only a wide array of teaching methods, but also of learning theories and their epistemological foundation will be in a far better position to make appropriate decisions about how to teach in a particular context. Also, as we shall see, having this kind of understanding will also facilitate an appropriate choice of technology for a particular learning task or context.

4.6.2 Relating teaching methods to the knowledge and skills needed in a digital age

The main purpose of this whole exercise has been to enable you as a teacher to identify the teaching methods that are most likely to support the development of the knowledge and skills that students or learners will need in a digital age. We still have a way to go before we have all the information and tools needed to make this decision, but we can at least have a stab at it from here, while recognising that such decisions will depend on a wide variety of factors, such as the nature of the learners and their prior knowledge and experience, the demands of particular subject areas, the institutional context in which teachers and learners find themselves, and the likely employment context for learners.

First, we can identify a number of different types of skills needed:

- conceptual skills, such as knowledge management, critical thinking, analysis, synthesis, problem-solving, creativity/innovation, experimental design
- developmental or personal skills, such as independent learning, communications skills, ethics, networking, responsibility and teamwork
- digital skills, embedded within and related to a particular subject or professional domain
- manual and practical skills, such as machine or equipment operation, safety procedures, observation and recognition of data, patterns, and spatial factors.
There are several key points for a teacher or instructor to note:

- the teacher needs to be able to identify/recognise the skills they are hoping to develop in their students
- these skills are often not easily separated but tend to be contextually based and often integrated
- teachers need to identify appropriate methods and contexts that will enable students to develop these skills
- students will need practice to develop such skills.
- students will need feedback and intervention from the teacher and other students to ensure a high level of competence or mastery in the skill
- an assessment strategy needs to be developed that recognises and rewards students' competence and mastery of such skills

One thing that becomes clear here is that just choosing a particular teaching method such as seminars or apprenticeship is not going to be sufficient. We have to provide a rich learning environment for students to develop such skills that includes contextual relevance, and opportunities for practice, discussion and feedback. As a result, we are likely to combine different methods of teaching. It is unlikely that one method, such as transmissive lectures, or seminars, will provide a rich enough learning environment for a full range of skills to be developed within the subject area.

So it would be foolish at this stage to say that seminars, or apprenticeship, or nurturing, is the best method for developing this range of skills. At the same time, we can see the limitations of transmissive lectures, especially if they are used as the dominant method for teaching.

In order to better answer the question, we need to look more closely at the design of teaching, which means deliberately planning methods of teaching and a broad learning environment that will facilitate the development of the knowledge and skills that our students need. This will be the subject of my next chapter, which I will also share through further blog posts.

Key Takeaways

This list of teaching methods is not meant to be exhaustive or comprehensive. The aim is to show that there many different ways to teach, and all are in some ways legitimate in certain circumstances. Most instructors will mix and match different methods, depending on the needs of both the subject matter and the needs of their students at a particular time (a topic covered in Chapter 5.). There are though some core conclusions to be drawn from this comparative review of different approaches to teaching.

1. No single method is likely to meet all the requirements teachers face in a digital age.
2. Nevertheless, some forms of teaching fit better with the development of the skills needed in a digital age. In particular, methods that focus on conceptual development, such as dialogue and discussion, and knowledge management, rather than information transmission, and experiential learning in real-world contexts, are more likely to develop the high level conceptual skills required in a digital age.
3. It is not just conceptual skills though that are needed. It is the combination of conceptual, practical and personal and social skills in highly complex situations that are needed. This again means combining a variety of teaching methods.
4. Nearly all of these teaching methods are media or technology independent. In other words, they can be used in classrooms or online. What matters from a learning perspective is not so much the choice of technology as the efficacy and expertise in appropriately choosing and using the teaching method.
5. Nevertheless, we shall see later in this book that new technologies offer new possibilities for teaching, including offering more practice or time on task, reaching out to new target groups, and increasing the productivity of both teachers and the system as a whole.

6. In order though to fully exploit the benefits of new technologies, changes to the way we teach will be necessary, making some methods, such as transmissive lectures, almost redundant, at least as far as developing skills for a digital age are concerned.

7. It is not enough to look just at teaching methods; we need to look at designing an appropriate learning environment to help foster and develop the knowledge and skills that students will need. We shall see that technology can be particularly helpful in providing such rich learning contexts.
Chapter 5 Building an effective learning environment

Purpose of this chapter

When you have completed this chapter you should be able to:

• design and implement a learning environment that best meets the needs of your course and students

What is covered in this chapter

Building a comprehensive and effective learning environment is an important step in designing teaching and learning for the digital age. This chapter discusses the key components of a learning environment and how these are affected by developments in a digital age. The chapter covers the following topics:

• Scenario D: Developing historical thinking
• 5.1 Moving from theory to practice
• 5.2 What is a learning environment?
• 5.3 Learner characteristics
  • 5.3.1 Increased diversity
  • 5.3.2 The work and home context
  • 5.3.3 Learners’ goals
  • 5.3.4 Prior knowledge and skills
  • 5.3.5 Digital natives
  • 5.3.6 In conclusion
• 5.4 Managing content
  • 5.4.1 Goals for content
  • 5.4.2 Quantity and depth
  • 5.4.3 Sources
  • 5.4.4 Structure
  • 5.4.5 Learner activities
  • 5.4.6 In conclusion
• 5.5 Developing skills
  • 5.5.1 Skills in a digital age
  • 5.5.2 Setting goals for skills development
  • 5.5.3 Thinking activities
  • 5.5.4 Practical activities
  • 5.5.5 Discussion as a tool for developing intellectual skills
  • 5.5.6 In conclusion
• 5.6 Learner support
  — 5.6.1 Scaffolding
  — 5.6.2 Feedback
  — 5.6.3 Counselling
  — 5.6.4 Other students
  — 5.6.5 Why learner support is so important
• 5.7 Resources
  — 5.7.1 Teaching assistance
  — 5.7.2 Facilities
  — 5.7.3 Technology
  — 5.7.4 The instructor’s time
  — 5.7.5 Resources, class size and control
• 5.8 Assessment of learning
  — 5.8.1 Learner assessment in a digital age
  — 5.8.2 The purpose of assessment
  — 5.8.3 Methods of assessment
  — 5.8.4 In conclusion
• 5.9 Building the foundation of good design
  — 5.9.1 Epistemology and learning environments
  — 5.9.2 Necessary but not sufficient

Also in this chapter you will find the following activities:

• Activity 5.1 Influencing a learning environment
• Activity 5.2 Developing skills
• Activity 5.3 Building learner support
• Activity 5.4 What resources matter?
• Activity 5.5 What assessments work in a digital age?
• Activity 5.6 Designing your own learning environment

Key Takeaways

1. To be able to design effective teaching, it is necessary to build an effective learning environment.
2. Effective learning environments will have a number of different components, and these components will vary, depending on context and the epistemology that drives teaching
3. The aim of building an effective learning environment is to enable more flexible models of learning design to be created, a topic to be discussed in the next chapter
Ralph Goodyear is a professor of history in a public Tier 1 research university in the central United States. He has a class of 72 undergraduate students taking HIST 305, ‘Historiography’. For the first three weeks of the course, Goodyear had recorded a series of short 15 minute video lectures that covered the following topics/content:

- the various sources used by historians (e.g. earlier writings, empirical records including registries of birth, marriage and death, eye witness accounts, artifacts such as paintings, photographs, and physical evidence such as ruins.)
- the themes around which historical analysis tend to be written,
- some of the techniques used by historians, such as narrative, analysis and interpretation
- three different positions or theories about history (objectivist, marxist, post modernist).
Students downloaded the videos according to a schedule suggested by Goodyear. Students attended two one hour classes a week, where specific topics covered in the videos were discussed. Students also had an online discussion forum in the course space on the university’s learning management system, where Goodyear had posted similar topics for discussion. Students were expected to make at least one substantive contribution to each online topic for which they received a mark that went towards their final grade. Students also had to read a major textbook on historiography over this three week period.

In the fourth week, he divided the class into twelve groups of six, and asked each group to research the history of any city outside the United States over the last 50 years or so. They could use whatever sources they could find, including online sources such as newspaper reports, images, research publications, and so on, as well as the university’s own library collection. In writing their report, they had to do the following:

- pick a particular theme that covered the 50 years and write a narrative based around the theme
- identify the sources they finally used in their report, and discuss why they selected some sources and dismissed others
- compare their approach to the three positions covered in the lectures
- post their report in the form of an online e-portfolio in the course space on the university’s learning management system

They had five weeks to do this.

The last three weeks of the course were devoted to presentations by each of the groups, with comments, discussion and questions, both in class and online (the in class presentations were recorded and made available online). At the end of the course, students assigned grades to each of the other groups’ work. Goodyear took these student gradings into consideration, but reserved the right to adjust the grades, with an explanation of why he did the adjustment. Goodyear also gave each student an individual grade, based on both their group’s grade, and their personal contribution to the online and class discussions.

Goodyear commented that he was surprised and delighted at the quality of the students’ work. He said: ‘What I liked was that the students weren’t learning about history; they were doing it.’

Based on an actual case, but with some embellishments.
5.1 Moving from theory to practice

It is one thing to have a good theory of learning and a choice of appropriate teaching method, but it is quite another to implement the chosen teaching method successfully. As noted in the previous chapter, teachers and instructors may need a mix of methods, depending on the circumstances.

One extremely useful strategy for effective teaching and learning is to create a broad learning environment that will facilitate the development of the knowledge and skills that are needed in a digital age. This requires an analysis of the critical components of a learning environment. In the following chapter, I will then look at different models for designing teaching and learning.
5.2 What is a learning environment?

**Definition**

*Learning environment* refers to the diverse physical locations, contexts, and cultures in which students learn. Since students may learn in a wide variety of settings, such as outside-of-school locations and outdoor environments, the term is often used as a more accurate or preferred alternative to classroom, which has more limited and traditional connotations—a room with rows of desks and a chalkboard, for example.

The term also encompasses the culture of a school or class—its presiding ethos and characteristics, including how individuals interact with and treat one another—as well as the ways in which teachers may organize an educational setting to facilitate learning....’

*The Glossary of Educational Reform*, 29 August, 2014

This definition recognises that students learn in many different ways in very different contexts. Since learners must do the learning, the aim is to create a total environment for learning that optimises the ability of students to learn. There is of course no single optimum learning environment. There is an infinite number of possible learning environments, which is what makes teaching so interesting.

Developing a total learning environment for students in a particular course or program is probably the most creative part of teaching. While there is a tendency to focus on either physical institutional learning environments (such as classrooms, lecture theatres and labs), or on the technologies used to to create online personal learning environments (PLEs), learning environments are broader than just these physical components. They will also include:

- the characteristics of the learners
- the goals for teaching and learning,
- the activities that will best support learning,
- the assessment strategies that will best measure and drive learning.

Figure 5.1 illustrates one possible learning environment from the perspective of a teacher or instructor. An instructor may have little or no control over some components, such as learner characteristics or resources, but may have full control over other components such as choice of content and how learners will be supported. Within each of the main components there are a set of sub-components that will need to be considered. In fact, it is in the sub-components (content structure, practical activities, feedback, use of technology, assessment methods, etc.) where the real decisions need to be made.

I have listed just a few components in Figure 5.1 and the set is not meant to be comprehensive. For instance it could have included other components, such as developing ethical behaviour, institutional factors, or external accreditation, each of which might also affect the learning environment in which a teacher or instructor has to work. Creating a model of a learning environment then is a heuristic device that aims to provide a comprehensive view of the whole teaching context for a particular course or program, by a particular instructor or teacher with a particular view of learning. Once again, the choice of components and their perceived importance will be driven to some extent by personal epistemologies and beliefs about knowledge, learning and teaching methods.

Lastly, I have deliberately suggested a learning environment from the perspective of a teacher, as the teacher has the main responsibility for creating an appropriate learning environment, but it is also important to consider learning environments from the learners’ perspectives. Indeed, adult or mature learners are capable of creating their own, personal, relatively autonomous learning environments, and this will also be discussed in more depth later in the book.

The significant point is that it is important to identify those components that need to be considered in teaching a
course or program, and in particular that there are other components besides content or curriculum. Each of the key components of the learning environment I have chosen as an example are discussed briefly below, with a focus on the components of a learning environment that are particularly relevant for a digital age. After that, different learning design models will be discussed in the next chapter.

Activity 5.1 Influencing a learning environment

1. Why do you think I focused on learning environments from a teacher’s perspective rather than a learner’s perspective?
2. In order to create the learning environment for HIST 305 in Scenario 5.1, Ralph Goodyear carefully considered the learning environment he wanted to create and ones he had little or no control over. What components do you think he had little or no control over?
3. What would you add (or remove) from the learning environment in Figure 5.1?
4. Figure 5.1 focuses on a learning environment from a teacher’s perspective. Could you design a similar model of a learning environment from the perspective of a learner? What would be the main differences?

5. Does thinking about the whole learning environment overly complicate the teaching endeavour? Why not just get on with it?

Please share your model or thoughts in the comment section at the end of this chapter.
5.3 Learner characteristics

Probably nothing more reflects changes to teaching in a digital age than the change in learner characteristics.

5.3.1 Increased diversity

I noted in Chapter 1 (Section 1.4) that in developed countries such as Canada, public *post-secondary institutions are expected to represent the same kind of socio-economic and cultural diversity as in society at large, rather than being institutions reserved for an elite minority.* In an age where economic development is tightly associated with higher levels of education, the goal now is to bring as many students as possible to the standards required, rather than focus on just the needs of the most able students. This means finding ways of helping a very wide range of students with very different levels of ability and/or prior knowledge to succeed. One size clearly does not fit all today. Dealing with an increasingly diverse student population is perhaps the greatest of all challenges then that teachers and instructors face in a digital age, particularly but not exclusively at a post-secondary level. This is not something for which instructors primarily qualified in subject matter expertise are well prepared.

We shall see in later chapters that a combination of good design and an appropriate use of technology will greatly facilitate the personalization of learning, allowing for instance for different students to work at different speeds, and to focus learning on students’ specific interests and needs, thus ensuring engagement and motivation for a diverse range of students. However, the first and perhaps most important step is for instructors to know their students, and in particular, to identify from the vast range of information regarding students and their differences, which are the most important for the design of teaching and learning in a digital age. I list some of the characteristics that I think are important from the perspective of designing teaching.

5.3.2 The work and home context

Two factors make the work and home context an important consideration in the design of teaching and learning: stu-
dents are increasingly working while studying (about half of all Canadian post-secondary students also work, and those that do work average 16 hours a week – Marshall, 2011); and the age range of students continues to spread, with the average age of students slowly increasing (at the University of British Columbia, the average age of undergraduates is 20, but more than one third of all their students are over 24 years old. The mean age for graduate students in 2014 was 31 – UBC Vancouver Fact Sheet, 2014.)

There are several reasons for the average age of students increasing, at least in North America:

- students are taking longer to graduate (partly because they tend to take a smaller study load when working)
- increasing numbers of students are going on to grad school
- more students are coming back for additional courses and programs after graduating (lifelong learners), mainly for economic reasons.

Partly or fully employed students, or students with families, increasingly need more flexibility in their studying, and especially avoiding long commutes between home, work and college. These students increasingly want hybrid or fully online courses, and smaller modules, certificates or programs that they can fit around their work and family life.

### 5.3.3 Learners’ goals

Understanding the motivation of students and what they expect to get out of a course or program should also influence the design of a course or program. For academic learning, it is often necessary to find ways to move students whose approach to learning is initially driven by extrinsic rewards such as grades or qualifications to an approach that engages and motivates students in the subject matter itself. Potential students already with a post-secondary qualification and a good job may not want to work through a pre-determined set of courses but may want just specific areas of content from existing courses, tailored to meet their needs (for instance, on demand and delivered online). Thus it is important to have some kind of knowledge or understanding of why learners are likely to take your course or program, and what they are hoping to get out of it.

### 5.3.4 Prior knowledge or skills

Future learning often depends on students having prior knowledge or an ability to do things at a certain level. Teachers aim to bridge the difference between what a learner can do without help and what he or she can do with help, what Vygotsky (1978) termed the zone of proximal development. If the difficulty level of the teaching is aimed too far beyond the capability or prior knowledge and skills of a learner, then learning fails to occur.

However, the more diverse the students in a program, the more diverse the knowledge and skill levels they are likely to bring with them. Indeed, lifelong learners, or new immigrants repeating a subject because their foreign qualifications are not recognised, may bring specialist or advanced knowledge that can be drawn on to enrich the learning experience for everyone. Other students may not have the same basic knowledge as others in a course and will need more help. In such a context it is important to design the learning experience so that it is flexible enough to accommodate students with a wide range of prior knowledge and skills.

### 5.3.5 Digital natives

Most students today have grown up with digital technologies such as mobile phones, tablets and social media, including Facebook, Twitter, blogs and wikis. Prensky (2010) and others (e.g. Tapscott, 2008) argue that not only are such students more proficient in using such technologies than previous generations, but that they also think differently (Tapscott, 2008). However, Jones and Shao (2011), following a thorough review of the literature on this topic, came to a contrary conclusion:
• the evidence indicates that young students do not form a generational cohort and they do not express consistent or
generationally organised demands.
• students do not naturally make extensive use [for study purposes] of many of the most discussed new technologies such
as Blogs, Wikis and 3D Virtual Worlds ....
• the gap between students and their teachers is not fixed, nor is the gulf so large that it cannot be bridged.
• students who are required to use these technologies in their courses are unlikely to reject them and low use does not
imply that they are inappropriate for educational use.
• the development of university infrastructures, such as new kinds of learning environments ....should be choices about
the kinds of provision that the university wishes to make and not a response to general statements about what a new
generation of students are demanding.

It is particularly important to understand that students themselves vary a great deal in their use of social media and new
technologies, that their use is largely driven by social and personal demands, and their use of digital technologies does
not naturally flow across into educational use. They will use new technologies and social media for learning though
where instructors make a good case for it and when students can see that the use of digital media will directly help them
in their studies. For this to happen though deliberate design choices are required on the part of the instructor.

5.3.6 In conclusion

The work and home context, learners’ goals, and students’ prior knowledge and skills (including their competence with
digital media) are some of the critical factors that should influence the design of teaching. For some instructors, other
characteristics of learners, such as learning styles, gender differences or cultural background, may be more important,
depending on the context. Whatever the context, good design in teaching requires good information about the learners
we are going to teach, and in particular good design needs to address the increasing diversity of our students.
For most teachers and instructors, content remains a key focus. Content includes facts, ideas, principles, evidence, and descriptions of processes or procedures. A great deal of time is spent on discussing what content should be included in the curriculum, what needs to be covered in a course or a program, what content sources such as text-books students should access, and so on. Teachers and instructors often feel pressured to cover the whole curriculum in the time available. In particular, lecturing or face-to-face classes remain a prime means for organizing and delivering content.

I have already made a case for balancing content with skills development, but issues around content remain critically important in teaching. In particular, instructors need to ask themselves these two questions: ‘What specific content will add value to the overall goals of this course or program? What content would be nice for students to cover, but could be avoided if necessary?’

5.4.1 Goals for content

Because as instructors we tend to take content for granted – this is what we teach – it is important, when designing teaching for a digital age, to be clear in our goals for teaching content. Why do we require students to know facts, ideas, principles, evidence, and descriptions of processes or procedures? Is learning specific content a goal in itself, or is it a means to an end? For instance, is there an intrinsic value in knowing the periodic table, or the dates of battles, or are they means to an end, such as designing experiments or understanding why French is an official language in Canada?

The question is important, because in a digital age, some would argue that learning or memorising content becomes less important or even irrelevant when it is easy just to look up facts or definitions or equations. Cognitivists will argue that content needs to be framed or put in context for it to have meaning. Does content need to be learned solely to enable us to do things, such as solve problems, or make decisions, and do we need only to draw on content as and when needed, as it is now so easy to access?

Probably more important than the instructor being clear on why content is being taught is for the students to understand this. One way of stating this is to ask: what value is added to the overall goals of this course or program by teaching this specific content? Do students need to memorise this content, or know where to find it, and when it is important to use it? This means of course having very clear goals for the course or program as a whole.
5.4.2 Quantity and depth

In many contexts, instructors have little choice over content. External bodies, such as accreditation agencies, state or provincial governments, or professional licensing boards, may well dictate what content a particular course or program needs to cover. However, the rapid growth of scientific and technological knowledge increasingly challenges the idea of a fixed body of content that students must learn. Engineering and medical programs struggle to cover even in six or eight years of formal education all the knowledge that professionals need to know to practice effectively. Professionals will need to go on learning well past graduation if they are to keep up with new developments in the field.

In particular, covering content quickly or overloading students with content are not effective teaching strategies, because even working harder all waking hours will not enable students in these subject domains to master all the information they need in their professions. Specialization has been a traditional way of handling the growth of knowledge, but that does not help in dealing with complex problems or issues in the real world, which often require inter-disciplinary and broader based approaches. Thus instructors need to develop strategies that enable students to cope with the massive and growing amounts of knowledge in their field.

We shall see in the next section (5.5) that one way to handle the problem of knowledge explosion is to focus on the development of skills, such as knowledge management, problem-solving and decision-making. However, these skills are not content-free. In order to solve problems or make decisions, you need access to facts, principles, ideas, concepts and data. To manage knowledge, you need to know what content is important and why, where to find it, and how to evaluate it. In particular there may be core or basic knowledge or content that needs to be mastered for many if not most of their professional activities. One teaching skill then will be the ability to differentiate between essential and desirable areas of content, and to ensure that whatever is done to develop skills, in the process core content is covered.
5.4.3 Sources

Another critical decision for teachers in a digital age is where students should source or find content. In medieval times, books were scarce, and the library was an essential source of content not only for students but also for professors. Professors had to select, mediate and filter content because the sources of content were extremely scarce. We are not in that situation today. Content is literally everywhere: on the Internet, in social media, on mass media, in libraries and books, as well as in the lecture theatre.

Often, a great deal of time is spent in departmental or program meetings on discussing what textbooks or articles students should be required to read. Part of the reason for selecting or limiting content is to limit the cost to students, as well as the need to focus on a limited range of material within a course or program. But today, content is increasingly open, free and available on demand over the Internet. It has already been argued that most students will need to continue learning after graduation. They will increasingly resort to digital media for their sources of knowledge. Therefore when deciding on content we should be considering:

(a) to what extent does the instructor need to choose the content for a program (other than a broad set of curriculum topics) and to what extent should students be free to choose both content and the source of that content?

(b) to what extent does the instructor need to deliver content themselves, such as through a lecture or Powerpoint slides, when content is so freely available elsewhere? What is the added value you are providing by delivering the content yourself? Could your time be better used in other ways?

(c) to what extent do we need to provide criteria or guidelines to students for choosing and using openly accessible content, and what is the best way to do that?

When answering such questions, we should also be asking whether our decisions will help students manage content better themselves after graduating.

5.4.4 Structure

One of the most critical supports that teachers and instructors provide is to structure the sequence and inter-relationship of different content elements. I include within structure:

- the selection and sequencing of content,
- developing a particular focus or approach to specific content areas,
- helping students with the analysis, interpretation or application of content
- integrating and relating different content areas.

Traditionally, content has been structured by breaking a course into a number of topic-related classes delivered in a particular sequence, and within the classes, by instructors ‘framing’ and interpreting content. However, new technologies provide alternative means to structure content. Learning management systems such as Blackboard or Moodle enable instructors to select and sequence content material, which students can access anywhere, at any time – and in any order. The availability of a wide range of content over the Internet, and the ability to collect and sort content through blogs, wikis, and e-portfolios, enable students increasingly to impose their own structures on content.

Students need some form of structure within content areas, partly because some things need to be learned in ‘the right order’, partly because without structure content becomes a jumble of unrelated topics, and partly because students can’t know or work out what is important and what is not within a total content domain, at least until they have started studying it. Novice students in particular need to know what they must study each week. There is a good deal of research evidence to suggest that novice students benefit a great deal from tightly structured, sequential approaches to content, but as they become more knowledgeable or experienced in the domain, they seek to develop their own approaches to the selection, ordering and interpretation of content.

Therefore in deciding on the structure of the content in a course or program instructors need to ask:

(a) how much structure should I provide in managing content, and how much should I leave to the students?
(b) how do new technologies affect the way I should structure the content? Will they enable me to provide more flexible structures that will suit a diverse range of student needs?

Similarly, when answering these questions we should ask how important it is for students themselves to be able to structure content, and whether our answers to the two questions above will further help them to do this.

5.4.5 Learner activities

Lastly, what activities do we need to ask students to do to help them learn content? To answer this question will mean returning to the goals for learning content and the overall goals of the course:

- if memorization is important, then automated tests such as computer-marked assignments with correct answers being provided can be used
- if the aim is to enable students to draw on content such as facts, principles, data or evidence to construct an argument, to solve equations, or to design an experiment, then opportunities for practising such skills will be needed
- if the aim is to help students to manage knowledge, then we may need to set tasks that require them to select, evaluate, analyse and apply content.

We shall see that technology enables us to widen considerably the range of activities that students can use to master content, but these need to be related to the learning goals set for the course of program. Without a planned set of activities, though, content may just enter the brain one day and leave it the next.

5.4.6 In conclusion

Even or especially in a digital age, content, in terms of things to know, remains critically important, but in a digital age the role of content is subtly changing, in some ways becoming a means to other ends, such as skills development, rather than an end in itself. Because of the rapid growth in knowledge in nearly all subject areas, being clear about the role and purpose of content in a course, and communicating that effectively to students, becomes particularly important.
5.5 Developing skills

5.5.1 Skills in a digital age

In Chapter 1, Section 1.4, I listed some of the skills that graduates need in a digital age, and argued that this requires a greater focus on developing such skills, at all levels of education, but particularly at a post-secondary level, where the focus is often on specialised content. Although skills such as critical thinking, problem solving and creative thinking have always been valued in higher education, the identification and development of such skills is often implicit and almost accidental, as if students will somehow pick up these skills from observing faculty themselves demonstrating such skills or through some form of osmosis resulting from the study of content.

It is of course somewhat artificial to separate content from skills, because content is the fuel that drives the development of intellectual skills. My aim here is not to downplay the importance of content, but to ensure that skills development receives as much focus and attention from instructors, and that we approach intellectual skills development in the same rigorous and explicit way as apprentices are trained in manual skills.

5.5.2 Setting goals for skills development

Thus a critical step is to be explicit about what skills a particular course or program is trying to develop, and to define these goals in such a way that they can be implemented and assessed. In other words it is not enough to say that a course aims to develop critical thinking, but to state clearly what this would look like in the context of the particular course or content area, in ways that are clear to students. In particular skills should be defined in such a way that they can be assessed, and students should be aware of the criteria or rubrics that will be used for assessment.
5.5.3 Thinking activities

A skill is not binary, in the sense that you either have it or you don’t. There is a tendency to talk about skills and competencies in terms of novice, intermediate, expert, and master, but in reality skills require constant practice and application and there is, at least with regard to intellectual skills, no final destination. So it is critically important when designing a course or program to design activities that require students to develop, practice and apply thinking skills on a continuous basis, preferably in a way that starts with small steps and leads eventually to larger ones. There are many ways in which this can be done, such as written assignments, project work, and focused discussion, but these thinking activities need to be designed, then implemented on a consistent basis by the instructor.

5.5.4 Practical activities

It is a given in vocational programs that students need lots of practical activities to develop their manual skills. This though is equally true for intellectual skills. Students need to be able to demonstrate where they are along the road to mastery, get feedback on it, and retry as a result. This means doing work that enables them to practice specific skills.

In the history scenario, students had to cover and understand the essential content in the first three weeks, do research in a group, develop an agreed project report, in the form of an e-portfolio, share it with other students and the instructor for comments, feedback and assessment, and present their report orally and online. Ideally, they will have the opportunity to carry over many of these skills into other courses where the skills can be further refined and developed. Thus, with skills development, a longer term horizon than a single course will be necessary, so integrated program as well as course planning is important.

5.5.5 Discussion as a tool for developing intellectual skills

Discussion is a very important tool for developing thinking skills. However, not any kind of discussion. It was argued in Chapter 2 that academic knowledge requires a different kind of thinking to everyday thinking. It usually requires students to see the world differently, in terms of underlying principles, abstractions and ideas. Thus discussion needs to be carefully managed by the instructor, so that it focuses on the development of skills in thinking that are integral to the area of study. This requires the instructor to plan, structure and support discussion within the class, keeping the discussions in focus, and providing opportunities to demonstrate how experts in the field approach topics under discussion, and comparing students’ efforts.

5.5.6 In conclusion

There are many opportunities in even the most academic courses to develop intellectual and practical skills that will carry over into work and life activities in a digital age, without corrupting the values or standards of academia. Even in vocational courses, students need opportunities to practice intellectual or conceptual skills such as problem-solving, communication skills, and collaborative learning. However, this won’t happen merely through the delivery of content. Instructors need to:

- think carefully about exactly what skills their students need,
- how this fits with the nature of the subject matter,
- the kind of activities that will allow students to develop and improve their intellectual skills, and
- how to give feedback and to assess those skills, within the time and resources available.

This is a very brief discussion of how and why skills development should be an integral part of any learning environment. We will be discussing skills and skill development in more depth in later chapters.
Figure 5.3: Online threaded discussion forums provide students with opportunities for developing intellectual skills, but the instructor needs to design and manage such forums carefully for this to happen.

Activity 5.2 Developing skills

1. Returning to the HIST 305 scenario, what specific skills was Ralph Goodyear trying to develop in his course?
2. Are the skills being developed by students in the history scenario relevant to a digital age?
3. Is this section likely to change the way you think about teaching your subject, or do you already cover skills development adequately? If you feel you do cover skills development well, does your approach differ from mine?

Write down your responses in the comment section at the end of this chapter.
5.6 Learner support

Learner support focuses on what the teacher or instructor can or should do to help learners beyond the formal delivery of content, or skills development. Learner support covers a wide range of functions, and is a topic that will be dealt with in more depth elsewhere. Here my focus is on indicating why it is an essential component of an effective learning environment, and to describe briefly some of the main activities associated with learner support.
5.6.1 Scaffolding

I use the term scaffolding to cover the many functions of an instructor in diagnosing learners’ difficulties, helping students when they struggle with new concepts or ideas, helping students to gain deep understanding of a topic or subject, helping students to evaluate a range of different ideas or practices, helping students to understand the limits of knowledge, and above all challenging students to go beyond their current level of thinking or practice to acquire deeper understanding or a higher level of competency. These activities normally take the form of personal interventions and communication between an instructor and an individual or a group of students, in face-to-face contexts or online. They tend not to be pre-planned. They are usually a means of individualising the learning, enabling student differences in learning to be better accommodated as they occur.

5.6.2 Feedback

This could be seen as a sub-category of scaffolding, but it covers the role of providing feedback on student performance of activities such as writing assignments, project work, creative activities, and other student activities that are beyond the current and perhaps future scope of automated computer feedback. Again, the instructor’s role here is to provide more individualisation of feedback to deal with more qualitatively assessed student activities, and may or may not be associated with formal assessment or grading.

5.6.3 Counselling

As well as direct support within their academic studying, learners often need help and guidance on administrative or personal issues, such as whether to repeat a course, delay an assignment because of sickness in the family, or cancel enrollment in a course and postpone it to another date. This potential source of help needs to be included in the design of an effective learning environment, with the aim of doing all that can be done to ensure that students succeed while meeting the academic standards of a program.

5.6.4 Other students

Other students can be a great support for learners. Much of this will happen informally, through students talking after
class, through social media, or helping each other with assignments. However, instructors can make more formal use of other students by designing collaborative learning activities, group work, and designing online discussions so that students need to work together rather than individually.

5.6.5 Why learner support is so important

We shall see in the next chapter that good design can substantially reduce demand for learner support, by ensuring clarity and building in appropriate learning activities. Students also vary enormously in their need for support in learning. Many lifelong learners, who have already been through a post-secondary education, have families, careers and a great deal of life experience, can be self-managed, autonomous learners, identifying what they need to learn and how best to do this. At the other extreme, there are students for whom the formal school system was a disaster, who lack basic learning skills or foundations, such as reading, writing and mathematical skills, and therefore lack confidence in learning. These will need a lot of support to succeed.

However the vast majority of learners are somewhere in the middle of the spectrum, occasionally running into problems, unsure what standards are expected, and needing to know how they are doing. Indeed, there is a good deal of research that indicates that ‘instructor presence’ is associated with student success or failure in a course, at least in online learning (Anderson et al, 2001; Richardson and Swan, 2003; Garrison and Cleveland-Innes, 2005; Baker, 2010; Sheridan and Kelly, 2010). Where students feel the instructor is not present, both learner performance and completion rates decline. For such students, good, timely learner support is the difference between success and failure.

It should be noted that the need for good learner support, and the ability to provide it, is not dependent on the medium of instruction. The kind of credit online courses that have been designed and delivered long before MOOCs came along often provided high levels of learner support, through having a strong instructor presence and careful design to ensure students were supported. At the same time, although computer programs can go some way to providing learner support, many of the most important functions of learner support associated with high-level conceptual learning and skills development still need to be provided by an expert teacher or instructor, whether present or at a distance. Furthermore, this kind of learner support is difficult to scale up, as it tends to be relatively labour intensive and requires instructors with a deep level of knowledge within the subject area. Thus, the need to provide adequate levels of learner support cannot just be wished away, if we are to achieve successful learning on a large scale.

This may seem obvious to teachers, but the importance of learner support for student success is not always recognised or appreciated, as can be seen from the design of many MOOCs, and the reaction of politicians and the media to the cost savings promised by MOOCs, which are entirely a function of eliminating learner support. There are also different attitudes from instructors and institutions towards the need for learner support. Some faculty may believe that ‘It’s my job to instruct and yours to learn’; in other words, once students are presented with the necessary content through lectures or reading, the rest is up to them.

Nevertheless, the reality is that in any system with a wide diversity of students, as is so common today, teachers and instructors will have to provide effective learner support, unless we are willing to sacrifice the future of many thousands of learners.

### Activity 5.3 Building learner support

1. do you think it is possible to design an effective course or program without the need for high levels of learner support? If so, what would it look like? A development of MOOCs or something completely different?
2. do you share my views about the limitations of computers for providing the kind of high-level learner support needed for conceptual learning in a digital age? What do they do well in terms of supporting learners?

3. is ‘scaffolding’ the best term to describe the kind of learning support I described in that section? If not is there a better term for this?

Write your answers in the comment section at the end of this chapter.
5.7 Resources

As in the case of learner characteristics, you may not have a lot of control over the resources available, but resources (or the lack of them) will impact a great deal on the design of teaching. Fighting for appropriate resources is often one of the most challenging tasks for many teachers and instructors.

5.7.1 Teaching assistance

I define teaching assistance as people such as adjunct or sessional instructors, teaching assistants, librarians, and technical support staff, including instructional designers, media producers and IT technical support. An institution may have policies or guidelines about how many support staff an instructor can have for a set number of students.

It is important to think about the best way to use supporting staff. In universities, the tendency is to chop a large class into sections, with each section with its own sessional instructor or teaching assistant, which then operate relatively independently, with often large differences in the quality of the teaching in different sections, depending on the experience of the instructor. However, new technologies enable the teaching to be organised differently and more consistently. For instance, a senior professor may determine the overall curriculum and assessment strategy, and working with an instructional designer, provide the overall design of a course. Sessionals and/or teaching assistants then are hired to deliver the course either face-to-face or online or more often a mix of both, under the supervision of the senior professor (see the National Center for Academic Transformation for examples). Flipped classrooms are another way to organise resources differently (see Blended Learning in Introductory Psychology as an example.)

Furthermore, online learning may bring in more revenues through government grants for extra students and/or direct tuition revenue, so there may be economies of scale which would enable the institution to hire more sessionals from the extra revenues generated by the additional online students. Indeed, there are now examples of fully online masters programs more than covering the full cost, including the hiring of research professors to teach the program, from tuition revenues alone (the University of British Columbia’s online Master in Educational Technology is one example.)

Thus design can influence resources, as well as the other way round.
5.7.2 Facilities

This refers primarily to physical facilities available to an instructor and students, such as classrooms, labs, and the library. These may provide constraints on the teaching, because for example the physical set-up of a lecture hall or classroom may limit opportunities for discussion or project work, or an instructor may be forced to organise the teaching around three hours of lecturing and six hours of labs per week, to ‘fit’ with broader institutional requirements for classroom allocations (see How Online Learning is Going to Affect Classroom Design regarding attempts to re-design classrooms for the digital age.)

Online learning can free instructors and students from such rigid physical constraints, but there is still a need for structure and organization of units or modules of teaching, even or especially when teaching online (see Section 5.4.4 above).

5.7.3 Technology

The development of new technologies, and especially learning management systems, lecture capture, and social media, have radical implications for the design of teaching and learning. This will be discussed in much more depth in Chapter 7, but for the purpose of describing an effective learning environment, the technologies available to an instructor can contribute immensely to creating interactive and engaging learning environments for students. However, it is important to emphasise that technology is just one component within any effective learning environment, and needs to be balanced and integrated with all the other components.

5.7.4 The instructor’s time

The greatest and most precious resource of all! Building an effective learning environment is an iterative process, but in the end, the teaching design, and to some extent the learning environment as a whole, will be dependent on the time available from the instructor (and his or her team) for teaching. The less time available, the more restrictive the learning environment is likely to be, unless the instructor’s time is very carefully managed. Again, though, we shall see in the next chapter that good design takes into account the time available for teaching.

5.7.5 Resources, class size and control

Nothing drives an instructor to distraction more than trying to manage with inadequate resources. Certainly, if a teacher or instructor is allocated a class of 200 students, in a large lecture hall, with no additional teaching support, then the instructor is going to have difficulty creating a rich and effective learning environment, because the lack of resources limits the options. On the other hand, an instructor with 30 students, access to a wide range of technology, freedom to organise and structure the curriculum, and with support from an instructional designer and a web designer, has the luxury of exploring a range of different designs and possible learning environments.

Nevertheless it is probably when resources are most scarce that the most creativity is needed to break out of traditional teaching models. New technology, if properly used and available, does enable even large classes with otherwise few resources to be designed with a relatively rich learning environment. This will be explored in more depth in the next chapter. At the same time, expectations need to be realistic. Providing adequate learner support with an instructor:student ratio of 1:200 will always be a challenge. Improvements are possible through re-design – but not miracles. (For more on increasing productivity through online teaching, see Productivity and Online Learning Redux.)
Activity 5.4 What resources matter?

- are there other resources that influence the design of an effective learning environment that I should have included?
- Winston Churchill once said 'We shape our buildings and in turn our buildings shape us.' To what extent do you think online learning can free us of some of the constraints that buildings impose on the design of teaching and learning? What new constraints does online learning bring in terms of design?
- how do you feel about the whole issue of teaching assistance? I have grave reservations myself about the use of students as teaching assistants in universities, in terms of the quality of the teaching. I also believe that sessionals and adjunct instructors are badly treated in terms of how they are managed. In British Columbia we have had two Supreme Court cases and a major teachers' strike over class size and composition, and in particular how much help school teachers should receive for coping with students with learning disabilities. But by bringing in less qualified (and cheaper) support for instructors, do we strengthen or weaken the learning environment for students?

Write your answers in the comment section at the end of this chapter.
5.8 Assessment of learning

Earle, 2003

5.8.1 Learner assessment in a digital age

Because assessment is a huge topic, it is important to be clear that the purpose of this section is:

(a) to look at one of the components that constitute an effective and comprehensive learning environment, and
(b) briefly to examine the extent to which assessment is or should be changing in a digital age.

Probably nothing drives the behaviour of students more than how they will be assessed. Not all students are instrumental in their learning, but given the competing pressures on students’ time in a digital age, most ‘successful’ learners focus on what will be examined and how they can most effectively (i.e. in as little time as possible) meet the assessment requirements. Therefore decisions about methods of assessment will in most contexts be fundamental to building an effective learning environment.

5.8.2 The purpose of assessment

There are many different reasons for assessing learners. It is important to be clear about the purpose of the assessment, because it is unlikely that one single assessment instrument will meet all assessment needs. Here are some reasons (you can probably think of many more):
1. to improve and extend students' learning
2. to assess students' knowledge and competence in terms of desired learning goals or outcomes
3. to provide the teacher/instructor with feedback on the effectiveness of their teaching and how it might be improved
4. to provide information for employers about what the student knows and/or can do
5. to filter students for further study, jobs or professional advancement
6. for institutional accountability and/or financial purposes.

I have deliberately ordered these in importance for creating an effective learning environment.

5.8.3 Methods of assessment

The form the assessment takes, as well as the purpose, will be influenced by the instructors’ or examiners’ underlying epistemology: what they believe constitutes knowledge, and therefore how students need to demonstrate their knowledge. The form of assessment should also be influenced by the knowledge and skills that students need in a digital age, which means focusing as much on assessing skills as knowledge of content. Thus continuous or formative assessment will be as important as summative or ‘end-of-course’ assessment.

There is a wide range of possible assessment methods. I have selected just a few to illustrate how technology can change the way we assess learners in ways that are relevant to a digital age:

5.8.3.1 No assessment

A question to be considered is whether there is a need for assessment of learning in the first place. There may be contexts, such as a community of practice, where learning is informal, and the learners themselves decide what they wish to learn, and whether they are satisfied with what they have learned. In other cases, learners may not want or need to be formally evaluated or graded, but do want or need feedback on how they are doing with their learning. 'Do I really understand this?' or 'How am I doing compared to other learners?'

However, even in these contexts, some informal methods of assessment by experts, specialists or more experienced participants could help other participants extend their learning by providing feedback and indicating the level of competence or understanding that a participant has achieved or has yet to accomplish. Lastly, students themselves can extend their learning by participating in both self-assessment and peer assessment, preferably with guidance and monitoring from a more knowledgeable or skilled instructor.

5.8.3.2 Computer-based multiple-choice tests

This method is good for testing 'objective' knowledge of facts, ideas, principles, laws, and quantitative procedures in mathematics, science and engineering etc., and are cost-effective for these purposes. This form of testing though tends to be limited for assessing high-level intellectual skills, such as complex problem-solving, creativity, and evaluation, and therefore less likely to be useful for developing or assessing many of the skills needed in a digital age.

5.8.3.3 Written essays or short answers

This method is good for assessing comprehension and some of the more advanced intellectual skills, such as critical thinking, but it is labour intensive, open to subjectivity, and not good for assessing practical skills. Experiments are taking place with automated essay marking, using developments in artificial intelligence, but so far automated essay marking still struggles to identify valid semantic meaning (for balanced and more detailed accounts of the current state of machine grading, see Mayfield, 2013 and Parachuri, 2013).
5.8.3.4 Project work

Project work encourages the development of authentic skills that require understanding of content, knowledge management, problem-solving, collaborative learning, evaluation, creativity and practical outcomes. Designing valid and practical project work needs a high level of skill and imagination from the instructor.

5.8.3.5 e-Portfolios (an online compendium of student work)

E-portfolios enable self-assessment through reflection, knowledge management, recording and evaluation of learning activities, such as teaching or nursing practice, and recording of an individual’s contribution to project work (as an example, see the use of e-portfolios in Visual Arts and Built Environment at the University of Windsor); E-portfolios are usually self-managed by the learner but can be made available or adapted for formal assessment purposes or job interviews.

5.8.3.6 Simulations, educational games (usually online) and virtual worlds

These facilitate the practice of skills, such as complex and real time decision-making, operation of (simulated or remote) complex equipment, the development of safety procedures and awareness, risk taking and decision-making in a safe environment, and activities that require a combination of manual and cognitive skills (see the training of Canadian Border Service officers at Loyalist College, Ontario). These methods are currently expensive to develop, but cost-effective with multiple use, where they replace the use of extremely expensive equipment, where operational activities cannot be halted for training purposes, or where available as open educational resources.
It can be seen that some of these assessment methods are both formative, in helping students to develop and increase their competence and knowledge, as well as summative, in assessing knowledge and skill levels at the end of a course or program. In a digital age, assessment and teaching tends to become even more closely integrated and contiguous.

5.8.4 In conclusion

Nothing is likely to drive student learning more than the method of assessment. At the same time, assessment methods are rapidly changing and are likely to continue to change. Assessment in terms of skills development needs to be both ongoing and continuous as well as summative. There is an increasing range of digitally based tools that can enrich the quality and range of student assessment. Therefore the choice of assessment methods, and their relevance to other components, are vital elements of any effective learning environment.

Activity 5.5 What assessments work in a digital age?

• are there other methods of assessment relevant to a digital age that I should have included?
• there is still a heavy reliance on computer-based multiple-choice tests in much teaching, mainly for cost reasons. However, although there are exceptions, I would argue in general that these really don’t assess the high level conceptual skills needed in a digital age. Do you agree?
• Are there other methods that are equally as economical, particularly in terms of instructor time, that are more suitable for assessment in a digital age? For instance, do you think automated essay grading is a viable alternative?
• would it be helpful to think about assessment right at the start of course planning, rather than at the end? Is this feasible?
• in Scenario 5.1, ‘Developing historical thinking’, did the instructor use assessment to help develop and assess the skills needed in a digital age in an effective manner? If so, how and if not, why not?

Write your answers in the comment section at the end of this chapter.
I have walked you through one possible learning environment. It is meant to be an example, not a recommendation. It probably fits a post-secondary educational context better than a school context. For instance, in a school context, play and parents may be two other important components, again depending on your underlying epistemology and beliefs about teaching and learning.

5.9.1 Epistemology and learning environments

People come from different epistemological and philosophical positions about teaching and learning. This can be illustrated by two different metaphors. Some people see teaching and learning very much like the mining and transportation of coal. Knowledge is coal; it has to be mined (research) and then loaded and delivered (teaching). Learners are seen
as buckets or railway wagons into which knowledge is delivered. Instructors are the shovels. In this process, learners are relatively passive in the sense that they do not transform the knowledge into something different. It is what it is.

Even though I come from a coal mining family on my mother’s side and a railway family on my father’s, I see teaching and learning differently. I see it more as a garden, with learners as the plants. Thus a gardener tries their best to create an ecological environment where plants grow and develop, by ensuring that they have the right balance of light, soil, water, and that they are not damaged by weeds or insects. I see learning as development and growth in individuals. My job as a teacher is to provide the best possible environment in which learners can grow and develop.

Similarly, teachers and instructors need to conceive and put in place a learning environment where students can grow and develop their own learning. Knowledge is not static, but grows and develops in learners. In particular, in a digital age, learning means developing skills as well as accumulating content. Thus the learning environment I have described reflects my more constructivist and ‘nurturing’ approach to teaching.

Even if you come from a different epistemological position though and see knowledge and learning in a different way, or are teaching in a very different context from post-secondary education, it still helps to look at all the components that need to be considered for effective learning, and how those should be configured. It is also worth remembering that in a digital age, our learning environment is no longer bounded by bricks and mortar. Technology allows us to create different and more flexible environments for encouraging learning.

5.9.2 Necessary but not sufficient

Thus as a teacher or instructor, you are in a better position to think about how you are going to design and implement a course or program if you already have in mind all the necessary components of a learning environment, taking into account new learning needs, changing learner characteristics, and the new technologies now available. The components
of a learning environment provide a kind of check list in terms of what has to be considered when designing and delivering a program. Analysing all the necessary components that go to make an effective learning environment provides you with a strong foundation around which to design your teaching.

It should be noted though that even once the main components have been identified, you will still need to make many decisions about how those components will be designed and delivered. Even with such a strong conceptual foundation, you still have to implement it; in other words, you still have to design your teaching. The next chapter looks at several very different approaches to designing teaching and learning.

### Activity 5.6 Designing your own learning environment

Describe the current learning environment in which you are teaching a particular course or program.

What are the main components to which you give the most attention?

Would you make changes to that learning environment as a result of reading this chapter? Why?
Now: can you design a learning environment that will best fit the needs of the course and your students? To do this you will need to:

- decide on the key main components and their sub-components
- make choices or decisions for each of the sub-components

When you have done this decide whether this is enough to begin teaching your course or program. If it isn’t – read the next chapter!
Chapter 6: Models for designing teaching and learning

Purpose of the chapter

At the end of this chapter you should be able to:

1. Describe key models or approaches to the design of teaching and learning
2. Analyse each model in terms of its value for teaching in a digital age
3. Decide which model or combination of models will fit best with your own teaching
4. Use the model as a basis for designing your own teaching

What is covered in this chapter

• 6.1 What is a design model?
• 6.2 The classroom design model
• 6.3 Old wine in new bottles: classroom-type online learning
• 6.4 Online collaborative learning
• 6.5 The ADDIE model
• 6.6 Design models for experiential learning
• 6.7 Competency-based learning
• 6.8 Communities of practice
• 6.9 Massive Open Online Courses
• 6.10 'Agile' Design: flexible designs for learning
• 6.11 Making decisions about design models
• Scenario E: ETEC 522, Ventures in e-Learning

Also in this chapter you will find the following activities:

• Activity 6.1: Moving the classroom model online
• Activity 6.2: Evaluating online collaborative learning models
• Activity 6.3: Using the ADDIE model
• Activity 6.4: Assessing experiential design models
• Activity 6.5: Thinking about competency-based education?
• Activity 6.6: Making communities of practice work
• Activity 6.7: Taking risks with 'agile' design
• Activity 6.8: Making choices
1. Traditional classroom teaching, and especially the transmissive lecture, was designed for another age. Although it has served us well, we are now in a different age that requires different methods.

2. The key shift is towards greater emphasis on skills and less on memorising content. We need design models for teaching and learning that lead to the development of the skills needed in a digital age.

3. There is no one 'best' design model for all circumstances. The choice of design model needs to take account of the context in which it will be applied, but nevertheless, some design models are better than others for developing the knowledge and skills needed in a digital age. For the contexts with which I'm most associated, online collaborative learning, experiential learning and agile design best meet my criteria.

4. Design models in general are not dependent on a particular mode of delivery; they can operate in most cases as well online as in class.

5. In an increasingly volatile, uncertain, complex and ambiguous world, we need design models for teaching that are light and nimble.
6.1 What is a design model?

One first step in learning design is the one we went through in Chapter 5: creating an effective learning environment. This chapter builds on that, looking at ways to convert that ideal or model learning environment into practical teaching and learning activities.

**Definition:**

*Design model: the organized steps taken to convert a desired learning environment and or learning theory/teaching model into teaching and learning activities.*

There are many design models in education, but I will be focusing mainly on those that are directly relevant to teaching in a digital age, in comparison with design models that are more traditional. In particular I will focus on the core design principles that underpin each design model and will look at the strengths and weaknesses of each design model in terms of developing the knowledge and skills needed in a digital age.
6.2 The classroom design model

The large urban school, college or university, organized by age stratification, learners in groups, and regulated units of time was an excellent fit for such a society. In effect, we still have a predominantly factory model of educational design, which in large part remains our default design model even today.

Some design models are so embedded in tradition and convention that we are often like fish in water – we just accept that this is the environment in which we have to live and breath. The classroom model is a very good example of this. In a classroom based model, learners are organised in classes that meet on a regular basis at the same place at certain times of the day for a given length of time over a given period (a term or semester).

This is a design decision that was taken more than 150 years ago. It was embedded in the social, economic and political context of the 19th century. This context included:

- the industrialization of society which provided ‘models’ for organizing both work and labour, such as factories and mass production
- the movement of people from rural to urban occupations and communities, with increased density resulting in larger institutions
• the move to mass education to meet the needs of industrial employers and an increasingly large and complex range of state-managed activities, such as government, health and education
• voter enfranchisement and hence the need for a better educated voting public
• over time, demand for more equality, resulting in universal access to education.

However, over the span of 150 years, our society has slowly changed. Many of these factors or conditions no longer exist, while others persist, but often in a less dominant way than in the past. Thus we still have factories and large industries, but we also have many more small companies, greater social and geographical mobility, and above all a massive development of new technologies that allow both work and education to be organized in different ways. This is not to say that the classroom design model is inflexible. Teachers for many years have used a wide variety of teaching approaches within this overall model.

I don’t want to devote much space to the classroom design model, as we are all so familiar with it, and there is so much invested in the ‘default’ model that it is impractical to rip everything up and start with something completely different. Nevertheless, we have at least the seeds of change already showing. ‘Flipped’ classrooms where students get lectures on video and come to class for discussion and the re-design of large lecture classes are moves to modify the default model, while fully online programs and MOOCs are a manifestation of more radical change by offering education at any time and any place.

The real danger though is that we fail to grasp the opportunities that are now available to us, because we are so comfortable and familiar with the classroom design model. Even worse is trying to force the old default model on to new developments, when what is needed is a totally different approach if we are to meet the needs of a digital age. I give two examples in the next section of forcing new technologies into the old classroom design model.
6.3 Old wine in new bottles: classroom-type online learning

When commercial movies were first produced, they were basically a transfer of previous music hall and vaudeville acts to the movie screen. Then along came D.W. Griffith’s ‘Birth of a Nation’, which transformed the design of movies, by introducing techniques that were unique to cinema at the time, such as panoramic long shots, panning shots, realistic battle scenes, and what are now known as special effects.

6.3.1 Learning management systems

Most learning management systems, such as Blackboard, Desire2Learn and Moodle, are in fact in essence a replication of a classroom design model. They have weekly units or modules, the instructor selects and presents the material to all students in the class at the same time, a large class enrollment can be organized into smaller sections with their own instructors, there are opportunities for (online) discussion, students work through the materials at roughly the same pace, and assessment is by end-of-course tests or essays.

The main design differences are that the content is primarily text based rather than oral (although increasingly video and audio are now integrated into LMSs), the online discussion is mainly asynchronous rather than synchronous, and the course content is available at any time from anywhere with an Internet connection. These are important differences from a physical classroom, and skilled teachers and instructors can modify or adapt LMSs to meet different teaching or learning requirements (as they can in physical classrooms), but the basic organizing framework of the LMS remains the same as for a physical classroom.

Nevertheless, the LMS is still an advance over online designs that merely put lectures on the Internet as pre-recorded videos, or load up pdf copies of Powerpoint lecture notes, as is still the case unfortunately in many online programs. There is also enough flexibility in the design of learning management systems for them to be used in ways that break away from the traditional classroom model, which is important, as good online design should take account of the special requirements of online learners, so the design needs to be different from that of a classroom model. Some of the design models that follow this section illustrate how this can be done.

6.3.2 Lecture capture

This technology, which automatically records a classroom lecture, was originally designed to enhance the classroom model by making lectures available for repeat viewings online at any time for students regularly attending classes – in other words, a form of homework. Flipped classrooms are an attempt to exploit more fully this potential, but the biggest impact has been the use of lecture capture for ‘instructionist’ massive open online courses (MOOCs), such as those offered by Coursera, Udacity and edX. However, even this type of MOOC is really a basic classroom design model. The main differences are that the classroom is open to anyone (but then in principle so are many university lectures), and MOOCs are available to unlimited numbers at a distance. These are important differences again, but the design of the teaching – lectures delivered in chunks – has not changed markedly.

‘Instructionist’ MOOCs have resulted in some important design changes to the classroom model, such as using computer-marked assignments to test students or give feedback, and the use of peer review (both often used also in physical classroom design of course), but the predominant design model of instructionist MOOCs is that of an admittedly massive classroom.
6.3.3 The limitations of the classroom design model for online learning

Old wine can still be good wine, whether the bottle is new or not. What matters is whether classroom design meets the changing needs of a digital age. Just adding technology to the mix, or delivering the same design online, does not automatically result in meeting changing needs. It is important then to look at the design that makes the most of the educational affordances of new technologies, because unless the design changes significantly to take full advantage of the potential of the technology, the outcome is likely to be inferior to that of the physical classroom model which it is attempting to imitate.

The second danger of just adding new technology to the classroom design is that we may just be increasing cost, both in terms of technology and the time of instructors, without changing outcomes. Thus even if the new technology, such as lecture capture and computer-based multiple-choice questions organised in a MOOC, result in helping more students memorise better or learn more content, for example, this may not be sufficient to meet the higher level skills needed in a digital age.

Education is no exception to the phenomenon of new technologies being used at first merely to reproduce earlier design models before they find their unique potential. However, changes to the basic design model are needed if the demands of a digital age and the full potential of new technology are to be exploited in education.
Activity 6.1: Moving the classroom model online

1. Do I manage to make clear what I mean by design ‘models’? If not, how can this be made clearer – or is the concept not helpful in the first place?

2. Do you agree that the classroom design model is a product of the 19th century and needs to be changed for teaching in a digital age? Or is there still enough flexibility in the classroom model for our times?

3. To what extent do you feel you have to teach in a certain way because of the classroom model – or are you able to work flexibly within this model?

4. Do you agree that LMSs are basically a classroom model delivered online, or are they a unique design model in themselves. If so, what makes them unique?
Figure 6.4: A classroom today: not much change in the basic design of teaching
Image: © University of Arts and Science Oklahoma
6.4 Online collaborative learning

From the quite early days of online learning, some instructors have focused heavily on the communication affordances of the Internet. They have based their teaching on the concept of knowledge construction, the gradual building of knowledge mainly through asynchronous online discussion among students and between students and an instructor.

6.4.1 What is online collaborative learning?

The concurrence of both constructivist approaches to learning and the development of the Internet has led to the development of a particular form of constructivist teaching, originally called computer-mediated communication (CMC), or networked learning, but which has been developed into what Harasim (2012) now calls online collaborative learning theory (OCL). She describes OCL as follows (p. 90):

OCL theory provides a model of learning in which students are encouraged and supported to work together to create knowledge: to invent, to explore ways to innovate, and, by so doing, to seek the conceptual knowledge needed to solve problems rather than recite what they think is the right answer. While OCL theory does encourage the learner to be active and engaged, this is not considered to be sufficient for learning or knowledge construction. In the OCL theory, the teacher plays a key role not as a fellow-learner, but as the link to the knowledge community, or state of the art in that discipline. Learning is defined as conceptual change and is key to building knowledge. Learning activity needs to be informed and guided by the norms of the discipline and a discourse process that emphasises conceptual learning and builds knowledge.

OCL builds on and integrates theories of cognitive development that focus on conversational learning (Pask, 1975), conditions for deep learning (Marton and Saljo, 1997; Entwistle, 2000), development of academic knowledge (Laurillard, 2000) and knowledge construction (Scardamalia and Bereiter, 2006)

6.4.2 Core design principles of OCL

Harasim emphasises the importance of three key phases of knowledge construction through discourse:

- **idea generating**: this is literally brainstorming, to collect the divergent thinking within a group
- **idea organising**: this is where learners compare, analyse and categorise the different ideas previously generated, again through discussion and argument
- **intellectual convergence**: the aim here is to reach a level of intellectual synthesis, understanding and consensus (including agreeing to disagree), usually through the joint construction of some artefact or piece of work, such as an essay or assignment.

This results in what Harasim calls a Final Position, although in reality the position is never final because for a learner, once started, the process of generating, organising and converging on ideas continues at an ever deeper or more advanced level. The role of the teacher or instructor in this process is seen as critical, not only in facilitating the process and providing appropriate resources and learner activities that encourage this kind of learning, but also, as a representative of a knowledge community or subject domain, in ensuring that the core concepts, practices, standards and principles of the subject domain are fully integrated into the learning cycle. Harasim provides the following diagram to capture this process:
Another important factor is that in the OCL model, discussion forums are not an addition or supplement to core teaching materials, such as textbooks, recorded lectures, or text in an LMS, but are the core component of the teaching. Textbooks, readings and other resources are chosen to support the discussion, not the other way round. This is a key design principle, and explains why often instructors or tutors complain, in more ‘traditional’ online courses, that students don’t participate in discussions. Often this is because where online discussions are secondary to more didactic teaching, or are not deliberately designed and managed to lead to knowledge construction, students see the discussions as optional or extra work, because they have no direct impact on grades or assessment. (It is also a reason why awarding grades for participation in discussion forums misses the point. It is not the extrinsic activity that counts, but the intrinsic value of the discussion, that matters (see, for instance, Brindley, Walti and Blashke, 2009). Thus although instructors using an OCL approach may use learning management systems for convenience, they are used differently from courses where traditional didactic teaching is moved online.

### 6.4.3 Community of Inquiry

The Community of Inquiry Model (CoI) is somewhat similar to the OCW model. As defined by Garrison, Anderson and Archer (2000)

> An educational community of inquiry is a group of individuals who collaboratively engage in purposeful critical discourse and reflection to construct personal meaning and confirm mutual understanding.
Garrison, Anderson and Archer argue that there are three essential elements of a community of inquiry:

- **social presence** is the ability of participants to identify with the community (e.g., course of study), communicate purposefully in a trusting environment, and develop inter-personal relationships by way of projecting their individual personalities.

- **teaching presence** is “the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes”

- **cognitive presence** is the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse.

**Figure 6.8: Community of Inquiry Image: © Marguerite Koole, 2013**

### 6.4.4 Other design principles

However, I consider CoI more of a theory than a model, since it does not indicate what activities or conditions are needed to create these three ‘presences’. I also see the two models as complementary rather than competing. Since the pub-
lication of the original CoI paper in 2000, there have been a number of studies that have identified the importance of these 'presences' within especially online learning (click here for a wide selection). Partly as a result of this research, and partly as the result of experienced online instructors who have not necessarily been influenced by either the OCW or the Community of Inquiry literature, several other design principles have been associated with successful (online) discussion, such as:

- **choice of appropriate technology** (e.g. software that allows for threaded discussions)
- **clear guidelines on student online behaviour**
- **student orientation and preparation**, including technology orientation and explaining the purpose of discussion
- **choice of appropriate topics**
- **setting an appropriate 'tone' or requirements for discussion** (e.g. respectful disagreement, evidence-based arguments)
- **defining clearly learner roles and expectations**
- **monitoring the participation of individual learners, and responding accordingly**
- **regular, ongoing instructor 'presence'**
- **ensuring strong articulation between discussion topics and assessment.**

These issues are discussed in more depth by Salmon (2000); Paloff and Pratt (2005; 2007); and Bates and Poole (2003). Therefore, although there has been a wide range of researchers and educators engaged in the area of online collaborative learning and communities of inquiry, there is a high degree of convergence and agreement about successful strategies and design principles.

### 6.4.5 Strengths and weaknesses of online collaborative learning

This approach to the use of technology for teaching is very different from the more objectivist approaches found in computer-assisted learning, teaching machines, and artificial intelligence applications to education, which primarily aim to use computing to replace at least some of the activities traditionally done by human teachers. With online collaborative learning, the aim is not to replace the teacher, but to use the technology primarily to increase and improve communication between teacher and learners, with a particular approach to the development of learning based on knowledge construction assisted and developed through social discourse. This social discourse furthermore is not random, but managed in such a way as to ‘scaffold’ learning:

- by assisting with the construction of knowledge in ways that are guided by the instructor,
- that reflect the norms or values of the discipline, and
- that also respect or take into consideration the prior knowledge within the discipline.

Thus there are two main strengths of this model:

- when applied appropriately, online collaborative learning can lead to deep, academic learning, or transformative learning, as well as, if not better than, discussion in campus-based classrooms. The asynchronous and recorded 'affordances' of online learning more than compensate for the lack of physical cues and other aspects of face-to-face discussion.
• online collaborative learning as a result can also directly support the development of a range of high level intellectual skills, such as critical thinking, analytical thinking, synthesis, and evaluation, which are key requirements for learners in a digital age.

There are though several limitations:

• it does not scale easily, requiring highly knowledgeable and skilled instructors, and a limited number of learners
• it is more likely to accommodate to the epistemological positions of faculty and instructors in humanities, social sciences, education and some areas of business studies and health and conversely it is likely to be less accommodating to the epistemological positions of faculty in science and engineering. However, if combined with a problem-based or inquiry-based approach, it might have acceptance even in some of these subject domains.

6.4.6 Cultural and epistemological issues

Students come to the educational experience with different expectations and backgrounds. As a result there are often major cultural differences in students with regard to participating in discussion-based collaborative learning that in the end reflect deep differences with regard to traditions of learning and teaching. Thus teachers need to be aware that there are likely to be students in any class who may be struggling with language, cultural or epistemological issues, but in online classes, where students can come from anywhere, this is a particularly important issue.

In many countries, there is a strong tradition of the authoritarian role of the teacher and the transmission of information from the teacher to the student. In some cultures, it would be considered disrespectful to challenge or criticize the views of teachers or even other students. In an authoritarian, teacher-based culture, the views of other students may be considered irrelevant or unimportant. Other cultures have a strong oral tradition, or one based on story-telling, rather than on direct instruction. Online environments then can present real challenges to students when a constructivist approach to the design of online learning activities is adopted. This may mean taking specific steps to help students who are unfamiliar with a constructivist approach to learning, such as sending drafts to the instructor by e-mail for approval before posting a ‘class’ contribution. For a fuller discussion of cross-cultural issues in online learning, see Jung and Gunawardena (2014) and the journal Distance Education, Vol. 22, No. 1 (2001), the whole edition of which is devoted to papers on this topic.

6.4.7 Summary

Many of the strengths and challenges of collaborative learning apply both in face-to-face or online learning contexts. It could be argued that there is no or little difference between online collaborative learning and well-conducted traditional classroom, discussion-based teaching. Once again, we see that the mode of delivery is less important than the design model, which can work well in both contexts. Indeed, it is possible to conduct either model synchronously or asynchronously, at a distance or face-to-face.

However, there is certainly enough evidence that collaborative learning can be done just as well online, which is important, given the need for more flexible models of delivery to meet the needs of a more diverse student body in a digital age. Also, the necessary conditions for success in teaching this way are now well known, even though they are not always universally applied.
Activity 6.2: Evaluating online collaborative learning models

1. Can you see the differences between ‘Open Collaborative Learning’ (OCL) and ‘Communities of Inquiry’? Or are they really the same model with different names?
2. Do you agree that either of these models can be applied just as successfully online or face-to-face?
3. Do you see other strengths or weaknesses with these models?
4. Is this common sense dressed up as theory?
5. Does it make sense to apply either of these models for courses in the quantitative sciences such as physics or engineering? If so, under what conditions?

References

Pask, G. (1975) Conversation, Cognition and Learning Amsterdam/London: Elsevier (out of press, but available online)

THIS TEXTBOOK IS AVAILABLE FOR FREE AT OPEN.BCCAMPUS.CA
6.5 The ADDIE model

This is an interactive infographic. To see more detail on each of the five stages, click on each stage in the graphic.

6.5.1 What is ADDIE?

There have been many books written about the ADDIE model (see for instance, Morrison, 2010; Dick and Carey, 2004). ADDIE stands for:
Analyse

- identify all the variables that need to be considered when designing the course, such as learner characteristics, learners’ prior knowledge, resources available, etc. This stage is similar to the describing the learning environment outlined in Chapter 5.

Design

- this stage focuses on identifying the learning objectives for the course and how materials will be created and designed (for instance, it may include describing what content areas are to be covered and a storyboard outlining what will be covered in text, audio and video and in what order), and deciding on the selection and use of technology, such as an LMS, video or social media.

Develop

- the creation of content, including whether to develop in-house or outsource, copyright clearance for third party materials, loading of content into a web site or LMS, etc.

Implement

- this is the actual delivery of the course, including any prior training or briefing of learner support staff, and student assessment.

Evaluate

- feedback and data is collected in order to identify areas that require improvement and this feeds into the design, development and implementation of the next iteration of the course.

The interactive infographic above provides an in-depth, step-by-step approach to the design of learning, with lots of online resources to draw on.

6.5.2 Where is ADDIE used?

This is a design model used by many professional instructional designers for technology-based teaching. ADDIE has been almost a standard for professionally developed, high quality distance education programs, whether print-based or online. It is also heavily used in corporate e-learning and training. There are many variations on this model (my favourite is ‘PADDIE’, where planning and/or preparation are added at the start). The model is mainly applied on an iterative basis, with evaluation leading to re-analysis and further design and development modifications. One reason for the widespread use of the ADDIE model is that it is extremely valuable for large and complex teaching designs. ADDIE’s roots go back to the Second World War and derive from system design, which was developed to manage the hugely complex Normandy landings.

Many open universities, such as the U.K. Open University and the OU of the Netherlands, and Athabasca University and Thompson Rivers Open University in Canada, have and still do make heavy use of ADDIE to manage the design of complex multi-media distance education courses. When the OU opened in 1971 with an initial intake of 20,000, it used
radio, television, specially designed printed modules, text books, reproduced research articles in the form of selected readings that were mailed to students, and regional study groups, with teams of often 20 academics, media producers and technology support staff developing courses, and with delivery and learner support provided by an army of regional tutors and senior counsellors. Creating and delivering its first courses within two years of receiving its charter would have been impossible without a systematic instructional design model, and in 2014, with over 200,000 students, the OU still employs a strong instructional design model based on ADDIE.

Although ADDIE and instructional design in general originated in the USA, the Open University’s success in developing high quality learning materials influenced many more institutions that were offering distance education on a much smaller scale to adopt the ADDIE model, if in a more modest way. As distance education courses became increasingly developed as online courses, the ADDIE model continued, and is now being used by instructional designers in many institutions for the re-design of large lecture classes, hybrid learning, and for fully online courses.

### 6.5.3 What are the benefits of ADDIE?

One reason it has been so successful is that it is heavily associated with good quality design, with clear learning objectives, carefully structured content, controlled workloads for faculty and students, integrated media, relevant student activities, and assessment strongly tied to desired learning outcomes. Although these good design principles can be applied with or without the ADDIE model, ADDIE is a model that allows these design principles to be identified and implemented on a systematic and thorough basis. It is also a very useful management tool, allowing for the design and development of large numbers of courses to a standard high quality.

### 6.5.4 What are the limitations of ADDIE?

The ADDIE approach can be used with any size of teaching project, but works best with large and complex projects. Applied to courses with small student numbers and a deliberately simple or traditional classroom design, it becomes expensive and possibly redundant, although there is nothing to stop an individual teacher following this strategy when designing and delivering a course.

A second criticism is that the ADDIE model is what might be called ‘front-end loaded’ in that it focuses heavily on content design and development, but does not pay as much attention to the interaction between instructors and students during course delivery. Thus it has been criticised by constructivists for not paying enough attention to learner-instructor interaction, and for privileging more behaviourist approaches to teaching.

Another criticism is that while the five stages are reasonably well described in most descriptions of the model, the model does not provide guidance on how to make decisions within that framework. For instance, it does not provide guidelines or procedures for deciding how to choose between different technologies, or what assessment strategies to use. Instructors have to go beyond the ADDIE framework to make these decisions.

The over-enthusiastic application of the ADDIE model can and has resulted in overly complex design stages, with many different categories of workers (faculty, instructional designers, editors, web designers) and consequently a strong division of labour, resulting in courses taking up to two years from initial approval to actual delivery. The more complex the design and management infrastructure, the more opportunities there are for cost over-runs and very expensive programming.

My main criticism though is that the model is too inflexible for the digital age. How does a teacher respond to rapidly developing new content, new technologies or apps being launched on a daily basis, to a constantly changing student base? Although the ADDIE model has served us well in the past, and provides a good foundation for designing teaching and learning, it can be too pre-determined, linear and inflexible to handle more volatile learning contexts. I will discuss more flexible models for design in Section 6.8.
Activity 6.3: Using the ADDIE model

1. Take a course you are currently offering. How many of the stages of the ADDIE model did you go through? If you missed out on some of the stages, do you think the course would have been better if you had included these stages? Given the amount of work needed to work through each of the stages, do you think the results would be worth the effort?

2. If you are thinking of designing a new course, use the Flexible Learning Australia infographic to work through the four steps of analysis they recommend (it is probably best to log in to the infographic directly). Was this helpful? If so, you might want to continue with the other recommended steps.

3. If you have previously used the ADDIE model, are you happy with it? Do you agree with my criticisms? Is it flexible enough for the context in which you are working?

If you wish to share any of the outcomes of this activity, please use the comment box below, for possible feedback.
6.6. Design models for experiential learning

6.6. What is experiential learning?

Definition

Simon Fraser University defines experiential learning as:

“the strategic, active engagement of students in opportunities to learn through doing, and reflection on those activities, which empowers them to apply their theoretical knowledge to practical endeavours in a multitude of settings inside and outside of the classroom.”

There is a wide range of design models that aim to embed learning within real world contexts, including:

- problem-based learning
- case-based learning
- project-based learning
- inquiry-based learning
- cooperative (work- or community-based) learning
- apprenticeship.

I will be focusing on the first four of these design models (for a discussion of the apprenticeship model, and lab or studio work, see Chapter 4, Section 4.) The focus here is on some of the main ways in which experiential learning can be designed and delivered, with particular respect to the use of technology, and in ways that help develop the knowledge and skills needed in a digital age. (For a more detailed analysis of experiential learning, see Moon, 2004).

6.6.1 Core design principles

Experiential learning is a major form of teaching at the University of Waterloo. Its web site lists the conditions needed to ensure that experiential learning is effective, as identified by the Association for Experiential Education:

- Experiential learning occurs when carefully chosen experiences are supported by reflection, critical analysis and synthesis.
- Experiences are structured to require the student to take initiative, make decisions and be accountable for results.
- Throughout the experiential learning process, the student is actively engaged in posing questions, investigating, experimenting, being curious, solving problems, assuming responsibility, being creative and constructing meaning.
- Students are engaged intellectually, emotionally, socially, soulfully and/or physically. This involvement produces a perception that the learning task is authentic.
- The results of the learning are personal and form the basis for future experience and learning.
• **Relationships are developed** and nurtured: student to self, student to others and student to the world at large.

• The instructor and student may experience success, failure, adventure, risk-taking and uncertainty, because the outcomes of the experience cannot totally be predicted.

• Opportunities are nurtured for **students and instructors to explore and examine their own values**.

• **The instructor’s primary roles** include setting suitable experiences, posing problems, setting boundaries, supporting students, insuring physical and emotional safety, and facilitating the learning process.

• The instructor recognizes and encourages **spontaneous opportunities for learning**.

• **Instructors strive to be aware of their biases, judgments and pre-conceptions**, and how these influence the student.

• The design of the learning experience includes **the possibility to learn from natural consequences, mistakes and successes**.

Ryerson University in Toronto is another institution with extensive use of experiential learning, and also has an extensive web site on the topic, also directed at instructors. The next section examines different ways in which these principles have been applied.

### 6.6.2 Experiential design models

There are many different design models for experiential learning, but they also have many features in common.

#### 6.6.2.1 Problem-based learning

The earliest form of systematised problem-based learning (PBL) was developed in 1969 by Howard Barrows and colleagues in the School of Medicine at McMaster University in Canada, from where it has spread to many other universities, colleges and schools. This approach is increasingly used in subject domains where the knowledge base is rapidly expanding and where it is impossible for students to master all the knowledge in the domain within a limited period of study. Working in groups, students identify what they already know, what they need to know, and how and where to access new information that may lead to resolution of the problem. The role of the instructor (usually called a tutor in classic PBL) is critical in facilitating and guiding the learning process.

Usually PBL follows a strongly systematised approach to solving problems, although the detailed steps and sequence tend to vary to some extent, depending on the subject domain. The following is a typical example.

Traditionally, the first five steps would be done in a small face-to-face class tutorial of 20-25 students, with the sixth step requiring either individual or small group (four or five students) private study, with a the seventh step being accomplished in a full group meeting with the tutor. However, this approach also lends itself to blended learning in particular, where the research solution is done mainly online, although some instructors have managed the whole process online, using a combination of synchronous web conferencing and asynchronous online discussion.

Developing a complete problem-based learning curriculum is challenging, as problems must be carefully chosen, increasing in complexity and difficulty over the course of study, and problems must be chosen so as to cover all the required components of the curriculum. Students often find the problem-based learning approach challenging, particularly in the early stages, where their foundational knowledge base may not be sufficient to solve some of the problems. (The term ‘cognitive overload’ has been used to describe this situation.) Others argue that lectures provide a quicker and more condensed way to cover the same topics. Assessment also has to be carefully designed, especially if a final exam carries heavy weight in grading, to ensure that problem-solving skills as well as content coverage are measured.
However, research (see for instance, Strobel and van Barneveld, 2009) has found that problem-based learning is better for long-term retention of material and developing ‘replicable’ skills, as well as for improving students’ attitudes towards learning. There are now many variations on the ‘pure’ PBL approach, with problems being set after initial content has been covered in more traditional ways, such as lectures or prior reading, for instance.

### 6.6.2.2 Case-based learning

With case-based teaching, students develop skills in analytical thinking and reflective judgment by reading and discussing complex, real-life scenarios.


University of Michigan Centre for Research on Teaching and Learning.

Case-based learning is sometimes considered a variation of PBL, while others see it as a design model in its own right. As with PBL, case-based learning uses a guided inquiry method, but usually requires the students to have a degree of prior knowledge that can assist in analysing the case. There is usually more flexibility in the approach to case-based learning compared to PBL. Case-based learning is particularly popular in business education, law schools and clinical practice in medicine, but can be used in many other subject domains.

1. Tells a story.
2. Focuses on an interest-arousing issue.
3. Set in the past five years
4. Creates empathy with the central characters.
5. Includes direct quotations from the characters.
6. Relevant to the reader.
7. Must have pedagogic utility.
8. Conflict provoking.
10. Has generality.
11. Is short.

Using examples from clinical practice in medicine, Irby (1994) recommends five steps in case-based learning:

- Anchor teaching in a (carefully chosen) case
- Actively involve learners in discussing, analysing and making recommendations regarding the case
- Model professional thinking and action as an instructor when discussing the case with learners
- Provide direction and feedback to learners in their discussions
- Create a collaborative learning environment where all views are respected

Case-based learning can be particularly valuable for dealing with complex, interdisciplinary topics or issues which have no obvious 'right or wrong' solutions, or where learners need to evaluate and decide on competing, alternative explanations. Case-based learning can also work well in both blended and fully online environments. Marcus, Taylor and Ellis (2004) used the following design model for a case-based blended learning project in veterinary science:

![Figure 6.11 Blended learning sequence involving online learning resources, Marcus, Taylor and Ellis, 2004](image)

Other configurations are of course also possible, depending on the requirements of the subject.

### 6.6.2.3 Project-based learning

Project-based learning is similar to case-based learning, but tends to be longer and broader in scope, and with even more student autonomy/responsibility in the sense of choosing sub-topics, organising their work, and deciding on what methods to use to conduct the project. Projects are usually based around real world problems, which give students a sense of responsibility and ownership in their learning activities.

Once again, there are several best practices or guidelines for successful project work. For instance, Larmer and Mergendoller (2010) argue that every good project should meet two criteria:

- students must perceive the work as personally meaningful, as a task that matters and that they want to do well.
- a meaningful project fulfills an educational purpose.
They then list seven essential elements of ‘meaningful’ projects:

• **need to know**: provide students with a compelling ‘event’ (a video, news item, picture, guest lecturer) that they are asked to engage with.

• **a driving question**: ‘a good driving question captures the heart of the project in clear, compelling language, which gives students a sense of purpose and challenge. The question should be provocative, open-ended, complex, and linked to the core of what you want students to learn.’

• **student voice and choice**: students should be engaged in initial ‘brainstorming’ about the driving question, and have some choice in how they approach answering this question, both in terms of methods of inquiry, and in how the results of their study will be presented. Different sub-groups in the class then may operate in different ways.

• **21st century skills**: encourage the development of skills, particularly collaboration, team-building, role differentiation, oral, written and multimedia communication and reflection through journals or e-portfolios. Both instructor and students should be involved with assessment, which should include measurement of these skills.

• **inquiry and innovation**: in order to tackle the driving question, students refine their own questions and line of inquiry, then seek out the information they need to answer their questions, then test their own ideas through discussion and further research. This may well lead to innovative suggestions for dealing with the issue under research.

• **feedback and revision**: students should be encouraged to share their work with other students and be willing to give feedback and help each other. The instructor should structure more formal feedback so students are receiving help and guidance throughout the project, and encourage external forms of feedback from outside the institutional context, such as responses from relevant businesses or government agencies.

• **a publicly presented product**: ideally the end product from the class should be presented to an external audience that has a major stake or interest in the issue under study, and should as far as possible offer constructive suggestions or conclusions.

The main danger with project-based learning is that the project can take a life of its own, with not only students but the instructor losing focus on the key, essential learning objectives, or important content areas may not get covered. Thus project-based learning needs careful design and monitoring by the instructor.

### 6.6.2.4 Inquiry-based learning

Inquiry-based learning (IBL) is similar to project-based learning, but the role of the teacher/instructor is somewhat different. In project-based learning, the instructor decides the ‘driving question’ and plays a more active role in guiding the students through the process. In inquiry-based learning, the learner explores a theme and chooses a topic for research, develops a plan of research and comes to conclusions, although an instructor is usually available to provide help and guidance when needed.

Banchi and Bell (2008) suggest that there are different levels of inquiry, and students need to begin at the first level and work through the other levels to get to ‘true’ or ‘open’ inquiry as follows:

It can be seen that the fourth level of inquiry describes the graduate thesis process, although proponents of inquiry-based learning have advocated its value at all levels of education.
6.6.2.5 Experiential learning in online learning environments

Advocates of experiential learning are often highly critical of online learning, because, they argue, it is impossible to embed learning in real world examples. However, this is an oversimplification, and there are contexts in which online learning can be used very effectively to support or develop experiential learning, in all its variations:

- blended or flipped learning: although group sessions to start off the process, and to bring a problem or project to a conclusion, are usually done in a classroom or lab setting, students can increasingly conduct the research and information gathering by accessing resources online, by using online multimedia resources to create reports or presentations, and by collaborating online through group project work or through critique and evaluation of each other’s work
- fully online: increasingly, instructors are finding that experiential learning can be applied fully online, through a combination of synchronous tools such as a web conference, asynchronous tools such as discussion forums and/or social media for group work, and e-portfolios and multimedia for reporting.

Indeed, there are circumstances where it is impractical, too dangerous, or too expensive to use real world experiential learning. Online learning can be used to simulate real conditions and to reduce the time to master a skill. Flight simulators have long been used to train commercial pilots, enabling trainee pilots to spend less time mastering fundamentals...
on real aircraft. Commercial flight simulators are still extremely expensive to build and operate, but in recent years the costs of creating realistic simulations has dropped dramatically.

For instance, instructors at Loyalist College have created a ‘virtual’ fully functioning border crossing and a virtual car in Second Life to train Canadian Border Services Agents. Each student takes on the role of an agent, with his/her avatar interviewing the avatars of the travellers wishing to enter Canada. All communication is done by voice communications in Second Life, with the people playing the travellers in a separate room from the students. Each student interviews three or four travellers and the entire class observes the interactions and discusses the situations and the responses. A secondary site for auto searches features a virtual car that can be completely dismantled so students learn all possible places where contraband may be concealed. This learning is then reinforced with a visit to the auto shop at Loyalist College and the search of an actual car. The students in the customs and immigration track are assessed on their interviewing techniques as part of their final grades. Students participating in the first year of the Second Life border simulation achieved a grade standing that was 28 per cent higher than the previous class who did not utilize a virtual world. The next class, using Second Life, scored a further 9 per cent higher. More details can be found here.

Staff in the Emergency Management Division at the Justice Institute of British Columbia have developed a simulation tool called Praxis that helps to bring critical incidents to life by introducing real-world simulations into training and exercise programs. Because participants can access Praxis via the web, it provides the flexibility to deliver immersive, interactive and scenario-based training exercises anytime, anywhere. A typical emergency might be a major fire in a warehouse containing dangerous chemicals. ‘Trainee’ first responders, who will include fire, police and paramedical personnel, as well as city engineers and local government officials, are ‘alerted’ on their mobile phones or tablets, and have to respond in real time to a fast developing scenario, ‘managed’ by a skilled facilitator, following procedures previously taught and also available on their mobile equipment. The whole process is recorded and followed later by a face-to-face debriefing session.

Once again, design models are not in most cases dependent on any particular medium. The pedagogy transfers easily across different delivery methods.

### 6.6.3 Strengths and weaknesses of experiential learning models

How one evaluates experiential learning designs depends partly on one’s epistemological position. Constructivists strongly support experiential learning models, whereas those with a strong objectivist position are usually highly sceptical of the effectiveness of this approach. Nevertheless, problem-based learning in particular has proved to be very popular in many institutions teaching science or medicine, and project-based learning is used across many subject domains and levels of education. There is evidence that experiential learning, when properly designed, is highly engaging for students and leads to better long-term memory. Proponents also claim that it leads to deeper understanding, and develops ‘21st century’ skills such as problem-solving, critical thinking, improved communications skills, and knowledge management. In particular, it enables learners to manage better highly complex situations that cross disciplinary boundaries, and subject domains where the boundaries of knowledge are difficult to manage.

Critics though such as Kirschner, Sweller and Clark (2006) argue that instruction in experiential learning is often ‘unguided’, and pointed to several ‘meta-analyses’ of the effectiveness of problem-based learning that indicated no difference in problem-solving abilities, lower basic science exam scores, longer study hours for PBL students, and that PBL is more costly. They conclude:

> In so far as there is any evidence from controlled studies, it almost uniformly supports direct, strong instructional guidance rather than constructivist-based minimal guidance during the instruction of novice to intermediate learners. Even with students with considerable prior knowledge, strong guidance when learning is most often found to be equally effective as unguided approaches.

Certainly, experiential learning approaches require considerable re-structuring of teaching and a great deal of detailed planning if the curriculum is to be fully covered. It usually means extensive re-training of faculty, and careful orientation
and preparation of students. I would also agree with Kirschner et al. that just giving students tasks to do in real world situations without guidance and support is likely to be ineffective.

However, many forms of experiential learning can and do have strong guidance from instructors, and one has to be very careful when comparing matched groups that the tests of knowledge include measurement of the skills that are claimed to be developed by experiential learning, and are not just based on the same assessments as for traditional methods, which often have a heavy bias towards memorisation and comprehension.

On balance then, I would support the use of experiential learning for developing the knowledge and skills needed in a digital age, but as always, it needs to be done well, following best practices associated with the design models.

**Activity 6.4 Assessing experiential design models**

1. If you have experiences with experiential learning, what worked well and what didn’t?
2. Are the differences between problem-based learning, case-based learning, project-based learning and inquiry-based learning significant, or are they really just minor variations on the same design model?
3. Do you have a preference for one of the four models? If so, why?
4. Do you agree that experiential learning can be done just as well online as in classrooms or in the field? If not, what is the ‘uniqueness’ of doing it face-to-face that cannot be replicated online? Can you give an example?
5. Kirschner, Sweller and Clark’s paper is a powerful condemnation of PBL. Read it in full, then decide whether or not you share their conclusion, and if not, why not.

If you wish to share any of the outcomes of this activity, please use the comment box below, for possible feedback.

**References**


6.7. Competency-based learning

6.7.1 What is competency-based learning?

Competency-based learning begins by identifying specific competencies or skills, and enables learners to develop mastery of each competency or skill at their own pace, usually working with a mentor. Learners can develop just the competencies or skills they feel they need (for which increasingly they may receive a 'badge' or some form of validated recognition), or can combine a whole set of competencies into a full qualification, such as a certificate, diploma or increasingly a full degree. Learners work individually, usually online, rather than in cohorts. If learners can demonstrate that they are already have mastery of a particular competency or skill, through a test or some form of prior learning assessment, they may be allowed to move to the next level of competency without having to repeat a prescribed course of study for the prior competency. Competency-based learning attempts to break away from the regularly scheduled classroom model, where students study the same subject matter at the same speed in a cohort of fellow students.
Its value for developing practical or vocational skills or competencies is more obvious, but increasingly competency-based learning is being used for education requiring more abstract or academic skills development, sometimes combined with other cohort-based courses or programs.

### 6.7.2 Who uses competency-based learning?

The Western Governors University in the USA, with nearly 40,000 students, has pioneered competency-based learning, but with the more recent support of the Federal Department of Education competency-based learning is expanding rapidly in the USA. Other institutions making extensive use of competency-based learning are Southern New Hampshire University through its College for America, designed specifically for working adults and their employers, Northern Arizona University, and Capella University.

Competency-based learning is particularly appropriate for adult learners with life experience who may have developed competencies or skills without formal education or training, for those who started school or college and dropped out and wish to return to formal study, but want their earlier learning to be recognized, or for those learners wanting to develop specific skills but not wanting a full program of studies. Competency-based learning can be delivered through a campus program, but it is increasingly delivered fully online, because many students taking such programs are already working or seeking work.

### 6.7.2 Designing competency-based learning

There are various approaches, but the Western Governors’ model illustrates many of the key steps.

#### 6.7.2.1 Defining competencies

A feature of most competency-based programs is a partnership between employers and educators in identifying the competencies required, at least at a high level. Some of the skills outlined in Chapter 1, such as problem-solving or critical thinking, may be considered high-level, but competency-based learning tries to break down abstract or vague goals into specific, measurable competencies.

For instance, at Western Governors University (WGU), for each degree, a high-level set of competencies is defined by the University Council, and then a working team of contracted subject matter experts takes the ten or so high level competencies for a particular qualification and breaks them down into about 30 more specific competencies, around which are built online courses to develop mastery of each competency. Competencies are based upon what graduates are supposed to know in the workplace and as professionals in a chosen career. Assessments are designed specifically to assess the mastery of each competency; thus students receive either a pass/no pass following assessment. A degree is awarded when all 30 specified competencies are successfully achieved.

Defining competencies that meet the needs of students and employers in ways that are progressive (i.e. one competency builds on earlier competencies and leads to more advanced competencies) and coherent (in that the sum of all the competencies produces a graduate with all the knowledge and skills required within a business or profession) is perhaps the most important and most difficult part of competency-based learning.

#### 6.7.2.2 Course and program design

At WGU, courses are created by in-house subject matter experts selecting existing online curriculum from third parties and/or resources such as e-textbooks through contracts with publishers. Increasingly open educational resources are used. WGU does not use an LMS but a specially designed portal for each course. E-textbooks are offered to students without extra cost to the student, through contracts between WGU and the publishers. Courses are pre-determined for
the student with no electives. Students are admitted on a monthly basis and work their way through each competency at their own pace.

Students who already possess competencies may accelerate through their program in two ways: transferring in credits from a previous associate degree in appropriate areas (e.g. general education, writing); or by taking exams when they feel they are ready.

6.7.2.3 Learner support

Again this varies from institution to institution. WGU currently employs approximately 750 faculty who act as mentors. There are two kinds of mentors: ‘student’ mentors and ‘course’ mentors. Student mentors, who have qualifications within the subject domain, usually at a masters level, are in at least bi-weekly telephone contact with their students, depending on the needs of the student in working through their courses, and are the main contact for students. A student mentor is responsible for roughly 85 students. Students start with a mentor from their first day and stay with their mentor until graduation. Student mentors assist students in determining and maintaining an appropriate pace of study and step in with help when students are struggling.

Course mentors are more highly qualified, usually with a doctorate, and provide extra support for students when needed. Course mentors will be available to between 200-400 students at a time, depending on the subject requirement.

Students may contact either student or course mentors at any time (unlimited access) and mentors are expected to deal with student calls within one business day. Student mentors are pro-active, calling students regularly (at least once every two weeks, more if necessary) to maintain contact. Mentors are full-time but work flexible hours, usually from home. Mentors are reasonably well paid, and receive extensive training in mentoring.

![Remote proctoring of exams](image)

Figure 6.14: Remote proctoring of exams

6.7.2.4 Assessment

WGU uses written papers, portfolios, projects, observed student performance and computer-marked assignments as appropriate, with detailed rubrics. Assessments are submitted online and if they require human evaluation, qualified graders (subject matter experts trained by WGU in assessment) are randomly assigned to mark work on a pass/fail basis. If students fail, the graders provide feedback on the areas where competency was not demonstrated. Students may resubmit if necessary.

Students will take both formative (pre-assessment) and summative (proctored) exams. WGU is increasingly using online proctoring, enabling students to take an exam at home under video supervision, using facial recognition technol-
ogy to ensure that the registered student is taking the exam. In areas such as teaching and health, student performance or practice is assessed in situ by professionals (teachers, nurses).

<table>
<thead>
<tr>
<th>Lessons Mastered</th>
<th>2 Lessons Mastered (6 available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze complicated materials</td>
<td>Analyze paintings and literature along with major themes in Marx, Spencer, Durkheim, and Simmel. Evaluate the differences between cognition and perception and analyze theories of human nature. Discuss emerging narrative and ideological components of postwar film and world literature. Demonstrate an understanding and knowledge of Film Noir, “Nations at War in the Middle East” and of the Cold War and its aftermath.</td>
</tr>
<tr>
<td>Write about culture effectively</td>
<td>Write a summary of a major position in Social Psychology, a clear analysis of victimization, and a position paper based on an argument.</td>
</tr>
<tr>
<td>Compose academic essays in various rhetorical styles</td>
<td>Write a summary of a major position in Weber, Veblen, Cooley, and Mead and a research proposal and paper in a liberal arts discipline with an annotated bibliography.</td>
</tr>
<tr>
<td>Demonstrate knowledge of potential and limitations of technology’s advances</td>
<td>Demonstrate understanding of impacts of technology on institutions and humanity. Discuss impact of technology on facets of psychology and Sociology, the perpetuation of stereotypes through technology and possible changes in human nature and ethics due to technology.</td>
</tr>
</tbody>
</table>

**Figure 6.15 Example transcript from Northern Arizona University**

### 6.7.3 Strengths of a competency-based approach to design

Proponents have identified a number of strengths in the competency-based learning approach:

- it meets the immediate needs of businesses and professions; students are either already working, and receive advancement within the company, or if unemployed, are more likely to be employed once qualified
- it enables learners with work or family commitments to study at their own pace
- for some students, it speeds up time to completion of a qualification by enabling prior learning to be recognized
- students get individual support and help from their mentors
- tuition fees are affordable ($6,000 per annum at WGU) and programs can be self-funding from tuition fees alone, since WGU uses already existing study materials and increasingly open educational resources
- increasingly, competency-based education is being recognized as eligible for Federal loans and student aid in the USA.

Consequently, institutions such as WGU, the University of Southern New Hampshire, and Northern Arizona University, using a competency-based approach, at least as part of their operations, have seen annual enrolment growth in the range of 30-40 per cent per annum.

### 6.7.4 Weaknesses of a competency-based approach to design

Its main weakness is that it works well with some learning environments and less well with others. In particular:
• it focuses on immediate employer needs and is less focused on preparing learners with the flexibility needed for a more uncertain future
• it does not suit subject areas where it is difficult to prescribe specific competencies or where new skills and new knowledge need to be rapidly accommodated
• it takes an objectivist approach to learning
• it ignores the importance of social learning
• it will not fit the preferred learning styles of many students.

6.7.5 In conclusion

Competency-based learning is a relatively new approach to learning design which is proving increasingly popular with employers and suits certain kinds of learners such as adult learners seeking to re-skill or searching for mid-level jobs requiring relatively easily identifiable skills. It does not suit though all kinds of learners and may be limited in developing the higher level, more abstract knowledge and skills requiring creativity, high-level problem-solving and decision-making and critical thinking.

Activity 6.5 Thinking about competency-based education?

1. What factors are likely to influence you to adopt a competency-based approach to teaching? Could you describe a scenario where you could use this approach effectively?
2. What are the advantages and disadvantages of students studying individually, rather than in a cohort? What skills are they likely to miss out on through individual study?
6.8 Communities of practice

6.8.1 The theories behind communities of practice

The design of teaching often integrates different theories of learning. Communities of practice are one of the ways in which experiential learning, social constructivism, and connectivism can be combined, illustrating the limitations of trying to rigidly classify learning theories. Practice tends to be more complex.

6.8.2 What are communities of practice?

Definition:

Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.

Wenger, 2014
The basic premise behind communities of practice is simple: we all learn in everyday life from the communities in which we find ourselves. Communities of practice are everywhere. Nearly everyone belongs to some community of practice, whether it is through our working colleagues or associates, our profession or trade, or our leisure interests, such as a book club. Wenger (2000) argues that a community of practice is different from a community of interest or a geographical community in that it involves a shared practice: ways of doing things that are shared to some significant extent among members.

Wenger argues that there are three crucial characteristics of a community of practice:

- **domain**: a common interest that connects and holds together the community
- **community**: a community is bound by the shared activities they pursue (for example, meetings, discussions) around their common domain
- **practice**: members of a community of practice are practitioners; what they do informs their participation in the community; and what they learn from the community affects what they do.

Wenger (2000) has argued that although individuals learn through participation in a community of practice, more important is the generation of newer or deeper levels of knowledge through the sum of the group activity. If the community of practice is centered around business processes, for instance, this can be of considerable benefit to an organization. Smith (2003) notes that:

...communities of practice affect performance. [This] is important in part because of their potential to overcome the inherent problems of a slow-moving traditional hierarchy in a fast-moving virtual economy. Communities also appear to be an effective way for organizations to handle unstructured problems and to share knowledge outside of the traditional structural boundaries. In addition, the community concept is acknowledged to be a means of developing and maintaining long-term organizational memory.

Brown and Duguid (2000) describe a community of practice developed around the Xerox customer service representatives who repaired the machines in the field. The Xerox reps began exchanging tips and tricks over informal meetings at breakfast or lunch and eventually Xerox saw the value of these interactions and created the Eureka project to allow these interactions to be shared across the global network of representatives. The Eureka database has been estimated to have saved the corporation $100 million. Companies such as Google and Apple are encouraging communities of practice through the sharing of knowledge across their many specialist staff.

Technology provides a wide range of tools that can support communities of practice, as indicated by Wenger (2010) in the diagram below:
6.8.3 Designing effective communities of practice

Most communities of practice have no formal design and tend to be self-organising systems. They have a natural life cycle, and come to an end when they no longer serve the needs of the community. However, there is now a body of theory and research that has identified actions that can help sustain and improve the effectiveness of communities of practice.

Wenger, McDermott and Snyder (2002) have identified seven key design principles for creating effective and self-sustaining communities of practice, related specifically to the management of the community, although the ultimate success of a community of practice will be determined by the activities of the members of the community themselves. Designers of a community of practice need to:

1. **Design for evolution**: ensuring that the community can evolve and shift in focus to meet the interests of the participants without moving too far from the common domain of interest

2. **Open a dialogue between inside and outside perspectives**: encourage the introduction and discussion of new perspectives that come or are brought in from outside the community of practice
3. **Encourage and accept different levels of participation**, from the ‘core’ (most active members), from those who participate regularly but do not take a leading role in active contributions, and from those (likely the majority) who are on the periphery of the community but may become more active participants if the activities or discussions start to engage them more fully.

4. **Develop both public and private community spaces**: communities of practice are strengthened if they encourage individual or group activities that are more personal or private as well as the more public general discussions; for instance, individuals may decide to blog about their activities, or a small group in an online community that live or work close together may also decide to meet informally on a face-to-face basis.

5. **Focus on value**. Attempts should be made explicitly to identify, through feedback and discussion, on the contributions that the community most values.

6. **Combine familiarity and excitement**, by focusing both on shared, common concerns and perspectives, but also by introducing radical or challenging perspectives for discussion or action.

7. **Create a rhythm for the community**: there needs to be a regular schedule of activities or focal points that bring participants together on a regular basis, within the constraints of participants’ time and interests.

Subsequent research has identified a number of critical factors that influence the effectiveness of participants in communities of practice. These include being:

- **aware of social presence**: individuals need to feel comfortable in engaging socially with other professionals or ‘experts’ in the domain, and those with greater knowledge must be willing to share in a collegial manner that respects the views and knowledge of other participants (social presence is defined as the awareness of others in an interaction combined with an appreciation of the interpersonal aspects of that interaction.)
- **motivated to share information for the common good of the community**
- **able and willing to collaborate**.

EDUCAUSE has developed a [step-by-step guide](https://www.educause.edu/ir/library/pdf/CD05305.pdf) for designing and cultivating communities of practice in higher education (Cambridge, Kaplan and Suter, 2005).

Lastly, research on other related sectors, such as collaborative learning or MOOCs, can inform the design and development of communities of practice. For instance, communities of practice need to balance between structure and chaos: too much structure and many participants are likely to feel constrained in what they need to discuss; too little structure and participants can quickly lose interest or become overwhelmed. Many of the other findings about group and online behaviour, such as the need to respect others, observing online etiquette, and preventing certain individuals from dominating the discussion, are all likely to apply. However, because many communities of practice are by definition self-regulating, establishing rules of conduct and even more so enforcing them is really a responsibility of the participants themselves.

### 6.8.4 Learning through communities of practice in a digital age

Communities of practice are a powerful manifestation of informal learning. They generally evolve naturally to address commonly shared interests and problems. By their nature, they tend to exist outside formal educational organisations. Participants are not usually looking for formal qualifications, but to address issues in their life and to be better at what they do. Furthermore, communities of practice are not dependent on any particular medium; participants may meet face-to-face socially or at work, or they can participate in online or virtual communities of practice.

It should be noted that communities of practice can be very effective in a digital world, where the working context is volatile, complex, uncertain and ambiguous. A large part of the lifelong learning market will become occupied by...
communities of practice and self-learning, through collaborative learning, sharing of knowledge and experience, and crowd-sourcing new ideas and development. Such informal learning provision will be particularly valuable for non-governmental or charitable organizations, such as the Red Cross, Greenpeace or UNICEF, or local government, looking for ways to engage communities in their areas of operation.

These communities of learners will be open and free, and hence will provide a competitive alternative to the high priced lifelong learning programs being offered by research universities. This will put pressure on universities and colleges to provide more flexible arrangements for recognition of informal learning, in order to hold on to their current monopoly of post-secondary accreditation.

One of the significant developments in recent years has been the use of massive open online courses (MOOCs) for developing online communities of practice. MOOCs are discussed in more detail in Chapter 6, but it is worth discussing here the connection between MOOCs and communities of practice. To date the focus of the majority of MOOCs from providers such as Coursera, Udacity and edX, has been on academic ‘courses’, on topics such as artificial intelligence or dinosaurs, which do have a widespread interest. However, these more instructionist MOOCs are not really developed as communities of practice, because they use mainly a transmissive pedagogy, from experts to those considered less expert. Even though there may be massive numbers participating in online forums, instructionist MOOCs are not constructed to maximise the contributions from the participants (despite the fact that most MOOC participants already have high levels of education.). Indeed there is evidence that in really large MOOCs, participants feel overwhelmed by the magnitude and lack of structuring of the participant contributions (see for instance Knox, 2014).

In comparison, connectivist MOOCs are an ideal way to bring together specialists scattered around the world to focus on a common interest or domain. Connectivist MOOCs are much closer to being virtual communities of practice, in that they put much more emphasis on sharing knowledge between more or less equal participants. However, current connectivist MOOCs do not always incorporate what research indicates are best practices for developing communities of practice, and those wanting to establish a virtual community of practice at the moment need some kind of MOOC provider to get them started and give them access to the necessary MOOC software.

In the long run, MOOCs need to evolve to the point where it is possible for those with a common interest to easily create their own open, online communities of practice. As open source MOOC platforms evolve, it should become easier for people without computer science degrees to create and more importantly manage their own MOOCs, without having to go through a MOOC provider such as Coursera or edX. Also, there are other simpler tools, such as wikis, or more complex ones, such as virtual worlds, that may in the long run have more potential for virtual communities of practice created and organised by the participants themselves.

Although communities of practice are likely to become more rather than less important in a digital age, it is probably a mistake to think of them as a replacement for traditional forms of education. There is no single, ‘right’ approach to the design of teaching. Different groups have different needs. Communities of practice are more of an alternative for certain kinds of learners, such as lifelong learners, and are likely to work best when participants already have some domain knowledge and can contribute personally and in a constructive manner – which suggests the need for at least some form of prior general education or training for those participating in effective communities of practice.

In conclusion, it is clear is that in an increasingly volatile, uncertain, complex, and ambiguous world, and given the openness of the Internet, the social media tools now available, and the need for sharing of knowledge on a global scale, virtual communities of practice will become even more common and important. Smart educators and trainers will look to see how they can harness the strength of this design model, particularly for lifelong learning. However, merely lumping together large numbers of people with a common interest is unlikely to lead to effective learning. Attention needs to be paid to those design principles that lead to effective communities of practice.
Activity 6.6 Making communities of practice work

1. Can you identify a community of practice to which you belong? Is it successful and does it meet the key design principles outlined above?
2. Could you think of a way to develop a community of practice that would support your work as a teacher?
3. Is there anything special you would need to do to make an online community of practice succeed that would not be necessary in a face-to-face community?

References

6.9 Massive Open Online Courses

6.9.1 What is a MOOC?

MOOCs will be discussed in more detail in Chapter 7. Here the focus is on the more general design features of MOOCs.

6.9.1 Key characteristics

All MOOCs have some common features, although we shall see that the term MOOC covers an increasingly wide range of designs.

6.9.1.1 Massive

In the three years following its launch in 2011, Coursera claims over 7.5 million sign-ups with its largest course
claiming 240,000 participants. The huge numbers (in the hundred of thousands) enrolling in the earliest MOOCs are not always replicated in later MOOCs, but the numbers are still substantial. For instance, in 2013, the University of British Columbia offered several MOOCs through Coursera, with the numbers initially signing up ranging from 25,000 to 190,000 per course (Engle, 2014).

However, even more important than the actual numbers is that in principle MOOCs have infinite scalability. There is technically no limit to their final size, because the marginal cost of adding each extra participant is nil for the institutions offering MOOCs. (In practice this is not quite true, as central technology, backup and bandwidth costs increase, and as we shall see, there can be some knock-on costs for an institution offering MOOCs as numbers increase. However, the cost of each additional participant is so small, given the very large numbers, that it can be more or less ignored). The scalability of MOOCs is probably the characteristic that has attracted the most attention, especially from governments, but it should be noted that this is also a characteristic of broadcast television and radio, so it is not unique to MOOCs.

6.9.1.2 Open

There are no pre-requisites for participants other than access to a computer/mobile device and the Internet. However, broadband access is essential for xMOOCs that use video streaming, and probably desirable even for cMOOCs. Furthermore, at least for the initial MOOCs, access is free for participants, although an increasing number of MOOCs are charging a fee for assessment leading to a badge or certificate.

However, there is one significant way in which MOOCs through Coursera are not fully open. Coursera owns the rights to the materials, so they cannot be repurposed or reused without permission, and the material may be removed from the Coursera site when the course ends. Also, Coursera decides which institutions can host MOOCs on its platform — this is not an open access for institutions. On the other hand, edX is an open source platform, so any institution that joins edX can develop their own MOOCs with their own rules regarding rights to the material. cMOOCs are generally completely open, but since individual participants of cMOOCs create a lot if not all of the material it is not always clear whether they own the rights and how long the MOOC materials will remain available.

It should also be noted that many other kinds of online material are also open and free over the Internet, often in ways that are more accessible for reuse than MOOC material.

6.9.1.3 Online

MOOCs are offered at least initially wholly online, but increasingly institutions are negotiating with the rights holders to use MOOC materials in a blended format for use on campus. In other words, the institution provides learner support for the MOOC materials through the use of campus-based instructors. For instance at San Jose State University, on-campus students used MOOC materials from Udacity courses, including lectures, readings and quizzes, and then instructors spent classroom time on small-group activities, projects and quizzes to check progress (Collins, 2013). More variations in the design of MOOCs will be discussed in more detail in Chapter 7, Section 3.

Again though it should be noted that MOOCs are not unique in offering courses online. There are over 7 million students in the USA alone taking for-credit online courses.

6.9.1.4 Courses

One characteristic that distinguishes MOOCs from most other open educational resources is that they are organized into a whole course.

However, what this actually means for participants is not exactly clear. Although many MOOCs offer certificates or badges for successful completion of a course, to date these have not been accepted for admission or for credit, even (or especially) by the institutions offering the MOOCs.
6.8.1.5 Summary

It can be seen that all the key characteristics of MOOCs exist in some form or other outside MOOCs. What makes MOOCs unique though is the combination of the four key characteristics, and in particular the fact that they scale massively and are open and free for participants.

6.9.2 Design features of MOOCs

This is discussed in more detail in Chapter 7, but there are two quite different basic educational philosophies behind MOOCs.

6.9.2.1 xMOOCs

MOOCs developed initially by Stanford University professors and a little later by MIT and Harvard instructors are based primarily on an information transmission model, the core teaching being through online recorded videos of short lectures, combined with computer automated testing, and sometimes also through the use of peer review. These MOOCs are offered through special cloud-based software platforms such as Coursera, Udacity and edX.

6.9.2.2 cMOOCs

cMOOCs, the first of which was developed by three instructors for a course at the University of Manitoba in 2008, are based on network learning, where learning develops through the connections and discussions between participants over social media. There is no standard technology platform for cMOOCs, which use a combination of webcasts, participant blogs, tweets, software that connects blogs and tweets on the same topic via hashtags, and online discussion forums. Although usually there are some experts who initiate and participate in cMOOCs, they are by and large driven by the interests and contributions of the participants. Usually there is no attempt at formal assessment.

6.9.2.3 Summary of differences

Again see Chapter 7, Section 4 for more details but xMOOC have the following key design characteristics:

- specially designed platform software
- video lectures
- computer-marked assessment
- sometimes peer assessment
- no or very light moderation of participants’ comments or discussion
- learning analytics
- badges or certificates for successful course completion

xMOOCs therefore tend to deliver high quality content delivery through a mainly behaviourist, information transmission model.

In contrast, cMOOC have the following key design characteristics:

- autonomy of learner/participant driven content
- diversity of tools and resources, especially social media
- interactivity through social media, discussion forums, and communication with other participants
6.9.3 A radical disruption of higher education?

MOOCs are one of the most controversial areas of teaching in a digital age. I need a whole chapter to explore the relative strengths and weaknesses of MOOCs (see Chapter 7). At this point, it is important to note that MOOCs are just one form of online learning, that to date they are not generally recognized for accreditation or credit towards more formal education, and that there are other forms of open learning, such as open educational resources and open universities. For a more detailed discussion of MOOCs as a design model, please go to Chapter 7.

Many others have referred to MOOCs as a prime example of the kind of disruptive technology that Clayton Christensen (2010) has argued will change the world of education. Others have argued that MOOCs are not a big deal, just a more modern version of educational broadcasting, and do not really affect the basic fundamentals of education, and in particular do not address the type of learning needed in the 21st century.

MOOCs can be seen then as either a major revolution in education or just another example of the overblown hyperbole often surrounding technology, particularly in the USA. In Chapter 7 I shall be arguing that MOOCs are a significant development, but they have severe limitations for developing the knowledge and skills needed in a digital age.

Activity

There is no activity with this section, because MOOCs are dealt with more fully in Chapter 7

References


6.10 'Agile' Design: flexible designs for learning

Scenario E: ETEC 522: Ventures in e-Learning

Mike: Hey, George, come and sit down and tell Allison and Rav about that weird course you’re taking from UBC.

George: Hi, you two. Yeah, it’s a great course, very different from any other I’ve taken.

Rav: What’s it about?

George: It’s how to go about starting up a technology company.

Allison: But I thought you were doing a masters in education.

George: Yeah, I am. This course is looking at how new technologies can be used in education and how to build a business around one of these technologies.

Mike: Really, George? So what about all your socialist principles, the importance of public education, and all that? Are you giving up and going to become a fat capitalist?

George: No, it’s not like that. What the course is really making me do is think about how we could be using technology better in school or college.

Mike: And how to make a profit out of it, by the sound of it.

Rav: Shut up, Mike – I’m curious, George, since I’m doing a real business program. You’re going to learn how to set up a business in 13 weeks? Gimme a break.

George: It’s more about becoming an entrepreneur – someone who takes risks and tries something different.

Mike: With someone else’s money.

George: Do you really want to know about this course, or are you just wanting to give me a hard time?

Allison: Yes, shut up, Mike. Have you chosen a technology yet, George?

George: Almost. We spend most of the course researching and analysing emerging technologies that could have an application in education. We have to find a technology, research it then come up with a plan of how it could be used in education, and how a business could be built around it. But I think the real aim is to get us to think about how technology could improve or change teaching or learning.

Rav: So what’s the technology you’ve chosen?

George: You’re jumping too far ahead, Rav. We go through two boot camps, one on analysing the edtech marketplace, and one on entrepreneurship: what it takes to be an entrepreneur. Why are you laughing, Mike?

Mike: I just can’t see you in combat uniform, crawling through tubes under gun fire, with a book in your hand.

George: Not that kind of bootcamp. This course is totally online. Our instructor points us in the direction of a few technologies to get us started, but because there’s more stuff coming out all the time, we’re encouraged to make our own choices about what to research. And we all help each other. I must have looked at more than 50 products or services so far, and we all share our analyses. I’m down to possibly three at the moment, but I’m going to have to make my mind up soon, as I have to do a YouTube elevator pitch for my grade.

Rav: A what?

George: If you look at most of these products, there’s a short YouTube video that pitches the business. I’ve got to make the case for whatever technology I choose in just under eight minutes. That’s going to be 25% of my grade.

Allison: Wow, that’s tough.

George: Well, we all help each other. We have to do a preliminary recording, then everyone pitches in to critique it. Then we have a few days to send in our final version.

Allison: What else do you get grades for?

George: I got 25% of my marks for an assignment that analysed a particular product called Dybuster which is used to help learners with dyslexia. I looked mainly at its educational strengths and weaknesses, and its likely commercial viability. For my second assignment, also worth 25%, we had to build an application of a particular product or service, in my case a module of teaching using a particular product. There were four of us altogether working as a team to do this. Our
team designed a short instructional module that showed a chemical reaction, using an off-the-shelf online simulation tool that is free for people to use. I’ll get my last 25% from analysing my own contribution to discussions and activities.

Rav: What, you give yourself the grade?

George: No, I have to collect my best contributions together in a sort of portfolio, then send them in to the instructor, who then gives the grade based on the quality of the contributions.

Allison: But what I don’t understand is: what’s the curriculum? What text books do you have to read? What do you have to know?

George: Well, there are the two boot camps, but really, we the students, set the curriculum. Our instructor asks us for our first week’s work to look at a range of emerging technologies that might be relevant for education, then we select eight which form the basis of our work groups. I’ve already learned a lot, just by searching and analysing different products over the Internet. We have to think about and justify our decisions. What kind of teaching philosophy do they imply? What criteria am I using when I support or reject a particular product? Is this a sustainable tool? (You don’t want to have to get rid of good teaching material because the company’s gone bust and doesn’t support the technology any more). What I’m really learning though is to think about technology differently. Previously I wasn’t really thinking about teaching differently. I was just trying to find a technology that made my life easier. But this course has woken me up to the real possibilities. I feel I’m in a much better position now to shake up my own school and move them into the digital age.

Allison (sighs): Well, I guess that’s the difference between an undergraduate and a graduate course. You couldn’t do this unless you already knew a lot about education, could you?

George: I’m not so sure about that, Allison. It doesn’t seem to have stopped a lot of entrepreneurs from developing tools for teaching!

Mike: George, I’m sorry. I can’t wait for you to become a rich capitalist – it’s your turn to buy the drinks.

Scenario based on a UBC graduate course for the Master in Educational Technology. The instructors are David Vogt and David Porter, assisted by Jeff Miller, the instructional designer for the course.

6.10.1 Why the need for more flexible design models?

Adamson (2012) states:

The systems under which the world operates and the ways that individual businesses operate are vast and complex – interconnected to the point of confusion and uncertainty. The linear process of cause and effect becomes increasingly irrelevant, and it is necessary for knowledge workers to begin thinking in new ways and exploring new solutions.

In particular knowledge workers must deal with situations and contexts that are volatile, uncertain, complex and ambiguous (what Adamson calls a VUCA environment). This certainly applies to teachers working with ever new, emerging technologies, very diverse students, and a rapidly changing external world that puts pressure on institutions to change.

If we look at course design, how does a teacher respond to rapidly developing new content, new technologies or apps being launched on a daily basis, to a constantly changing student base, to pressure to develop the knowledge and skills that are needed in a digital age? For instance, even setting prior learning outcomes is fraught in a VUCA environment, unless you set them at an abstract ‘skill’ level such as thinking flexibly, networking, and information retrieval and analysis. Students need to develop the key knowledge management skills of knowing where to find relevant information, how to assess, evaluate and appropriately apply such information. This means exposing them to less than certain knowledge and providing them with the skills, practice and feedback to assess and evaluate such knowledge, then apply that to solving real world problems.

In order to do this, learning environments need to be created that are rich and constantly changing, but which at the same time enable students to develop and practice the skills and acquire the knowledge they will need in a volatile, uncertain, complex and ambiguous world.
6.10.2 Core features of flexible design models

Describing the design features is a challenge, for two reasons. First, there is no single approach to flexible design. The whole point of a flexible design is to be adaptable to the circumstances in which it operates. Second, it is only with the development of light, easy to use technology and media in the last few years that instructors and course designers have started to break away from the standard design models, so flexible designs are still emerging. However, this is a challenge that software designers have also been facing (see for instance, Larman and Vodde, 2009; Ries, 2011) and perhaps there are lessons that can be applied to educational design.

First, it is important to distinguish ‘agile’ design from rapid instructional design (Meier, 2000) or rapid prototyping, which are really both streamlined versions of the ADDIE model. Although rapid instructional design/rapid prototyping enable courses or modules to be designed more quickly (especially important for corporate training), they still follow the same kind of sequential or iterative processes as in the ADDIE model, but in a more compressed form. Rapid instructional design and rapid prototyping might be considered particular kinds of flexible design, but they lack some of the most important characteristics outlined below:
• **Light and nimble:** if ADDIE is a 100-piece orchestra, with a complex score and long rehearsals, then flexible design models are a jazz trio who get together for a single performance then break up until the next time. Although there may be a short preparation time before the course starts, most of the decisions about what will go into the course, what tools will be used, what activities learners will do, and sometimes even how students will be assessed, are decided as the course progresses. On the teaching side, there are usually only a few people involved in the actual design, one or sometimes two instructors and possibly an instructional designer, who nevertheless meet frequently during the offering of the course to make decisions based on feedback from learners and how learners are progressing through the course. However, many more content contributors may be invited – or spontaneously offer – to participate on a single occasion as the course progresses.

• **Content, learner activities, tools used and assessment vary, according to the changing environment.** The content to be covered in a course is likely to be highly flexible, based more on emerging knowledge and the interests or prior experience of the learners, although the core skills that the course aims to develop are more likely to remain constant. For instance, for ETEC 522, the overall objective is to develop the skills needed to be a pioneer or innovator in education, and this remains constant over each iteration of the course. However, because the technology is rapidly developing with new products, apps and services every year, the content of the course is quite different from year to year. Also learner activities and methods of assessment are also likely to change, because students can use new tools or technology themselves for learning as they become available. Very often learners themselves seek out and organise much of the core content of the course and are free to choose what tools they use.

• **The design attempts to exploit the affordances of either existing or emerging technologies.** Flexible design aims to exploit fully the educational potential of new tools or software, which means sometimes changing at least sub-goals. This may mean developing different skills in learners from year to year, as the technology changes and allows new things to be done. The emphasis here is not so much on doing the same thing better with new technology, but striving for new and different outcomes that are more relevant in a digital world. ETEC 522 for instance did not start with a learning management system. Instead, a web site, built in WordPress, was used as the starting point for student activities, because students as well as instructors were posting content, but in another year the content focus of the course was mainly on mobile learning, so apps and other mobile tools were strong components of the course.

• **Sound, pedagogical principles guide the overall design of a course – to a point.** Just as most successful jazz trios work within a shared framework of melody, rhythm, and musical composition, so is flexible design shaped by overarching principles of best practice. Most successful flexible designs have been guided by core design principles associated with ‘good’ teaching, such as clear learning outcomes or goals, assessment linked to these goals, strong learner support, including timely and individualised feedback, active learning, collaborative learning, and regular course maintenance based on learner feedback, all within a rich learning environment. Sometimes though deliberate attempts are made to move away from an established best practice for experimental reasons, but usually on a small scale, to see if the experiment works without risking the whole course.

• **Experiential, open and applied learning.** Usually this kind of course design is strongly embedded in the real, external world. Much or all the course may be open to other than registered students. For instance, a good deal of ETEC 522, such as the final YouTube business pitches, is openly available to those interested in
the topics. Sometimes this results in entrepreneurs contacting the course with suggestions for new tools or services, or just to share experience. Another example is a course on Latin American studies from a Canadian university. This particular course had an open, student-managed wiki, where they could discuss contemporary events as they arose. This course was active at the same time that the Argentine government nationalised the Spanish oil company, Repsol. Several students posted comments critical of the government action, but after a week, a professor from a university in Argentina, who had come across the wiki by accident while searching the Internet, responded, laying out a detailed defence of the government’s policy. This was then made a formal topic for discussion within the course. Such courses may though be only partially open. Discussion of sensitive subjects for instance may still take place behind a password controlled discussion forum, while other parts of the course may be open to all.

As experience grows in this kind of design, other and perhaps clearer design principles are likely to emerge.

### 6.10.3 Strengths and weaknesses of flexible design models

The main advantage of flexible design is that it focuses directly on preparing students for a volatile, uncertain, complex and ambiguous world. It aims explicitly at helping students develop many of the specific skills they will need in a digital age, such as knowledge management, multimedia communication skills, critical thinking, innovation, and digital literacy embedded within a subject domain. Where flexible design has been successfully used, students have found the design approach highly stimulating and great fun, and instructors have been invigorated and enthusiastic about teaching. Flexible design enables courses to be developed and offered quickly and at much lower initial cost than ADDIE-based approaches.

However, flexible design approaches are very new and have not really been much written about, never mind evaluated. There is no ‘school’ or set of agreed principles to follow, although there are similarities between the flexible approach to design for learning with ‘agile’ design for computer software. Indeed it could be argued that most of the things in flexible design are covered in other teaching models, such as online collaborative learning or experiential learning. Despite this, innovative instructors are beginning to develop courses in a similar way to ETEC 522 and there is a consistency in the basic design principles that give them a certain coherence and shape, even though each course or program appears on the surface to be very different (another example of flexible design, but with quite a different overall program from ETEC 522, is the Integrated Science program at McMaster University.)

Certainly flexible design approaches require confident instructors willing to take a risk, and success is heavily dependent on instructors having a good background in best teaching practices and/or strong instructional design support from innovative and creative instructional designers. Because of the relative lack of experience in such design approaches the limitations are not well identified yet. For instance, this approach can work well with relatively small class sizes but how well will it scale? Successful use probably also depends on learners already having a good foundational knowledge base in the subject domain. Nevertheless I expect more flexible designs for learning to grow over the coming years, because they are more likely to meet the needs of a VUCA world.

<table>
<thead>
<tr>
<th>Activity 6.7 Taking risks with ‘agile’ design</th>
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</thead>
<tbody>
<tr>
<td>1. Do you think a ‘agile’/flexible design approach will increase or undermine academic excellence? What are your reasons?</td>
</tr>
<tr>
<td>2. Would you like to try something like this in your own teaching (or are you already doing something like this)? What would be the risks and benefits in your subject area of doing this?</td>
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</table>
References

6.11 Making decisions about design models

6.11.1 Choosing a model

This chapter covers a range of different design models or approaches to teaching. There are many more that could have been included. However, it is clear that there is a choice of possible models, depending on a number of factors, most of which are listed in Chapter 5, Building an Effective Learning Environment.

Your choice of model will then depend very much on the context in which you are teaching. However, I have suggested that a key criterion should be the suitability of the design model for developing the knowledge and skills that learners will need in a digital age. Other critical factors will be the demands of the subject domain, characteristics of the learners
you will likely be teaching, the resources available, especially in terms of supporting learners, and probably most important of all, your own views and beliefs about what constitutes ‘good teaching.’

Furthermore, the models by and large are not mutually exclusive. They can probably be mixed and matched to a certain degree, but there are limitations in doing this. Moreover, a consistent approach will be less confusing not only to learners, but also to you as a teacher or instructor.

So: how would you go about choosing an appropriate design model? I set out below in Figure 6.20 one way of doing this. I have chosen five criteria as headings along the top of the table:

- **epistemological basis:** in what epistemological view of knowledge is this model based? Does the model suggest a view of knowledge as content that must be learned, does the model suggest a rigid (‘correct’) way of designing learning (objectivist)? Or does the model suggest that learning is a dynamic process and knowledge needs to be discovered and is constantly changing (constructivist)? Does the model suggest that knowledge lies in the connections and interpretations of different nodes or people on networks and that connections matter more in terms of creating and communicating knowledge than the individual nodes or people on the network (connectivist)? Or is the model epistemologically neutral, in that one could use the same model to teach from different epistemological positions?

- **20th century learning:** does this design model lead to the kind of learning that would prepare people for an industrial society, with standardised learning outcomes, will it help identify and select a relatively small elite for higher education or senior positions in society, does it enable learning to be easily organised into similarly performing groups of learners?

- **21st century learning:** does the model encourage the development of the soft skills and the effective management of knowledge needed in a digital world? Does the model enable and support the appropriate educational use of the affordances of new technologies? Does it provide the kind of educational support that learners need to succeed in a volatile, uncertain, complex and ambiguous world? Does it enable and encourage learners to become global citizens?

- **academic quality:** does it lead to deep understanding and transformative learning? Does it enable students to become experts in their chosen subject domain?

- **flexibility:** does the model meet the needs of the diversity of learners today? Does it encourage open and flexible access to learning? Does it help teachers and instructors to adapt their teaching to ever changing circumstances?

Now these are my criteria, and you may well want to use different criteria (cost is another important factor), but I have drawn up the table this way because it has helped me consider better where I stand on the different models. Where I think the model is strong on a particular criterion, I have given it three stars, where weak, one star, and n/a for not applicable. Again, you may – no, should – rank the models differently. (See, that’s why I’m a constructivist – if I was an objectivist, I’d tell you what damned criteria to use!).

It can be seen that the only model that ranks highly on all three criteria of 21st century learning, academic quality and flexibility is online collaborative learning. Experiential learning and agile design also score highly. Transmissive lectures come out worst. This is a pretty fair reflection of my preferences. However, if you are teaching first year civil engineering to over 500 students, your criteria and rankings will almost certainly be different from mine. So please see Figure 6.20 as a heuristic device and not a general recommendation.
6.11.2 Common design characteristics

It is worth noting that, once again, there is extensive research and experience that point to the key factors to be taken into consideration in the successful implementation of teaching, whichever design model is being used. In essence we are talking about using best practices in the design of teaching. Although different design models have different approaches to teaching, there is a significant number of the core principles in the design of teaching and learning that extend across several of the design models. These can be summarised as follows:

<table>
<thead>
<tr>
<th>Design model</th>
<th>Epistemology</th>
<th>20th century learning</th>
<th>21st century learning</th>
<th>Academic quality</th>
<th>Flexibility</th>
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<tr>
<td>Transmissive lectures</td>
<td>Objectivist</td>
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<td>Classroom-type online learning</td>
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Figure 6.20 A comparison of different design models
• know your students: identify the key characteristics of the students you will be or could be teaching, and how that will influence your methods of teaching
• know what you are trying to achieve: in any particular course or program what are the critical areas of content and the particular skills or learning outcomes that students need to achieve as a result of your teaching? What is the best way to identify and assess these desired outcomes?
• know how students learn: what drives learning for your students? How do you engage or motivate students? How can you best support that learning?
• know how to implement this knowledge: What kind of learning environment do you need to create to support student learning? What design model(s) will work best for you within that environment?
• know how to use technology to support your teaching: this is really a sub-set of the previous point, and is discussed in much more detail in other chapters
• know what resources you have, and what can be done within the constraints you have to work with
• ensure that the assessment of students actually measures the intended learning outcomes – and unintended ones.

6.11.3 Design models and the quality of teaching and learning

Lastly, the review of different models indicate some of the key issues around quality:

• first, what students learn is more likely to be influenced by choosing an appropriate design model for the context in which you are teaching, than by focusing on a particular technology or delivery method. Technology and delivery method are more about access and flexibility and hence learner characteristics than they are about learning. Learning is affected more by pedagogy and the design of instruction.
• second, different design models are likely to lead to different kinds of learning outcomes. This is why there is so much emphasis in this book on being clear about what knowledge and skills are needed in a digital age. These are bound to vary somewhat across different subject domains, but only to a limited degree. Understanding of content is always going to be important, but the skills of independent learning, critical thinking, innovation and creativity are even more important. Which design model is most likely to help develop these skills in your students?
• third, quality depends not only on the choice of an appropriate design model, but also on how that approach to teaching is implemented. Online collaborative learning can be done well, or it can be done badly. The same applies to other design models. Following core design principles is critical for the successful use of any particular design model. Also there is considerable research on what the conditions are for success in using some of the newer models. The findings from such research need to be applied when implementing a particular model.
• lastly students and teachers get better with practice. If you are moving to a new design model, give yourself (and your students) time to get comfortable with it. It will probably take two or three courses where the new model is applied before you begin to feel comfortable that it is producing the results you were hoping for. However, it is better to make some mistakes along the way than to continue to teach comfortably, but not produce the graduates that are needed in the future.
Even when we have chosen a particular design model or teaching approach, though, it still has to be implemented. The remaining chapters in this book will focus then on implementation.

### Activity 6.8 Making choices

Describe your main subject area and level. Then try to answer each of the following questions:

1. What are the main learning outcomes (at a high level) that I need to achieve in this course or program, if the students are to be fit for the future?
2. What design model is most likely to enable me to help learners achieve these outcomes?
3. How much would I have to change what I’m doing now, and what would the course or program look like in the future? Could I write a scenario to describe how I would be teaching in the future? Or how students will be learning in my course or program?
4. What support am I likely to get from my institution, in terms of supporting my ideas, supporting change, providing resources such as training in new methods, or professional help such as instructional designers?
5. How will my students react to the changes I’m contemplating? How could I ‘sell’ it to them?

If you want to share your response(s), please use the comment box below.

### Key Takeaways

1. Traditional classroom teaching, and especially the transmissive lecture, was designed for another age. Although it has served us well, we are now in a different age that requires different methods.
2. The key shift is towards greater emphasis on skills and less on memorising content. We need design models for teaching and learning that lead to the development of the skills needed in a digital age.
3. There is no one ‘best’ design model for all circumstances. The choice of design model needs to take account of the context in which it will be applied, but nevertheless, some design models are better than others for developing the knowledge and skills needed in a digital age. For the contexts with which I’m most associated, online collaborative learning, experiential learning and agile design best meet my criteria.
4. Design models in general are not dependent on a particular mode of delivery; they can operate in most cases as well online as in class.
5. In an increasingly volatile, uncertain, complex and ambiguous world, we need design models for teaching that are light and nimble.
6.12 References on design models

Pask, G. (1975) Conversation, Cognition and Learning Amsterdam/London: Elsevier (out of press, but available online)
Chapter 7: MOOCs

Purpose of the chapter

MOOCs (Massive, Open, Online Courses) are the most disruptive of all technologically-based innovations in higher education, and as a result are the most controversial.

When you have finished this chapter your should be able to:

• understand the differences between various kinds of MOOCs, and between MOOCs and other forms of online and open learning
• decide whether to study a MOOC, and if so, what kind
• decide on whether or not to develop your own MOOC and what kind of MOOC
• advise your administration on whether or not to invest in MOOCs

What is covered in this chapter

This chapter covers the following topics:

• a brief history of MOOCs
• variations in MOOC designs
• the strengths and weaknesses of MOOCs including:
  — open and free education
  — student persistence and commitment
  — what students learn from MOOCs
  — assessing students in MOOCs
  — branding
  — costs and economies of scale
  — summary of strengths and weaknesses
• the political, social and economic drivers of MOOCs
• conclusion: why MOOCs are only part of the answer
• Scenario E: How to cope with being old.

Also in this chapter you will find the following activities:

• Activity 7.1: Thinking about MOOC design
• Activity 7.2: Assessing the strengths and weaknesses of MOOCs
• Activity 7.3: Strategising about MOOCs
1. MOOCs are forcing every higher education institution to think carefully both about its strategy for online teaching and its approach to open education.

2. MOOCs are not the only form of online learning or of open educational resources. It is important to look at the strengths and weaknesses of MOOCs within the overall context of online learning and open-ness.

3. There are considerable differences in the design of MOOCs, reflecting different purposes and philosophies.

4. MOOCs are at still a relatively early stage of maturity. As their strengths and weaknesses become clearer, and as experience in improving their design grows, they are likely to occupy a significant niche within the higher education learning environment.

5. There are still major structural limitations in MOOCs for developing deep or transformative learning, or for developing the high level knowledge and skills needed in a digital age.

6. MOOCs could well replace some forms of traditional teaching (such as large lecture classes). However, MOOCs are more likely to remain an important supplement or alternative to other conventional education methods. They are not on their own a solution to the high cost of higher education, although MOOCs are and will continue to be an important factor in forcing change.

7. Perhaps the greatest value of MOOCs in the future will be for providing a means for tackling large global problems through community action.
Section 7.1 Introduction

Probably no development in teaching in recent years has been as controversial as the development of Massive Open Online Courses (MOOCs). In 2013, the author Thomas Friedland wrote in the New York Times:

...nothing has more potential to enable us to reimagine higher education than the massive open online course ....For relatively little money, the U.S. could rent space in an Egyptian village, install two dozen computers and high-speed satellite Internet access, hire a local teacher as a facilitator, and invite in any Egyptian who wanted to take online courses with the best professors in the world, subtitled in Arabic...I can see a day soon where you’ll create your own college degree by taking the best online courses from the best professors from around the world ....paying only the nominal fee for the certificates of completion. It will change teaching, learning and the pathway to employment.

Many others have referred to MOOCs as a prime example of the kind of disruptive technology that Clayton Christensen (2010) has argued will change the world of education. Others have argued that MOOCs are not a big deal, just a more modern version of educational broadcasting, and do not really affect the basic fundamentals of education, and in particular do not address the type of learning needed in the 21st century.

MOOCs can be seen then as either a major revolution in education or just another example of the overblown hyperbole often surrounding technology, particularly in the USA. I shall be arguing that MOOCs are a significant development, but they have severe limitations for developing the knowledge and skills needed in a digital age.
Reference


Section 7.2 Brief history

To see this YouTube video, click on the graphic. For a response to this video, see: ‘What’s right and what’s wrong with Coursera-style MOOCs’.

Elements of MOOCs have been around for some time. The British Open University, funded by the U.K. government, started offering open degree programs by distance in 1971, although sadly its degree programs are no longer free. Nevertheless, much of its teaching material is still open through its OpenLearn portal. Some of the British OU’s courses are also quite large (around 5,000 students).

In 2003 Massachusetts Institute of Technology (MIT) began offering digital video recordings of many of its lectures and accompanying materials such as slides for free downloading through its OpenCourseWare (OCW) project. Apple opened iTunes U in its iTunes store in 2007. iTunesU enables educational audio and video files from universities to be downloaded for free. It currently has over 50,000 entries. OpenLearn, OCW, and iTunesU are just some examples of open educational resources, free for students (and also instructors) to use in their learning and teaching. However, generally they are not courses.

Fully online credit courses have been offered by school boards, colleges and universities since 1995, usually in parallel with the on-campus version of the same course. Credit-based online learning has been gaining ground steadily, with increases in annual enrolment for fully online courses averaging between 10-20 per cent per annum per year across the higher education system in the USA, resulting in somewhere between 25 to 30 per cent of all credit enrolments by 2013 (Allen and Seaman, 2014). However, access to online credit courses requires admission to university and the payment of tuition fees, so although online, they are neither open nor massive.

The term MOOC was used for the first time in 2008 for a course offered by the Extension Division of the University
of Manitoba in Canada. This non-credit course, *Connectivism and Connective Knowledge* (CK08) was designed by George Siemens, Stephen Downes and Dave Cormier. It enrolled 27 on-campus students who paid a tuition fee but was also offered online for free. Much to the surprise of the instructors, 2,200 students enrolled in the free online version. Downes classified this course and others like it that followed as connectivist or cMOOCs, because of their design (Downes, 2012).

In the fall of 2011, two computer science professors from Stanford University, Sebastian Thrun and Peter Norvig, launched a MOOC on *The Introduction to AI* (artificial intelligence) that attracted over 160,000 enrollments, followed quickly by two other MOOCs, also in computer sciences, from Stanford instructors Andrew Ng and Daphne Koller. Thrun went on to found Udacity, and Ng and Koller established Coursera. These are for-profit companies using their own specially developed software that enable massive numbers of registrations and a platform for the teaching. Udacity and Coursera formed partnerships with other leading universities where the universities pay a fee to offer their own MOOCs through these platforms. Udacity more recently has changed direction and is now focusing more on the vocational and corporate training market.

The Massachusetts Institute of Technology (MIT) and Harvard University in March 2012 developed an open source platform for MOOCs called edX, which also acts as a platform for online registration and teaching. edX has also developed partnerships with leading universities to offer MOOCs without direct charge for hosting their courses, although some may pay to become partners in edX. Other platforms for MOOCs, such as the U.K. Open University's FutureLearn, have also been developed. Because the majority of MOOCs offered through these various platforms are based mainly on video lectures and computer-marked tests, Downes has classified these as xMOOCs, to distinguish them from the more connectivist cMOOCs.

In 2014 there were approximately 1,000 MOOCs available from universities in the USA, and 800 from European institutions.

References


Section 7.3 Variations in MOOC designs

The basic design features of MOOCs were described in Chapter 6, Section 8. However, MOOCs are a relatively new phenomenon and as a result are still evolving, particularly in terms of their design. Although the early MOOC courses reflected two quite different philosophical positions, and different design models, as MOOCs have evolved, so have their designs. In this section then the different MOOC designs will be analysed in more detail.
7.3.1 xMOOCs

This is the term coined by Stephen Downes (2012) for courses developed by Coursera, Udacity and edX. I am starting with xMOOCs because at the time of writing they are by far the most common MOOC. Because instructors have considerable flexibility in the design of the course, there is considerable variation in the details, but in general xMOOCs have the following common design features:

- **specially designed platform software**

  xMOOCs use specially designed platform software that allows for the registration of very large numbers of participants, provides facilities for the storing and streaming on demand of digital materials, and automates assessment procedures and student performance tracking.

- **video lectures**

  xMOOCs use the standard lecture mode, but delivered online by participants downloading on demand recorded video lectures. These video lectures are normally available on a weekly basis over a period of 10-13 weeks. Initially these were often 50 minute lectures, but as a result of experience some xMOOCs now are using shorter recordings (sometimes down to 15 minutes in length) and thus there may be more video segments. Over time, xMOOC courses, as well as the videos, are becoming shorter in length, some now lasting only five weeks. Various video production methods have been used, including lecture capture (recording face-to-face on-campus lectures, then storing and streaming them on demand), full studio production, or desk-top recording by the instructor on their own.

- **computer-marked assignments**

  Students complete an online test and receive immediate computerised feedback. These tests are usually offered throughout the course, and may be used just for participant feedback. Alternatively the tests may be used for determining the award of a certificate. Another option is for an end of course grade or certificate based solely on an end-of-course online test. Most xMOOC assignments are based on multiple-choice, computer-marked questions, but some MOOCs have also used text or formula boxes for participants to enter answers, such as coding in a computer science course, or mathematical formulae, and in one or two cases, short text answers, but in all cases these are computer-marked.

- **peer assessment**

  Some xMOOCs have experimented with assigning students randomly to small groups for peer assessment, especially for more open-ended or more evaluative assignment questions. This has often proved problematic though because of wide variations in expertise between the different members of a group, and because of the different levels of involvement in the course of different participants.

- **supporting materials**

  Sometimes copies of slides, supplementary audio files, urls to other resources, and online articles may be included for downloading by participants.
• **a shared comment/discussion space**

These are places where participants can post questions, ask for help, or comment on the content of the course.

• **no or very light discussion moderation**

The extent to which the discussion or comments are moderated varies probably more than any other feature in xMOOCs, but at its most, moderation is directed at all participants rather than to individuals. Because of the very large numbers participating and commenting, moderation of individual comments by the instructor(s) offering the MOOC is rarely possible, although there are some examples. Some instructors offer no moderation whatsoever, so participants rely on other participants to respond to questions or comments. Some instructors ‘sample’ comments and questions, and post comments in response to these. Some instructors use volunteers or paid teaching assistants to comb for or identify common areas of concern shared by a number of participants then the instructor or teaching assistants will respond. However, in most cases, participants moderate each other’s comments or questions.

• **badges or certificates**

Most xMOOCs award some kind of recognition for successful completion of a course, based on a final computer-marked assessment. However, at the time of writing, MOOC badges or certificates have not been recognised for credit or admission purposes even by the institutions offering a MOOC, or even when the lectures are the same as for on-campus students. No evidence exists to date about employer acceptance of MOOC qualifications.

• **learning analytics**

Although to date there has not been a great deal of published information about the use of learning analytics in xMOOCs, the xMOOC platforms have the capacity to collect and analyse ‘big data’ about participants and their performance, enabling, at least in theory, for immediate feedback to instructors about areas where the content or design needs improving and possibly directing automated cues or hints for individuals.

xMOOCs therefore primarily use a teaching model focused on the transmission of information, with high quality content delivery, computer-marked assessment (mainly for student feedback purposes), and automation of all key transactions between participants and the learning platform. There is rarely any direct interaction between an individual participant and the instructor responsible for the course, although instructors may post general comments in response to a range of participants’ comments.

### 7.3.2 cMOOCs

**cMOOCs** have a very different educational philosophy from xMOOCs, in that cMOOCs place heavy emphasis on networking and in particular on strong content contributions from the participants themselves. Indeed, there may be no formally identified instructor, although ‘guest’ instructors may be invited to offer a web cast or a blog for the course.

#### 7.3.2.1 Key design principles

Downes (2014) has identified four key design principles for cMOOCs:
• **autonomy of the learner:** in terms of learners choosing what content or skills they wish to learn, learning is personal, and thus there being no formal curriculum

• **diversity:** in terms of the tools used, the range of participants and their knowledge levels, and varied content

• **interactivity:** in terms of co-operative learning, communication between participants, resulting in emergent knowledge

• **open-ness:** in terms of access, content, activities and assessment.

Thus for the proponents of cMOOCs, learning results not from the transmission of information from an expert to novices, as in xMOOCs, but from sharing of knowledge between participants.

### 7.3.2.2 From principles to practice

Identifying how these key design features for cMOOCs are turned into practice is somewhat more difficult to pinpoint, because cMOOCs depend on an evolving set of practices. Most cMOOCs to date have in fact made some use of ‘experts’, both in the organization and promotion of the MOOC, and in providing ‘nodes’ of content around which discussion tends to revolve. In other words, the design practices of cMOOCs are still more a work in progress than those of xMOOCs.

Nevertheless, I see the following as key design practices to date in cMOOCs:

• **use of social media**

Partly because most cMOOCs are not institutionally based or supported, they do not at present use a shared platform or platforms but are more loosely supported by a range of ‘connected’ tools and media. These may include a simple online registration system, and the use of web conferencing tools such as Blackboard Collaborate or Adobe Connect, streamed video or audio files, blogs, wikis, ‘open’ learning management systems such as Moodle or Canvas, Twitter, LinkedIn or Facebook, all enabling participants to share their contributions. Indeed, as new apps and social media tools develop, they too are likely to be incorporated into cMOOCs. All these tools are connected through web-based hashtags or other web-based linking mechanisms, enabling participants to identify social media contributions from other participants. Downes (2014) is working on a Learning and Performance Support System that could be used to help both participants and cMOOC organisers to communicate more easily across the whole MOOC and to organise their personal learning. Thus the use of loosely linked/connected social media is a key design practice in cMOOCs.

• **participant-driven content**

In principle, other than a common topic that may be decided by someone wanting to organise a cMOOC, content is decided upon and contributed by the participants themselves, in this sense very much like any other community of practice. In practice though cMOOC organisers (who themselves tend to have some expertise in the topic of the cMOOC) are likely to invite potential participants who have expertise or are known already to have a well articulated approach to a topic to make contributions around which participants can discuss and debate. Other participants choose their own ways to contribute or communicate, the most common being through blog posts, tweets, or comments on other participants’ blog posts, although some cMOOCs use wikis or open source online discussion forums. The key design practice with regard to content is that all participants contribute to and share content.
• **distributed communication**

This is probably the most difficult design practice to understand for those not familiar with cMOOCs – and even for those who have participated. With participants numbering in the hundreds or even thousands, each contributing individually through a variety of social media, there are a myriad different inter-connections between participants that are impossible to track (in total) for any single participant. This results in many sub-conversations, more commonly at a binary level of two people communicating with each other than an integrated group discussion, although all conversations are 'open' and all other participants are able to contribute to a conversation if they know it exists. The key design practice then with regard to communication is a self-organising network with many sub-components.

• **assessment**

There is no formal assessment, although participants may seek feedback from other, more knowledgeable participants, on an informal basis. Basically participants decide for themselves whether what they have learned is appropriate to them. cMOOCs therefore primarily use a networked approach to learning based on autonomous learners connecting with each other across open and connected social media and sharing knowledge through their own personal contributions. There is no pre-set curriculum and no formal teacher-student relationship, either for delivery of content or for learner support. Participants learn from the contributions of others, from the meta-level knowledge generated through the community, and from self-reflection on their own contributions, thus reflecting many of the features of communities of interest or practice.

7.3.3 Other variations

I have deliberately focused on the differences in design between xMOOCs and cMOOCs, and Mackness (2013) and Yousef et al. (2014) also emphasise similar differences in philosophy/theory between cMOOCs and xMOOCs, as well as Downes himself (2012), one of the original designers of cMOOCs. However, it should be noted that the design of MOOCs continues to evolve, with all kinds of variations. Yousef et al. (2014) represent this graphically as follows:

![Graphical representation of MOOC varieties](from Yousef et al., 2014, Figure 5, p.12)

In Yousef et al.’s terminology smOOcs represent small open online courses and bMOOCs represent MOOCs that are blended with on-campus teaching. However, Chauhan (2014) offers an even wider range of MOOC instructional models, as follows:

- cMOOCs
- xMOOCs
- BOOCs (a big open online course) – a cross between an xMOOC and a cMOOC

FROM YOUSEF ET AL., 2014, FIGURE 5, P.12

In Yousef et al.’s terminology smOOcs represent small open online courses and bMOOCs represent MOOCs that are blended with on-campus teaching. However, Chauhan (2014) offers an even wider range of MOOC instructional models, as follows:

- cMOOCs
- xMOOCs
- BOOCs (a big open online course) – a cross between an xMOOC and a cMOOC
• **DOCCs** (distributed open collaborative course): this involves 17 universities sharing and adapting the same basic MOOC

• **LOOC** (little open online course): as well as 15–20 tuition-paying campus-based students, such courses also allow a limited number of non-registered students to also take the course, but also paying a fee.

• **MOORs** (massive open online research): a mix of video-based lecturers and student research projects guided by the instructors

• **SPOCs** (small, private, online courses): the example given is from Harvard Law School, which pre-selected 500 students from over 4,000 applicants, who take the same video-delivered lectures as on-campus students enrolled at Harvard

• **SMOCs**: (synchronous massive open online courses): live lectures offered to campus-based students that are also available synchronously to non-enrolled students for a fee.

Hernandez et al. (2014) describe what they term an iMOOC developed by the Open University of Portugal which combines features of both xMOOCs and cMOOCs, and other features, such as collaborative group work and paced instruction, that can be found in their credit-based online courses. The MOOCs developed by UBC and a number of other institutions use volunteers, paid academic assistants or even the instructor to moderate the online discussions and participant comments, making such MOOCs closer in design to regular for-credit online courses – except that they are open to anyone.

### 7.3.4 What’s going on here?

It is not surprising that over time, the design of MOOCs is evolving. There seem to be three distinct kinds of development:

- some of the newer MOOCs, especially those from institutions with a history of credit-based online learning prior to the introduction of MOOCs, are beginning to apply some of the best practices, such as organised and moderated discussion groups, from online credit courses to MOOCs

- others are trying to open up their regular campus classes also, simultaneously, to non-registered students (which in fact is how the first MOOC, from Cormier, Downes and Siemens, originated)

- yet others are trying to blend online MOOC materials or content with their on-campus teaching.

MOOCs are also tending to get shorter, coming down from the traditional 13 week semester to smaller, six week chunks, with also the video lectures getting shorter in length. It is likely that innovation in MOOC design and the way MOOCs are used will continue.

However, some of these developments also indicate a good deal of confusion around the definition and goals of MOOCs, especially regarding massiveness and openness. If participants from outside a university have to pay a hefty fee to participate in an otherwise ‘closed’, on-campus course, or if off-campus participants have to be selected on certain criteria before they can participate, is it really open? Is the term MOOC now being used to describe any unconventional online offering or any online continuing education course? It’s difficult to see how a SPOC for instance differs from a typical online continuing education course, except perhaps in that it uses a recorded lecture rather than a learning management system. There is a danger of having any online course ending up being described as a MOOC, when in fact there are major differences in design and philosophy.

Although each of these individual innovations are to be welcomed in principle, often the result of the initiative of an individual instructor, the consequences need to be carefully considered in fairness to potential participants. Individual instructors designing MOOCs really need to make sure that the design is consistent in terms of educational philoso-
phy, and be clear as to why they are opting for a MOOC rather than a conventional online course. This is particularly important if there is to be any form of formal assessment. The status of such an assessment for participants who are not formally admitted to or registered as a student in an institution needs to be clear and consistent.

There is even more confusion about mixing MOOCs with on-campus teaching. At the moment the strategy appears to be first develop a MOOC then see how it can be adapted for on-campus teaching. However, a better strategy might be to develop a conventional, for-credit online course, in terms of design, then see how it could be scaled for open access to other participants. Another strategy might be to use open social media, such as a course wiki and student blogs, to widen access to the teaching of a formal course, rather than develop a full-blown MOOC.

Thinking through the policy implications of incorporating MOOCs or MOOC materials with on-campus teaching does not appear to be happening at the moment in most institutions experimenting with ‘blended’ MOOCs. If MOOC participants are taking exactly the same course and assessment as registered on-campus for-credit students, will the institution award the external MOOC participants who successfully complete the assessment credit for it and/or admit them to the institution? If not, why not? For an excellent discussion of these issues framed for an institution’s Board of Governors, see Green, 2013.

Thus some of these MOOC developments seem to be operating in a policy vacuum regarding open learning in general. At some point, institutions will need to develop a clearer, more consistent strategy for open learning, in terms of how it can best be provided, how it calibrates with formal learning, and how open learning can be accommodated within the fiscal constraints of the institution, and then where MOOCs, other OERs and conventional for-credit online courses might fit with the strategy.

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**Activity 7.1: Thinking about MOOC design**

1. When is a MOOC a MOOC and when is it not a MOOC? Can you identify the common features? Is MOOC still a useful term?
2. If you were to design a MOOC, who would be the target audience? What kind of MOOC would it be? What form of assessment could you use? What would make you think your MOOC was a success, after it was delivered? What criteria would you use?
3. Could you think of other ways to make one or more of your courses more open, other than creating a MOOC from scratch? What would be the advantages and disadvantages of these other methods, compared to a MOOC?

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**7.3.5 References**


Downes, S. (2012) Massively Open Online Courses are here to stay, Stephen’s Web, July 20


Green, K. (2013) Mission, money and MOOCs Association of Governing Boards Trusteeship, No. 1, Volume 21


Mackness, J. (2013) *cMOOCs and xMOOCs – key differences*, Jenny Mackness, October 22

Section 7.4 Strengths and weaknesses of MOOCs

In-depth analysis by standard academic criteria shows that MOOCs have more academic rigor and are a far more effective teaching methodology than in-house teaching.

Benton R. Groves, Ph.D. student

My big concern with xMOOCs is their limitation, as currently designed, for developing the higher order intellectual skills needed in a digital world.

Tony Bates, e-Learning, consultant

Because at the time of writing most MOOCs are less than three years old, there are few research publications on MOOCs, although research activities are now beginning to pick up. Much of the research to date on MOOCs comes from the institutions offering MOOCs, mainly in the form of reports on enrolments, or self-evaluation by instructors. The commercial platform providers such as Coursera and Udacity have provided limited research information overall, which is a pity, because they have access to really big data sets. However, MIT and Harvard, the founding partners in edX, are conducting some research, mainly on their own courses. There is very little independent research to date on either xMOOCs or cMOOCs.

However, where possible, I have tried to use any research that has been done that provides insight into the strengths and weaknesses of MOOCs. At the same time, we should be clear that we are discussing a phenomenon that to date has been marked largely by political, emotional and often irrational discourse, and in terms of cumulative hard evidence, we will have to wait for some time.

Lastly, it should be remembered when I am evaluating MOOCs I am applying the criteria of whether MOOCs are likely to lead to the kinds of learning needed in a digital age: in other words, do they help develop the knowledge and skills defined in Chapter 1?

7.4.1 Open and free education

MOOCs, particularly xMOOCs, deliver high quality content from some of the world’s best universities for free to anyone with a computer and an Internet connection. This in itself is an amazing value proposition. In this sense, MOOCs are an incredibly valuable addition to educational provision. Who could argue against this? Certainly not me, so long as the argument for MOOCs goes no further.

However, this is not the only form of open and free education. Libraries, open textbooks and educational broadcasting are also open and free and have been for some time, even if they do not have the same power and reach as Internet-based delivery. There are also lessons we can learn from these earlier forms of open and free education that still apply to MOOCs.

The first is that these earlier forms of open and free did not replace the need for formal, credit-based education, but were used to supplement or strengthen it. In other words, MOOCs are a tool for continuing and informal education, which has high value in its own right. As we shall see though they work best when people are already reasonably well educated.

The problem comes when it is argued that because MOOCs are open and free to end-users, they will inevitably force down the cost of conventional higher education, or eliminate the need for it altogether, especially in Third World countries (see the Friedman comment at the beginning of this chapter.)

There have been many attempts in the past to use educational broadcasting and satellite broadcasting in Third World
countries (see Bates, 1985), and they all failed substantially to increase access or reduce cost for a variety of reasons, the most important being:

- the high cost of ground equipment (including security from theft or damage)
- the need for local support for learners without high levels of education, and the high cost of local, ‘ground’ support
- the need to adapt to the culture of the receiving countries
- the difficulty of covering the operational costs of management and administration, especially for assessment, qualifications and local accreditation.

Also the priority in most Third World countries is not for courses from high-level Stanford University professors, but for programs for high schools. Finally, although mobile phones are widespread in Africa, they operate on very narrow bandwidths. For instance, it costs US$2 to download a typical YouTube video – equivalent to a day’s salary for many Africans. Streamed video lectures then have limited applicability.

This is not to say that MOOCs could not be valuable in Third World countries, but this will mean:

- being realistic as to what they can actually deliver
- working in partnership with Third World educational institutions and systems and other partners
- ensuring that the necessary local support – which costs real money – is put in place
- adapting the design, content and delivery of MOOCs to the cultural and economic requirements of those countries.

Furthermore, MOOCs are not always open as in the sense of open educational resources. Coursera and Udacity for instance offer limited access to their material for re-use without permission. On other more open platforms, such as edX, individual faculty or institutions may restrict re-use of material. Lastly, many MOOCs exist for only one or two years then disappear, which limits their use as open educational resources for re-use in other courses or programs.

Finally, although MOOCs are in the main free for participants, they are not without substantial cost to MOOC providers, an issue that will be discussed in more detail in Section 7.4.7.

### 7.4.2 The audience that MOOCs mainly serve

In a research report from Ho et al. (2014), researchers at Harvard University and MIT found that on the first 17 MOOCs offered through edX, 66 per cent of all participants, and 74 per cent of all who obtained a certificate, have a bachelor’s degree or above, 71 per cent were male, and the average age was 26. This and other studies also found that a high proportion of participants came from outside the USA, ranging from 40-60% of all participants, indicating strong interest internationally in open access to high quality university teaching.

In a study based on over 80 interviews in 62 institutions ‘active in the MOOC space’, Hollands and Tirthali (2014), researchers at Columbia University Teachers’ College, found that:

Data from MOOC platforms indicate that MOOCs are providing educational opportunities to millions of individuals across the world. However, most MOOC participants are already well-educated and employed, and only a small fraction of them fully engages with the courses. Overall, the evidence suggests that MOOCs are currently falling far short of “democratizing” education and may, for now, be doing more to increase gaps in access to education than to diminish them.

Thus MOOCs, as is common with most forms of university continuing education, cater to the better educated, older and employed sectors of society.
7.4.3 Persistence and commitment

The edX researchers (Ho et al., 2014) identified different levels of commitment as follows across 17 edX MOOCs:

- Only Registered: Registrants who never access the courseware (35%).
- Only Viewed: Non-certified registrants who access the courseware, accessing less than half of the available chapters (56%).
- Only Explored: Non-certified Registrants who access more than half of the available chapters in the courseware, but did not get a certificate (4%).
- Certified: Registrants who earn a certificate in the course (5%).

Hill (2013) has identified five types of participants in Coursera courses:

![Emerging Student Patterns in Coursera-style MOOCs](image)

© Phil Hill, 2013

Engle (2014) found similar patterns for the UBC MOOCs on Coursera (also replicated in other studies):

- of those that initially sign up, between one third and a half do not participate in any other active way
- of those that participate in at least one activity, between 5-10% go on to successfully complete a certificate
Those going on to achieve certificates usually are within the 5-10 per cent range of those that sign up and in the 10-20 per cent range for those who actively engaged with the MOOC at least once. Nevertheless, the numbers obtaining certificates are still large in absolute terms: over 43,000 across 17 courses on edX and 8,000 across four courses at UBC (between 2,000-2,500 certificates per course).

Milligan et al. (2013) found a similar pattern of commitment in cMOOCs, from interviewing a relatively small sample of participants (29 out of 2,300 registrants) about halfway through a cMOOC:

- passive participants: in Milligan’s study these were those that felt lost in the MOOC and rarely but occasionally logged in.
- lurkers: they were actively following the course but did not engage in any of the activities (these were just under half those interviewed)
- active participants (again, just under half those interviewed) who were fully engaged in the course activities.

MOOCs need to be judged for what they are, a somewhat unique – and valuable – form of non-formal education. These results are very similar to research into non-formal educational broadcasts (e.g. the History Channel). One would not expect a viewer to watch every episode of a History Channel series then take an exam at the end. Ho et al. (p.13) produced the following diagram to show the different levels of commitment to xMOOCs:

Now compare that to what I wrote in 1985 about educational broadcasting in Britain (Bates, 1985):

(p.99): At the centre of the onion is a small core of fully committed students who work through the whole course, and, where available, take an end-of-course assessment or examination. Around the small core will be a rather larger layer of students who do not take any examination but do enrol with a local class or correspondence school. There may be an even larger layer of students who, as well as watching and listening, also buy the accompanying textbook, but who do not enrol in any courses. Then, by far the largest group, are those that just watch or listen to the programmes. Even within this last group, there will be considerable variations, from those who watch or listen fairly regularly, to those, again a much larger number, who watch or listen to just one programme.

I also wrote (p.100):

A sceptic may say that the only ones who can be said to have learned effectively are the tiny minority that worked right through the course and successfully took the final assessment...A counter argument would be that broadcasting can be considered successful if it merely attracts viewers or listeners who might otherwise have shown no interest in the topic; it is the numbers exposed to the material that matter...the key issue then is whether broadcasting does attract to education those who would not otherwise have been interested, or merely provides yet another opportunity for those who are already well educated...There is a good deal of evidence that it is still the better educated in Britain and Europe that make the most use of non-formal educational broadcasting.

Exactly the same could be said about MOOCs. In a digital age where easy and open access to new knowledge is critical for those working in knowledge-based industries, MOOCs will be one valuable source or means of accessing that knowledge. The issue is though whether there are more effective ways to do this. Thus MOOCs can be considered a useful – but not really revolutionary – contribution to non-formal continuing education.

7.4.4 What do students learn in MOOCs?

This is a much more difficult question to answer, because so little of the research to date (2014) has tried to answer this question. (One reason, as we shall see in the next section, is that assessment of learning in MOOCs remains a major challenge). There are at least two kinds of study: quantitative studies that seek to quantify learning gains; and qualitative studies that describe the experience of learners within MOOCs, which indirectly provide some insight into what they have learned.
At the time of writing, the most quantitative study of learning in MOOCs has been by Colvin et al. (2014), who investigated ‘conceptual learning’ in an MIT Introductory Physics MOOC. They compared learner performance not only between different sub-categories of learners within the MOOC, such as those with no physics or math background with those such as physic teachers who had considerable prior knowledge, but also with on-campus students taking the same curriculum in a traditional campus teaching format. In essence, the study found no significant differences in learning gains between or within the two types of teaching, but it should be noted that the on-campus students were students who had failed an earlier version of the course and were retaking it.

This research is a classic example of the no significant difference in comparative studies in educational technology; other variables, such as differences in the types of students, were as important as the mode of delivery. Also, this MOOC design represents a behaviourist-cognitivist approach to learning that places heavy emphasis on correct answers to conceptual questions. It doesn’t attempt to develop the skills needed in a digital age as identified in Chapter 1.

There have been far more studies of the experience of learners within MOOCs, particularly focusing on the discussions within MOOCs (see for instance, Kop, 2011). In general (although there are exceptions), discussions are unmonitored, and it is left to participants to make connections and respond to other students comments. However, there are some strong criticisms of the effectiveness of the discussion element of MOOCs for developing the high-level conceptu-
al analysis required for academic learning. To develop deep, conceptual learning, there is a need in most cases for intervention by a subject expert, to clarify misunderstandings or misconceptions, to provide accurate feedback, to ensure that the criteria for academic learning, such as use of evidence, clarity of argument, etc., are being met, and to ensure the necessary input and guidance to seek deeper understanding (see Harasim, 2013).

Furthermore, the more massive the course, the more likely participants are to feel ‘overload, anxiety and a sense of loss’, if there is not some instructor intervention or structure imposed (Knox, 2014). Firmin et al. (2014) have shown that when there is some form of instructor ‘encouragement and support of student effort and engagement’, results improve for all participants in MOOCs. Without a structured role for subject experts, participants are faced with a wide variety of quality in terms of comments and feedback from other participants. There is again a great deal of research on the conditions necessary for the successful conduct of collaborative and co-operative group learning (see for instance, Dillenbourg, 1999, Lave and Wenger, 1991), and these findings certainly have not been generally applied to the management of MOOC discussions to date.

One counter argument is that at least cMOOCs develop a new form of learning based on networking and collaboration that is essentially different from academic learning, and MOOCs are thus more appropriate to the needs of learners in a digital age. Adult participants in particular, it is claimed by Downes and Siemens, have the ability to self-manage the development of high level conceptual learning. MOOCs are ‘demand’ driven, meeting the interests of individual students who seek out others with similar interests and the necessary expertise to support them in their learning, and for many this interest may well not include the need for deep, conceptual learning but more likely the appropriate applications of prior knowledge in new or specific contexts. MOOCs do appear to work best for those who already have a high level of education and therefore bring many of the conceptual skills developed in formal education with them when they join a MOOC, and therefore contribute to helping those who come without such prior knowledge or skills.

Over time, as more experience is gained, MOOCs are likely to incorporate and adapt some of the findings from research on smaller group work to the much larger numbers in MOOCs. For instance, some MOOCs are using ‘volunteer’ or community tutors (Dillenbourg, 2014). The US State Department has organized MOOC camps through US missions and consulates abroad to mentor MOOC participants. The camps include Fulbright scholars and embassy staff who lead discussions on content and topics for MOOC participants in countries abroad (Haynie, 2014). Some MOOC providers, such as the University of British Columbia, pay a small cohort of academic assistants to monitor and contribute to the MOOC discussion forums (Engle, 2014). Engle reported that the use of academic assistants, as well as limited but effective interventions from the instructors themselves, made the UBC MOOCs more interactive and engaging. However, paying for people to monitor and support MOOCs will of course increase the cost to providers. Consequently, MOOCs are likely to develop new automated ways to manage discussion effectively in very large groups. The University of Edinburgh is experimenting with automated ‘teacherbots’ that crawl through online discussion forums and direct predetermined comments to students identified as needing help or encouragement (Bayne, 2014).

These results and approaches are consistent with prior research on the importance of instructor presence for successful for-credit online learning. In the meantime, though, there is much work still to be done if MOOCs are to provide the support and structure needed to ensure deep, conceptual learning where this does not already exist in students. The development of the skills needed in a digital age is likely to be an even greater challenge when dealing with massive numbers. However, we need much more research into what participants actually learn in MOOCs and under what conditions before any firm conclusions can be drawn.

### 7.4.5 Assessment

Assessment of the massive numbers of participants in MOOCs has proved to be a major challenge. It is a complex topic that can be dealt with only briefly here. However, Chapter 5.8 provides a general analysis of different types of assessment, and Suen (2014) provides a comprehensive and balanced overview of the way assessment has been used in MOOCs to date. This section draws heavily on Suen’s paper.
7.4.5.1 Computer marked assignments

Assessment to date in MOOCs has been primarily of two kinds. The first is based on quantitative multiple-choice tests, or response boxes where formulae or ‘correct code’ can be entered and automatically checked. Usually participants are given immediate automated feedback on their answers, ranging from simple right or wrong answers to more complex responses depending on the type of response checked, but in all cases, the process is usually fully automated.

For straight testing of facts, principles, formulae, equations and other forms of conceptual learning where there are clear, correct answers, this works well. In fact, multiple choice computer marked assignments were used by the UK Open University as long ago as the 1970s, although the means to give immediate online feedback were not available then. However, this method of assessment is limited for testing deep or ‘transformative’ learning, and particularly weak for assessing the intellectual skills needed in a digital age, such as creative or original thinking.

7.4.5.2 Peer review

The second type of assessment that has been tried in MOOCs has been peer assessment, where participants assess each other’s work. Peer assessment is not new. It has been successfully used for formative assessment in traditional classrooms and in some online teaching for credit (Falchikov and Goldfinch, 2000; van Zundert et al., 2010). More importantly, peer assessment is seen as a powerful way to improve deep understanding and knowledge through the process of students evaluating the work of others, and at the same time, it can be useful for developing some of the skills needed in a digital age, such as critical thinking, for those participants doing assessment.

However, a key feature of the successful use of peer assessment has been the close involvement of an instructor or teacher, in providing benchmarks, rubrics or criteria for assessment, and for monitoring and adjusting peer assessments to ensure consistency and a match with the benchmarks set by the instructor. Although an instructor can provide the benchmarks and rubrics in MOOCs, close monitoring of the multiple peer assessments is difficult if not impossible with the very large numbers of participants in MOOCs. As a result, MOOC participants often become incensed at being randomly assessed by other participants who may not and often do not have the knowledge or ability to give a ‘fair’ or accurate assessment of a participant’s work.

Various attempts to get round the limitations of peer assessment in MOOCs have been tried such as calibrated peer reviews, based on averaging the all the peer ratings, and Bayesian post hoc stabilization (Piech at al. 2013), but although these statistical techniques reduce the error (or spread) of peer review somewhat they still do not remove the problems of systematic errors of judgement in raters due to misconceptions. This is particularly a problem where a majority of participants fail to understand key concepts in a MOOC, in which case peer assessment becomes the blind leading the blind.

7.4.5.3 Automated essay scoring

This is another area where there have been attempts to automate scoring (Balfour, 2013). Although such methods are increasingly sophisticated they are currently limited in terms of accurate assessment to measuring primarily technical writing skills, such as grammar, spelling and sentence construction. Once again they do not measure accurately essays where higher level intellectual skills are demonstrated.

7.4.5.4 Badges and certificates

Particularly in xMOOCs, participants may be awarded a certificate or a ‘badge’ for successful completion of the MOOC, based on a final test (usually computer-marked) which measures the level of learning in a course.

The American Council on Education (ACE), which represents the presidents of U.S. accredited, degree-granting insti-
recommend certain offering credit for five courses on the Coursera MOOC platform. However, according to the person responsible for the review process:

‘what the ACE accreditation does is merely accredit courses from institutions that are already accredited. The review process doesn’t evaluate learning outcomes, but is a course content focused review thus obviating all the questions about effectiveness of the pedagogy in terms of learning outcomes.’ (Book, 2013)

Indeed, most of the institutions offering MOOCs will not accept their own certificates for admission or credit within their own, campus-based programs. Probably nothing says more about the confidence in the quality of the assessment than this failure of MOOC providers to recognize their own teaching.

7.4.5.5 The intent behind assessment

To evaluate assessment in MOOCs requires an examination of the intent behind assessment. As identified earlier in Chapter 5, Section 8, there are many different purposes behind assessment. Peer assessment and immediate feedback on computer-marked tests can be extremely valuable for formative assessment, enabling participants to see what they have understood and to help develop further their understanding of key concepts. In cMOOCs, as Suen points out, learning is measured as the communication that takes place between MOOC participants, resulting in crowdsourced validation of knowledge – it’s what the sum of all the participants come to believe to be true as a result of participating in the MOOC, so formal assessment is unnecessary. However, what is learned in this way is not necessarily academically validated knowledge, which to be fair, is not the concern of cMOOC proponents.

Academic assessment is a form of currency, related not only to measuring student achievement but also affecting student mobility (e.g., entrance to graduate school) and perhaps more importantly employment opportunities and promotion. From a learner’s perspective, the validity of the currency – the recognition and transferability of the qualification – is essential. To date, MOOCs have been unable to demonstrate that they are able to assess accurately the learning achievements of participants beyond comprehension and knowledge of ideas, principles and processes (recognizing that there is some value in this alone). What MOOCs have not been able to demonstrate is that they can either develop or assess deep understanding or the intellectual skills required in a digital age. Indeed, this may not be possible within the constraints of massiveness, which is their major distinguishing feature from other forms of online learning.

7.4.6 Branding

Hollands and Tirthali (2014) in their survey on institutional expectations for MOOCs, found that building and maintaining brand was the second most important reason for institutions launching MOOCs (the most important was extending reach, which can also be seen as partly a branding exercise). Institutional branding through the use of MOOCs has been helped by elite Ivy League universities such as Stanford, MIT and Harvard leading the charge, and by Coursera limiting access to its platform to only ‘top tier’ universities. This of course has led to a bandwagon effect, especially since many of the universities launching MOOCs had previously disdained to move into credit-based online learning. MOOCs provided a way for these elite institutions to jump to the head of the queue in terms of status as ‘innovators’ of online learning, even though they arrived late to the party.

It obviously makes sense for institutions to use MOOCs to bring their areas of specialist expertise to a much wider public, such as the University of Alberta offering a MOOC on dinosaurs, MIT on electronics, and Harvard on Ancient Greek Heroes. MOOCs certainly help to widen knowledge of the quality of an individual professor (who is usually delighted to reach more students in one MOOC than in a lifetime of on-campus teaching). MOOCs are also a good way to give a glimpse of the quality of courses and programs offered by an institution.

However, it is difficult to measure the real impact of MOOCs on branding. As Hollands and Tirthali put it:

*While many institutions have received significant media attention as a result of their MOOC activities, isolating and measuring...*
impact of any new initiative on brand is a difficult exercise. Most institutions are only just beginning to think about how to capture and quantify branding-related benefits.

In particular, these elite institutions do not need MOOCs to boost the number of applicants for their campus-based programs (none to date is willing to accept successful completion of a MOOC for admission to credit programs), since elite institutions have no difficulty in attracting already highly qualified students.

Furthermore, once every other institution starts offering MOOCs, the branding effect gets lost to some extent. Indeed, exposing poor quality teaching or course planning to many thousands can have a negative impact on an institution’s brand, as Georgia Institute of Technology found when one of its MOOCs crashed and burned (Jaschik, 2013). However, by and large, most MOOCs succeed in the sense of bringing an institution’s reputation in terms of knowledge and expertise to many more people than it would through any other form of teaching or publicity.

7.4.7 Costs and economies of scale

The MOOC value proposition is that MOOCs can eliminate the variable costs of course delivery. Image: © OpenTuition.com, 2014

One main strength claimed for MOOCs is that they are free to participants. Once again we shall see this is more true in principle than in practice, because MOOC providers may charge a range of fees, especially for assessment. Furthermore, although MOOCs may be free for participants, they are not without substantial cost to the provider institutions. Also, there are large differences in the costs of xMOOCs and cMOOCs, the latter being generally much cheaper to develop, although there are still some opportunity or actual costs even for cMOOCs.

Once again, there is very little information to date on the actual costs of designing and delivering a MOOC. However, we do know what the main cost factors or variables are in online and distance learning, from previous research by Rumble (2001) and Hülsmann (2003). Using similar costing methodology, I tracked and analysed the cost of an online masters program at the University of British Columbia over a seven year period (Bates and Sangrà, 2011). This program used mainly a learning management system as the core technology, with instructors both developing the course and
providing online learner support and assessment, assisted where necessary by extra adjunct faculty for handling larger class enrolments.

The costs of online learning break down into several categories:

- initial program planning
- course development
- course delivery
- course maintenance
- institutional overheads.

Within each of these categories, there are sub-categories, such as the cost of instructors, media production and delivery costs, instructional design, and the cost of producing and delivering support materials. Not all costs apply in all circumstances, of course.

I found in my analysis of the costs of the UBC program that in 2003, development costs were approximately $20,000 to $25,000 per course. However, over a seven year period course development constituted less than 15% of the total cost, and occurred mainly in the first year or so of the program. Delivery costs, which included providing online learner support and student assessment, constituted more than a third of the total cost, and of course continued each year the course was offered (see Figure 7.4 below). Thus in credit-based online learning, delivery costs tend to be more than double the development costs over the life of a program.

Figure 7.4: Costs of an online masters program over seven years (from Bates and Sangrà, 2011, p. 172)
The main difference between MOOCs, credit-based online teaching, and campus-based teaching is that in principle MOOCs eliminate all delivery costs, because MOOCs do not provide learner support or instructor-delivered assessment, although again in practice this is not always true.

We do not have enough cases at the moment to draw firm conclusions about the costs of MOOCs but we do have some data. The University of Ottawa (2013) estimated the cost of developing an xMOOC, based on figures provided to the university by Coursera, and on their own knowledge of the cost of developing online courses for credit, at around $100,000.

Engle (2014) has reported on the actual cost of five MOOCs from the University of British Columbia. (In essence, there were really four UBC MOOCs, as one was in two shorter parts.) There are two important features concerning the UBC MOOCs that do not necessarily apply to other MOOCs. First, the UBC MOOCs used a wide variety of video production methods, from full studio production to desktop recording, so development costs varied considerably, depending on the sophistication of the video production technique. Second, the UBC MOOCs made extensive use of paid academic assistants, who monitored discussions and adapted or changed course materials as a result of student feedback, so there were substantial delivery costs as well.

Appendix B of the UBC report gives a pilot total of $217,657, but this excludes academic assistance or, perhaps the most significant cost, instructor time. Academic assistance came to 25% of the overall cost in the first year (excluding the cost of faculty). Working from the video production costs ($95,350) and the proportion of costs (44%) devoted to video production in Figure 1 in the report, I estimate the direct cost at $216,700, or approximately $54,000 per MOOC, excluding faculty time and co-ordination support (i.e. excluding program administration and overheads), but including academic assistance. However, the range of cost is almost as important. The video production costs for the MOOC which used intensive studio production were more than six times the video production costs of one of the other MOOCs.

There is also clearly a large opportunity cost involved in offering xMOOCs. By definition, the most highly valued faculty are involved in offering MOOCs. In a large research university, such faculty are likely to have, at a maximum, a teaching load of four to six courses a year. Although most instructors volunteer to do MOOCs, their time is limited. Either it means dropping one credit course for at least one semester, equivalent to 25 per cent or more of their teaching load, or xMOOC development and delivery replaces time spent doing research. Furthermore, unlike credit-based courses, which run from anywhere between five to seven years, MOOCs are often offered only once or twice.

However one looks at it, the cost of xMOOC development, without including the time of the MOOC instructor, tends to be almost double the cost of developing an online credit course using a learning management system, because of the use of video in MOOCs. If the cost of the instructor is included, xMOOC production costs come closer to three times that of a similar length online credit course, especially given the extra time faculty tend put in for such a public demonstration of their teaching in a MOOC. xMOOCs could (and some do) use cheaper production methods, such as an LMS instead of video, for content delivery, or using and re-editing video recordings of classroom lectures via lecture capture.

Without learner support or academic assistance, though, delivery costs for MOOCs are zero, and this is where the huge potential for savings exist. If the cost per participant is calculated the unit costs are very low. Even if the cost per student successfully obtaining an end of course certificate is calculated it will be many times lower than the cost of an online or campus-based successful student. For instance, the fees of the UBC online master’s courses were set at around ‘break-even’ point for covering the full cost, and in 2003 these were set at $1,200 per course. If we take a MOOC costing roughly $100,000 to develop, and 5,000 participants complete the end of course certificate, the average cost per successful participant is $20. Even allowing for institutional overheads and institutional planning, the cost will be vastly lower. However, this assumes that the same type of knowledge and skills is being assessed for both a MOOC and for a graduate masters program; usually this not the case.

The issue then is whether MOOCs can succeed without the cost of learner support and human assessment, or more likely, whether MOOCs can substantially reduce delivery costs through automation without loss of quality in learner performance. There is no evidence to date though that they can do this in terms of higher order learning skills and ‘deep’ knowledge. To assess this kind of learning requires setting assignments that test such knowledge, and such assessments usually need human marking, which then adds to cost. We also know from prior research from successful online credit programs that active instructor online presence is a critical factor for successful online learning. Thus adequate
learner support and assessment remains a major challenge for MOOCs. It would appear to me then that MOOCs are a good way to teach certain levels of knowledge but will have major structural problems in teaching other types of knowledge. Unfortunately, it is the type of knowledge most needed in a digital world that MOOCs struggle to teach.

In terms of sustainable business models, the elite universities have been able to move into xMOOCs because of generous donations from private foundations and use of endowment funds, but these forms of funding are limited for most institutions. Coursera and Udacity have the opportunity to develop successful business models through various means, such as charging MOOC provider institutions for use of their platform, by collecting fees for badges or certificates, through the sale of participant data, through corporate sponsorship, or through direct advertising.

However, particularly for publicly funded universities or colleges, most of these sources of income are not available or permitted, so it is hard to see how they can begin to recover the cost of a substantial investment in MOOCs, even with ‘cannibalising’ MOOC material for on-campus use. Every time a MOOC is offered, this takes away resources that could be used for online credit programs. Thus institutions are faced with some hard decisions about where to invest their resources for online learning. The case for putting scarce resources into MOOCs is far from clear, unless some way can be found to give credit for successful MOOC completion.

7.4.8 Brief summary of strengths and weaknesses

The main points of this analysis of the strengths and weaknesses of MOOCs can be summarised as follows:

7.5.8.1 Strengths

- MOOCs main value proposition is to eliminate through computer automation and/or peer-to-peer communication the very large variable costs in higher education associated with providing learner support and quality assessment
- MOOCs, particularly xMOOCs, deliver high quality content from some of the world’s best universities for free to anyone with a computer and an Internet connection
- MOOCs can be useful for opening access to high quality content, particularly in Third World countries, but to do so successfully will require a good deal of adaptation, and substantial investment in local support and partnerships
- MOOCs are valuable for developing basic conceptual learning, and for creating large online communities of interest or practice
- MOOCs are an extremely valuable form of lifelong learning and continuing education
- MOOCs have forced conventional and especially elite institutions to reappraise their strategies towards online and open learning
- institutions have been able to extend their brand and status by making public their expertise and excellence in certain academic areas

7.5.8.2 Weaknesses

- the high registration numbers for MOOCs are misleading; less than half of registrants actively participate, and of these, only a small proportion successfully complete the course; nevertheless, absolute numbers are still higher than for conventional courses
• MOOCs are expensive to develop, and although commercial organisations offering MOOC platforms have opportunities for sustainable business models, it is difficult to see how publicly funded higher education institutions can develop sustainable business models for MOOCs
• MOOCs tend to attract those with already a high level of education, rather than widen access
• MOOCs so far have been limited in the ability to develop high level academic learning, or the high level intellectual skills needed in a knowledge based society
• assessment of the higher levels of learning remains a challenge for MOOCs, to the extent that most MOOC providers will not recognise their own MOOCs for credit
• MOOC materials may be limited by copyright or time restrictions for re-use as open educational resources

Activity 7.2: Assessing the strengths and weaknesses of MOOCs

1. Do you agree that MOOCs are just another form of educational broadcasting? What are your reasons?
2. Is it reasonable to compare the costs of xMOOCs to the costs of online credit courses? Are they competing for the same funds, or are they categorically different in their funding source and goals? If so, how?
3. Could you make the case that cMOOCs are a better value proposition than xMOOCs – or are they again too different to compare?
4. MOOCs are clearly cheaper than either face-to-face or online credit courses if judged on the cost per participant successfully completing a course. Is this a fair comparison, and if not, why not?
5. Do you think institutions should give credit for students successfully completing MOOCs? If so, why, and what are the implications?

If you want to share your answers, please use the comment box below.

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Section 7.5 Political, social and economic drivers of MOOCs

7.5 Why the fuss about MOOCs?

It can be seen from the previous section that the pros and cons of MOOCs are finely balanced. Given though the obvious questions about the value of MOOCs, and the fact that before MOOCs arrived, there had been substantial but quiet progress for over ten years in the use of online learning for undergraduate and graduate programs, you might be wondering why MOOCs have commanded so much media interest, and especially why a large number of government policy makers, economists, and computer scientists have become so ardently supportive of MOOCs, and why there has been such a strong, negative reaction, not only from many university and college instructors, who are right to be threatened by the implications of MOOCs, but also from many professionals in online learning (see for instance, Hill, 2012; Bates, 2012; Daniel, 2012; Watters, 2012), who might be expected to be more supportive of MOOCs.

It needs to be recognised that the discourse around MOOCs is not usually based on a cool, rational, evidence-based analysis of the pros and cons of MOOCs, but is more likely to be driven by emotion, self-interest, fear, or ignorance of what education is actually about. Thus it is important to explore the political, social and economic factors that have driven MOOC mania.
7.5.1 Massive, free and Made in America!

This is what I will call the intrinsic reason for MOOC mania. It is not surprising that, since the first MOOC from Stanford professors Sebastian Thrun, Andrew Ng and Daphne Koller each attracted over 200,000 sign-ups from around the world, since the courses were free, and since it came from professors at one of the most prestigious private universities in the USA, the American media were all over it. It was big news in its own right, however you look at it.

7.5.2 It’s the Ivy Leagues!

Until MOOCs came along, the major Ivy League universities in the USA, such as Stanford, MIT, Harvard and UC Berkeley, as well as many of the most prestigious universities in Canada, such as the University of Toronto and McGill, and elsewhere, had largely ignored online learning in any form (the exception was MIT, which made much of its teaching material available for free via the OpenCourseWare project).

However, by 2011, online learning, in the form of for credit undergraduate and graduate courses, was making big inroads at many other, very respectable universities, such as Carnegie Mellon, Penn State, and the University of Maryland in the USA, and also in many of the top tier public universities in Canada and elsewhere, to the extent that almost one in three course enrolments in the USA were now in online courses. Furthermore, at least in Canada, the online courses were often getting good completion rates and matching on-campus courses for quality.

The Ivy League and other highly prestigious universities that had ignored online learning were beginning to look increasingly out of touch by 2011. By launching into MOOCs, these prestigious universities could jump to the head of the queue in terms of technology innovation, while at the same time protecting their selective and highly personal and high cost campus programs from direct contact with online learning. In other words, MOOCs gave these prestigious universities a safe sandbox in which to explore online learning, and the Ivy League universities gave credibility to MOOCs, and, indirectly, online learning as a whole.

7.5.3 It’s disruptive!

For years before 2011, various economists, philosophers and industrial gurus had been predicting that education was the next big area for disruptive change due to the march of new technologies (see for instance Lyotard, 1979; Tapscott (undated); Christensen, 2010).

Online learning in credit courses though was being quietly absorbed into the mainstream of university teaching, through blended learning, without any signs of major disruption, but here with MOOCs was a massive change, providing evidence at long last in the education sector to support the theories of disruptive innovation.

7.5.4 It’s Silicon Valley!

It is no coincidence that the first MOOCs were all developed by entrepreneurial computer scientists. Ng and Koller very quickly went on to create Coursera as a private commercial company, followed shortly by Thrun, who created Udacity. Anant Agarwal, a computer scientist at MIT, went on to head up edX.

The first MOOCs were very typical of Silicon Valley start-ups: a bright idea (massive, open online courses with cloud-based, relatively simple software to handle the numbers), thrown out into the market to see how it might work, supported by more technology and ideas (in this case, learning analytics, automated marking, peer assessment) to deal with any snags or problems. Building a sustainable business model would come later, when some of the dust had settled.

As a result it is not surprising that almost all the early MOOCs completely ignored any pedagogical theory about best practices in teaching online, or any prior research on factors associated with success or failure in online learning. It is also not surprising as a result that a very low percentage of participants actually successfully complete MOOCs – there’s a lot of catching up still to do, but so far Coursera and to a lesser extent edX have continued to ignore educators and
prior research in online learning. They would rather do their own research, even if it means re-inventing the wheel. The commercial MOOC platform providers though are beginning to work out a sustainable business model.

### 7.5.5 It’s the economy, stupid!

Of all the reasons for MOOC mania, Bill Clinton’s famous election slogan resonates most with me. It should be remembered that by 2011, the consequences of the disastrous financial collapse of 2008 were working their way through the economy, and particularly were impacting on the finances of state governments in the USA.

The recession meant that states were suddenly desperately short of tax revenues, and were unable to meet the financial demands of state higher education systems. For instance, California’s community college system, the nation’s largest, suffered about $809 million in state funding cuts between 2008-2012, resulting in a shortfall of 500,000 places in its campus-based colleges (Rivera, 2012). Free MOOCs were seen as manna from heaven by the state governor, Jerry Brown (see for instance To, 2014).

One consequence of rapid cuts to government funding was a sharp spike in tuition fees, bringing the real cost of higher education sharply into focus. Tuition fees in the USA have increased by 7% per annum over the last 10 years, compared with an inflation rate of 4% per annum. Here at last was a possible way to rein in the high cost of higher education.

Now though the economy in the USA is picking up and revenues are flowing back into state coffers, and so the pressure for more radical solutions to the cost of higher education is beginning to ease. It will be interesting to see if MOOC mania continues as the economy grows, although the search for more cost-effective approaches to higher education is not going to disappear.

### 7.5.6 Don’t panic!

These are all very powerful drivers of MOOC mania, which makes it all the more important to try to be clear and cool headed about the strengths and weaknesses of MOOCs. The real test is whether MOOCs can help develop the knowledge and skills that learners need in a knowledge-based society. The answer of course is yes and no.

As a low-cost supplement to formal education, they can be quite valuable, but not as a complete replacement. They can at present teach conceptual learning, comprehension and in a narrow range of activities, application of knowledge. They can be useful for building communities of practice, where already well educated people or people with a deep, shared passion for a topic can learn from one another, another form of continuing education.

However, certainly to date, MOOCs have not been able to demonstrate that they can lead to transformative learning, deep intellectual understanding, evaluation of complex alternatives, and evidence-based decision-making, and without greater emphasis on expert-based learner support and more qualitative forms of assessment, they probably never will, at least without substantial increases in their costs.

At the end of the day, there is a choice between throwing more resources into MOOCs and hoping that some of their fundamental flaws can be overcome without too dramatic an increase in costs, or investing in other forms of online learning and educational technology that could lead to more cost-effective learning outcomes in terms of the needs of learners in a digital age.

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Section 7.6 Why MOOCs are only part of the answer

Scenario E: How to cope with being old

Beth Carter Good evening, everyone. This is Beth Carter, for BBC Radio. The Open University yesterday announced that it had signed up half a million participants in what they claim is now the world's largest online course. The OU's MOOC – which stands for massive, open, online course – is about something many of you will be familiar with – getting old, and the many challenges and opportunities that come with that.

In the studio with me is Jane Dyson, who is the course co-ordinator. Jane: at 55, and coming from a social services background, you seem to be the least likely person to be running such a massive, technology-based program. How did that happen?

Jane Dyson: (laughing). Well, it's all my own fault! I've been an OU graduate for many years, and they have an online alumni forum, where they ask former students for ideas about what are the most pressing issues we see in the world, and what the OU could do to address some of these issues. I do a lot of work advising elderly people, their families and even employers these days about the many different kinds of issues that arise with aging.

The OU has many courses and online materials that deal with lots of these issues, but you have to sign up for a degree or diploma or you can just get the materials online but without any support. Also, there are just too many different issues for even the OU to cover in its formal courses. So I suggested that they should do a MOOC where all the different people involved – health care workers, social workers, care givers, family, and most important of all, old people themselves – could talk about their problems and challenges, and what services are available, what people can do for themselves and so on.

Beth Carter. So what happened then?

Jane Dyson. The OU asked me to come in to my local OU regional office, and I met with several people from the OU, and after that meeting, they asked me if I would be willing to co-ordinate such a course.

Beth Carter. Now tell me more about MOOCs. I remember they were big about 10 years ago, then they went all quiet, and we haven't heard much about them since. So what's made this MOOC so popular?

Jane Dyson. The problem with the earlier MOOCs was that participants just got lost in them. Many of the MOOCs were just lectures and then it was up to the participants to help each other out. There was no organization.

What the OU did was to ask those who signed up for the 'Aging' MOOC to fill in a very simple online questionnaire that asked for just a few details such as where they lived, whether they were professionals in aging, or family, or elderly people themselves, and then used that data to automatically allocate participants into groups, so that there was a mix of participants in each group.

Beth Carter. Why was that important?

Jane Dyson. Well, at the OU, the Institute of Educational Technology had done some research on the early MOOCs, and had identified this problem of how to get groups to work in large online classes. They worked with another research group in the OU called the KMI, who developed the software we are using that allocates participants into groups so that there is enough expertise and support in each group to help with the issues raised in the group discussions.

Beth Carter. And how does that work?

Jane Dyson. You wouldn't believe the range of issues or problems that come up. For instance, we have family members desperate because their father or mother is suffering from dementia, but don't know what to do to help them. We have some seniors who feel that their family are trying to force them out of their homes, while they feel they are quite capable of looking after themselves. We have social workers who feel that they are liable to get fired or even prosecuted because they can't handle their case load. And we have some participants who are just old and lonely, and want someone to talk to.

When we put all these participants into an online discussion forum, the results are amazing. What's really critical is getting the right mix of people in the same group, with enough expertise to provide help, and having someone in that group who knows how to moderate the discussions. We have a huge list of services available not just in Britain but in...
many of the other countries from which we have students. So the course is a kind of self-help, support service within a broader community of practice.

Beth Carter. Let’s talk about the international students. As I understand it, almost half the participants are from outside the U.K.

Jane Dyson. That’s right. The problems of an aging population aren’t just British. The OU is part of a very powerful network of open universities around the world. When we were talking about starting this course, the OU went to several other open universities and asked them if they were interested in participating. So we have participants from the Netherlands, Germany, France, Spain, Japan, Canada, the USA, and many other countries, who participate in the English language version.

In Spain, though, we have a ‘mirror’ site, with materials in Spanish, Basque and Catalan, and the discussion forums are managed by the Open University of Catalonia. That brings in not only participants from Spain, but also from Latin America. We are about to develop a similar agreement with the Open University of China, which we expect will bring in another half million participants. What’s really neat is that because we have so many participants, there are always enough dual language participants to move stuff from one language discussion forum to another.

Beth Carter. So what’s next?

Jane Dyson. One of the big issues that keeps coming up in the Aging course is the issue of mental health. This of course is not just about elderly people. The Aging course has already resulted in petitions to parliament about better services for isolated elderly people, and I think we will see some positive developments on this front over the next couple of years.

I think the OU is thinking about a similar MOOC on mental health, and I’d really like to be part of that initiative.

Beth Carter. Well, thank you, Jane. Next week we will be discussing online gambling, with an addiction counsellor.

This was developed as a ‘what if?’ scenario for the U.K. Open University as part of its planning for teaching and learning in 2014.

### 7.6.1 The importance of context and design

I am frequently categorised as a major critic of MOOCs, which is somewhat surprising since I have been a longtime advocate of online learning. In fact I do believe MOOCs are an important development, and under certain circumstances they can be of tremendous value in education.

But as always in education, context is important. There is not one but many different markets and needs for education. A student leaving high school at eighteen has very different needs and will want to learn in a very different context from a 35 year old employed engineer with a family who needs some management education. Similarly a 65 year old man struggling to cope with his wife’s early onset of Alzheimers and desperate for help is in a totally different situation to either the high school student or the engineer. When designing educational programs, it has to be horses for courses. There is no single silver bullet or solution for every one of these various contexts.

Secondly, as with all forms of education, how MOOCs are designed matters a great deal. If they are designed inappropriately, in the sense of not developing the knowledge and skills needed by a particular learner in a particular context, then they have little or no value for that learner. However, designed differently and a MOOC may well meet that learner’s needs.

### 7.6.2 The potential of cMOOCs

So let me be more specific. cMOOCs have the most potential, because lifelong learning will become increasingly important, and the power of bringing a mix of already well educated and knowledgeable people from around the world to work with other committed and enthusiastic learners on common problems or areas of interest could truly revolutionise not just education, but the world in general.

However, cMOOCs at present are unable to do this, because they lack organisation and do not apply what is already known about how online groups work best. Once we learn these lessons and apply them, though, cMOOCs can be a tremendous tool for tackling some of the great challenges we face in the areas of global health, climate change, civil
rights, and other ‘good civil ventures.’ The beauty of cMOOCs is that they involve not just the people who have the will and the power to make changes, but every participant has the power to define and solve the problems being tackled. The scenario which starts this section is an example of how cMOOCs could be used for such ‘good civil ventures.’

But is should be noted that behind this MOOC are the resources of a very powerful institution, that provides the initial impetus, simple to use software, overall structure, organization and co-ordination within the MOOC, and some essential human resources for supporting the MOOC when running. At the same time, it does not have to be an educational institution. It could be a Public Health Authority, or a broadcasting organization, or an international charity, or a consortium of organisations with a common interest. Also, of course, we need to recognise the danger that even cMOOCs could be manipulated by corporate or government interests. Finally, in the scenario the MOOC is not a replacement for formal education, but a rocket that needs formal education as its launch pad.

7.6.3 The limitations of xMOOCs

The real threat of xMOOCs is to the very large face-to-face lecture classes found in many universities at the undergraduate level. MOOCs, at a cost of around $20-$50 a student, are a more effective way of replacing such lectures. They are more interactive and permanent so students can go over the materials many times. I have heard MOOC instructors argue that their MOOCs are better than their classroom lectures. They put more care and effort into them.

However, we should question why we are teaching in this way on campus. Content is now freely available anywhere on the Internet – including MOOCs. What is needed is information management: how to identify the knowledge you need, how to evaluate it, how to apply it. xMOOCs do not do that. They pre-select and package the information. My big concern with xMOOCs is their limitation, as currently designed, for developing the higher order intellectual skills needed in a digital world. Unfortunately, xMOOCs are taking the least appropriate design model for developing 21st century skills from on-campus teaching, and moving this inappropriate design model online. Just because the lectures come from elite universities does not necessarily mean that learners will develop high level intellectual skills, even though the content is of the highest quality. More importantly, with MOOCs, relatively few students succeed, in terms of assessment, and those that do are tested mainly on comprehension and limited application of knowledge.

We can and have done much better in terms of skills for a digital age with other pedagogical approaches on campus, such as problem- or inquiry-based learning, and with online learning using more constructivist approaches in online credit courses, but these alternative methods to lectures do not scale so easily. The interaction between an expert and a novice still remains critical for developing deep understanding, transformative learning resulting in the learner seeing the world differently, and for developing high levels of evidence-based critical thinking, evaluation of complex alternatives, and high level decision-making. Computer technology to date is extremely poor at enabling this kind of learning to develop. This is why credit-based classroom and online learning still aim to have a relatively low instructor:student ratio and still need to focus a great deal on interaction between instructor and students.

I have no problem however with xMOOCs as a form of continuing education or as a source of open educational materials that can be part of a broader educational offering. They can be a valuable supplement to campus-based education. It is when the claim is made that they can replace both conventional education or the current design of online credit programs that I become really concerned. As a form of continuing education, low completion rates and the lack of formal credit is not of great significance. However, completion rates and quality assessment DO matter if MOOCs are being seen as a substitute or a replacement for formal education, even classroom lectures.

7.6.4 Undermining the public higher education system?

The real danger is that if we are not vigilant, MOOCs will undermine what is admittedly an expensive public higher education system. If elite universities can deliver MOOCs for free, why do we need crappy state universities? The risk is a sharply divided two tier system, with a relatively small number of elite universities catering to the rich and privileged, and developing the knowledge and skills that will provide rich rewards, and the masses going to MOOC-delivered
courses with state universities providing minimal and low cost learner support for such courses. This would be both a social and economic disaster, because it would fail to produce enough learners with the high-level skills that are going to be needed for good jobs in the the coming years – unless you believe that automation will remove all decently paid jobs except for a tiny elite (bring on the Hunger Games).

It should be noted that even for credit-based online programs, content accounts for less than 15 per cent of the total cost over five years; the main costs required to ensure high quality outcomes and high rates of completion are spent on learner support, providing the learning that matters most. The kind of MOOCs being promoted by politicians and the media fail spectacularly to do this. We do need to be careful that the open education movement in general, and MOOCs in particular, are not used as a stick by those in the United States and elsewhere who are deliberately trying to undermine public education for ideological and commercial reasons. Open content, OERs and MOOCs do not automatically lead to open access to high quality credentials for everyone. In the end, a well-funded public higher education system remains the best way to assure access to higher education for the majority of the population.

Having said that, there is enormous scope for improvements within that system. MOOCs, open education and new media offer promising ways to bring about some much needed improvements. However, that means building on what we already know from the use of credit based online learning, from prior experience in open and distance learning, and designing courses and programs in a variety of ways appropriate to the wide range of learning needs. MOOCs can be one important part of that environment, but not a replacement for other forms of educational provision that meet different needs.

**Activity 7.3: Strategising about MOOCs**

You are the Vice President Academic of a middle sized research university, which is under financial pressure. The President has been asked by the Board to come forward with a strategy for innovation in teaching and learning, with the university facing a cut of approximately 5% in next year’s operating budget.

One powerful Board member is pushing really hard for the university to develop MOOCs as a solution to the economic pressure.

The President has asked for a briefing paper from you for the Board on what the university’s strategy should be regarding MOOCs, and how they would fit into the overall strategy for teaching and learning. How would you respond?

If you want to share your response, please use the comment box below.

**Key Takeaways**

1. MOOCs are forcing every higher education institution to think carefully both about its strategy for online teaching and its approach to open education.
2. MOOCs are not the only form of online learning or of open educational resources. It is important to look at the strengths and weaknesses of MOOCs within the overall context of online learning and open-ness.
3. There are considerable differences in the design of MOOCs, reflecting different purposes and philosophies.
4. MOOCs are at still a relatively early stage of maturity. As their strengths and weaknesses become clearer, and as experience in improving their design grows, they are likely to occupy a significant niche within the higher education learning environment.
5. There are still major structural limitations in MOOCs for developing deep or transformative learning, or for developing the high level knowledge and skills needed in a digital age.
6. MOOCs could well replace some forms of traditional teaching (such as large lecture classes). However, MOOCs are more likely to remain an important supplement or alternative to other conventional education methods. They are not on their own a solution to the high cost of higher education, although MOOCs are and will continue to be an important factor in forcing change.

7. Perhaps the greatest value of MOOCs in the future will be for providing a means for tackling large global problems through community action.
7.7 References on MOOCs

I have collected together all the references made in Chapter 7 for convenience. However, there are many other publications – this cannot be considered a comprehensive list.

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Chapter 8 Understanding technology in education

Purpose of this chapter

When you have completed this chapter you should

- be able to understand the difference between media and technologies in educational contexts
- be able to place different media and technologies, including new and emerging technologies, within an analytical framework
- have a model that will enable you to make decisions about particular media and technologies within any specific learning context

What is covered in this chapter

Understanding the nature and role of media and technologies in education, and being able to use media and technologies appropriately, are critical to teaching well in a digital age. This is the first of two chapters that focus on media choice and use.

In this chapter, which focuses on the foundations of educational technology, you will cover the following topics

- 8.1 Choosing technologies for teaching and learning: the challenge
- 8.2 A short history of educational technology
- 8.3 Media or technology?
- 8.4 Broadcast vs communicative media
- 8.5 The time and space dimensions of media
- 8.6 Interactivity and media
- 8.7 Media richness
- 8.8 Understanding the foundations of educational media

Chapter 9 continues the topic, focusing on making decisions about the choice and use of technology.

Also in this chapter you will find the following activities:

- Activity 8.1 How do you currently make decisions about what technology to use for teaching?
- Activity 8.2 What does history tell us?
- Activity 8.3 Media or technology?
- Activity 8.4 Broadcast or communicative?
- Activity 8.5 Time and space dimensions of technology
- Activity 8.6 Using media to promote student activity
- Activity 8.7 How rich is your medium?
- Activity 8.8 Analysing your current use of technology
1. Technologies are merely tools that can be used in a variety of ways. What matters more is how technologies are applied. The same technology can be applied in different ways, even or especially in education. So in judging the value of a technology, we need to look more closely at the ways in which it is being or could be used. In essence this means focusing more on media – which represent the more holistic use of technologies – than on individual tools or technologies themselves, while still recognising that technology is an essential component of almost all media.

2. By focusing on media rather than technologies, we can then include face-to-face teaching as a medium, enabling comparisons with more technology-based media to be made along a number of dimensions or characteristics.

3. Media differ in terms of their formats, symbols systems, and cultural values. These unique features are increasingly referred to as the affordances of media or technology. Thus different media can be used to assist learners to learn in different ways and achieve different outcomes, thus also individualising learning more.

4. There are many dimensions along which some technologies are similar and others are different. By focusing on these dimensions, we have a basis for analysing new media and technologies, to see where they 'fit' within the existing landscape, and to evaluate their potential benefits or limitations for teaching and learning.

5. There are probably other characteristics or dimensions of educational media that might also be identified, but I believe these four key characteristics or dimensions to be the most important:
   - 5.1 broadcast vs communicative
   - 5.1 synchronous (live) vs asynchronous (recorded)
   - 5.1 passive vs interactive
   - 5.1 single vs rich media

6. However, the identification of where a particular medium fits along any specific characteristic or dimension will depend in most cases on how that medium is designed. At the same time, there is usually a limit to how far a technology can be forced along one of these dimensions; there is likely to be a single, ‘natural’ position on each dimension, subject to good design, in terms of exploiting the educational affordances of the medium.

7. These characteristics or dimensions of media then need to be evaluated against the learning goals and outcomes desired, while recognising that a new educational medium or application might enable goals to be achieved that had not been previously considered possible.

8. However, it is worth noting that in recent years, technologies have tended to become more communicative, asynchronous, interactive and rich in media, thus offering teachers and learners more powerful tools for teaching and learning.
9. The appropriateness of decisions made by teachers (and increasingly learners) about how to use a particular medium, i.e. design decisions, are likely to be more important than the choice of the medium itself. Hence good teaching/good design in terms of for instance student activities might save a poor choice in technology, but technology will never save poor teaching.

10. If we look carefully at the characteristics of educational media, we shall see that technology is more important in helping to make decisions about modes of delivery (face-to-face, blended or distance) than about teaching methods or pedagogy. This issue will be discussed in more detail in Chapter 10.

11. The Internet is an extremely powerful medium because through a combination of tools and media it can encompass all the characteristics and dimensions of educational media.
8.1 Choosing technologies for teaching and learning: the challenge

Even an electronics engineer will be hard pressed to answer the question in the photo caption of a not untypical home entertainment system in a North American home in 2014. The answer will depend on what you mean by technology:

- hardware? (e.g. TV monitor)
- software? (e.g. audio-visual/digital convertor)
- networks? (e.g. Internet, satellite)
• services? (e.g. television, Twitter)

The answer of course is all these, plus the systems that enable everything to be integrated. Indeed, the technologies represented in just this one photograph are probably too many to list (if you don’t believe me, just try it – I did!). In a digital age we are immersed in technology. Education, although often a laggard in technology adoption, is nevertheless no exception today. Yet learning is also a fundamental human activity that can function quite well (some would say better) without any technological intervention. So in an age immersed in technology, what is its role in education? What are the strengths (or affordances) and what are the limitations of technology in education? When should we use technology, and which technologies should we use for what purposes?

The aim of this chapter and the next is to provide some frameworks or models for decision-making that are both soundly based on theory and research and are also pragmatic within the context of education.

This will not be an easy exercise. There are deep philosophical, technical and pragmatic challenges in trying to provide a model or set of models flexible but practical enough to handle the huge range of factors involved. For instance, theories and beliefs about education will influence strongly the choice and use of different technologies. On the technical side, it is becoming increasingly difficult to classify or categorize technologies, not just because they are changing so fast, but also because technologies have many different qualities and affordances that change according to the contexts in which they are used. On the pragmatic side, it would be a mistake to focus solely on the educational characteristics of technologies. There are social, organizational, cost and accessibility issues also to be considered. The selection and use of technologies for teaching and learning is driven, once again, as much by context and values and beliefs as by hard scientific evidence or rigorous theory. So there will not be one ‘best’ framework or model. On the other hand, given the rapidly escalating range of technologies, educators are open to technological determinism (MOOCs, anyone?) or the total rejection of technology for teaching, unless there are some models to guide their selection and use.

In fact, there are still some fundamental questions to be answered regarding technology for teaching, including:

• what is best done face-to-face and what online, and in what contexts?
• what is the role of the human teacher, and can/should/will the human teacher be replaced by technology?

These are questions that will be tackled later in the book, but if we consider a teacher facing a group of students and a curriculum to teach, or a learner seeking to develop their own learning, they need practical guidance now when they consider whether or not to use one technology or another. In this and the next chapter I will provide some models or frameworks that will enable such questions to be answered effectively and pragmatically so that the learning experience is optimized.

In the meantime let’s start with what your views are at the moment about choosing technology for teaching and learning.

Activity 8.1 How do you currently make decisions about what technology to use for teaching?

1. How do you decide at the moment about what technologies to use for teaching? Use what’s in the room? Ask the IT support people? Do you have a theory or set of principles for making such a decision?
2. Is this an easy question to answer? Why (not)?
3. How many technologies can you see in Figure 8.1? List them

Please share your answers in the comment box below. For my answer to question 3, see Feedback on Activity 8.1
8.2 A short history of educational technology

Technology has always been closely linked with teaching, but particularly in recent years, technology has changed from being a peripheral factor to becoming more central in all forms of teaching. Nevertheless, arguments about the role of technology in education go back at least 2,500 years. To understand better the role and influence of technology on teaching, we need a little history, because as always there are lessons to be learned from history. Paul Saettler’s ‘The Evolution of American Educational Technology’ (1990) is one of the most extensive historical accounts, but only goes up to 1989. A lot has happened since then. Teemu Leinonen also has a good blog post on the more recent history (for a more detailed account see Leitonen, 2010). See also this infographic: The Evolution of Learning Technologies.

What I’m giving you here is the postage stamp version of ed tech history, and a personal one at that.

8.2.1 Oral communication

One of the earliest means of formal teaching was oral – though human speech – although over time, technology has been increasingly used to facilitate or ‘back-up’ oral communication. In ancient times, stories, folklore, histories and news were transmitted and maintained through oral communication, making accurate memorization a critical skill, and the oral tradition is still the case in many aboriginal cultures. For the ancient Greeks, oratory and speech were the means by which people learned and passed on learning. Homer’s Iliad and the Odyssey were recitative poems, intended for public performance. To be learned, they had to be memorized by listening, not by reading, and transmitted by recitation, not by writing.
Nevertheless, by the fifth century B.C, written documents existed in considerable numbers in ancient Greece. If we believe Socrates, education has been on a downward spiral ever since. According to Plato, Socrates caught one of his students (Phaedrus) pretending to recite a speech from memory that in fact he had learned from a written version. Socrates then told Phaedrus the story of how the god Theuth offered the King of Egypt the gift of writing, which would be a ‘recipe for both memory and wisdom’. The king was not impressed. According to the king,

‘it [writing] will implant forgetfulness in their souls; they will cease to exercise memory because they will rely on what is written, creating memory not from within themselves, but by means of external symbols. What you have discovered is a recipe not for memory, but for reminding. And it is no true wisdom that you offer your disciples, but only its semblance, for by telling them many things without teaching them anything, you will make them seem to know much, while for the most part they will know nothing. And as men filled not with wisdom but the conceit of wisdom, they will be a burden to their fellow men.’

Phaedrus, 274c-275, translation adapted from Mangual, 1996

I can just hear some of my former colleagues saying the same thing about social media.

The term 'lecture', which comes from the Latin 'to read', is believed to originate from professors in medieval times reading from the scrolled manuscripts handwritten by monks (around 1200 AD). Because the process of writing on scrolls was so labour intensive, the library would usually have only one copy, so students were usually forbidden direct access to the manuscripts. Thus scarcity of one medium drove the predominance of another.

Slate boards were in use in India in the 12th century AD, and blackboards/chalkboards became used in schools around the turn of the 18th century. At the end of World War Two the U.S. Army started using overhead projectors for training, and their use became common for lecturing, until being largely replaced by electronic projectors and presentational software such as Powerpoint around 1990. This may be the place to point out that most technologies used in education were not developed specifically for education but for other purposes (mainly for the military or business.)

Although the telephone dates from the late 1870s, the standard telephone system never became a major educational tool, not even in distance education, because of the high cost of analogue telephone calls for multiple users, although audio-conferencing has been used to supplement other media since the 1970s. Video-conferencing using dedicated cable systems and dedicated conferencing rooms have been in use since the 1980s. The development of video compression technology and relatively low cost video servers in the early 2000s led to the introduction of lecture capture systems for recording and streaming classroom lectures in 2008. Webinars now are used largely for delivering lectures over the Internet.

None of these technologies though changes the oral basis of communication for teaching.

**8.2.2 Written communication**

The role of text or writing in education also has a long history. According to the Bible, Moses used chiseled stone to convey the ten commandments in a form of writing, probably around the 7th century BC. Even though Socrates is reported to have railed against the use of writing, written forms of communication make analytic, lengthy chains of reasoning and argument much more accessible, reproducible without distortion, and thus more open to analysis and critique than the transient nature of speech. The invention of the printing press in Europe in the 15th century was a truly disruptive technology, making written knowledge much more freely available, very much in the same way as the Internet has done today. As a result of the explosion of written documents resulting from the mechanization of printing, many more people in government and business were required to become literate and analytical, which led to a rapid expansion of formal education in Europe. There were many reasons for the the development of the Renaissance and the Enlightenment, and triumph of reason and science over superstition and beliefs in Europe, but the technology of printing was a key agent of change.

Improvements in transport infrastructure in the 19th century, and in particular the creation of a cheap and reliable postal system in the 1840s, led to the development of the first formal correspondence education, with the University of London offering an external degree program by correspondence from 1858. This first formal distance degree pro-
gram still exists today in the form of the University of London International Program. In the 1970s, the Open University transformed the use of print for teaching through specially designed, highly illustrated printed course units that integrated learning activities with the print medium, based on advanced instructional design.

With the development of web-based learning management systems in the mid-1990s, textual communication, although digitized, became, at least for a brief time, the main communication medium for Internet-based learning, although lecture capture is now changing that.

8.2.3 Broadcasting and video

The British Broadcasting Corporation (BBC) began broadcasting educational radio programs for schools in the 1920s. The first adult education radio broadcast from the BBC in 1924 was a talk on *Insects in Relation to Man*, and in the same year, J.C. Stobart, the new Director of Education at the BBC, mused about ‘a broadcasting university’ in the journal...
Radio Times (Robinson, 1982). Television was first used in education in the 1960s, for schools and for general adult education (one of the six purposes in the current BBC’s Royal Charter is still ‘promoting education and learning’).

In 1969, the British government established the Open University (OU), which worked in partnership with the BBC to develop university programs open to all, using a combination originally of printed materials specially designed by OU staff, and television and radio programs made by the BBC but integrated with the courses. It should be noted that although the radio programs involved mainly oral communication, the television programs did not use lectures as such, but focused more on the common formats of general television, such as documentaries, demonstration of processes, and cases/case studies (see Bates, 1985). In other words, the BBC focused on the unique ‘affordances’ of television, a topic that will be discussed in much more detail later. Over time, as new technologies such as audio- and video-cassettes were introduced, live broadcasting, especially radio, was cut back for OU programs, although there are still some general educational channels broadcasting around the world (e.g. TVOntario in Canada; PBS, the History Channel, and the Discovery Channel in the USA).

The use of television for education quickly spread around the world, being seen in the 1970s by some, particularly in international agencies such as the World Bank and UNESCO, as a panacea for education in developing countries, the hopes for which quickly faded when the realities of lack of electricity, cost, security of publicly available equipment, climate, resistance from local teachers, and local language and cultural issues became apparent (see, for instance, Jamison and Klees, 1973). Satellite broadcasting started to become available in the 1980s, and similar hopes were expressed of delivering ‘university lectures from the world’s leading universities to the world’s starving masses’, but these hopes too quickly faded for similar reasons. However, India, which had launched its own satellite, INSAT, in 1983, used it initially for delivering locally produced educational television programs throughout the country, in several indigenous languages, using Indian-designed receivers and television sets in local community centres as well as schools (Bates, 1984). India is still using satellites for tele-education into the poorest parts of the country at the time of writing (2014).

In the 1990s the cost of creating and distributing video dropped dramatically due to digital compression and high-speed Internet access. This reduction in the costs of recording and distributing video also led to the development of lecture capture systems. The technology allows students to view or review lectures at any time and place with an Internet connection. The Massachusetts Institute of Technology (MIT) started making its recorded lectures available to the public, free of charge, via its OpenCourseWare project, in 2002. YouTube started in 2005 and was bought by Google in 2006. YouTube is increasingly being used for short educational clips that can be downloaded and integrated into online courses. The Khan Academy started using YouTube in 2006 for recorded voice-over lectures using a digital blackboard for equations and illustrations. Apple Inc. in 2007 created iTunesU to become a portal or a site where videos and other digital materials on university teaching could be collected and downloaded free of charge by end users.

Until lecture capture arrived, learning management systems had integrated basic educational design features, but this required instructors to redesign their classroom-based teaching to fit the LMS environment. Lecture capture on the other hand required no changes to the standard lecture model, and in a sense reverted back to primarily oral communication supported by Powerpoint or even writing on a chalkboard. Thus oral communication remains as strong today in education as ever, but has been incorporated into or accommodated by new technologies.

### 8.2.4 Computer technologies

#### 8.2.4.1 Computer-based learning

In essence the development of programmed learning aims to computerize teaching, by structuring information, testing learners’ knowledge, and providing immediate feedback to learners, without human intervention other than in the design of the hardware and software and the selection and loading of content and assessment questions. B.F. Skinner started experimenting with teaching machines that made use of programmed learning in 1954, based on the theory of behaviourism (see Chapter 3, Section 3.2.). Skinner’s teaching machines were one of the first forms of computer-based
learning. There has been a recent revival of programmed learning approaches as a result of MOOCs, since machine based testing scales much more easily than human-based assessment.

PLATO was a generalized computer assisted instruction system originally developed at the University of Illinois, and, by the late 1970s, comprised several thousand terminals worldwide on nearly a dozen different networked mainframe computers (Wikipedia). It was in fact a highly successful system, lasting almost 40 years, and incorporated key on-line concepts: forums, message boards, online testing, e-mail, chat rooms, instant messaging, remote screen sharing, and multi-player games.

Attempts to replicate the teaching process through artificial intelligence (AI) began in the mid-1980s, with a focus initially on teaching arithmetic. Despite large investments of research in AI for teaching over the last 30 years, the results generally have been disappointing. It has proved difficult for machines to cope with the extraordinary variety of ways in which students learn (or fail to learn.) Recent developments in cognitive science and neuroscience are being watched closely but at the time of writing the gap is still great between the basic science, and analysing or predicting specific learning behaviours from the science.

More recently we have seen the development of adaptive learning, which analyses learners’ responses then re-directs them to the most appropriate content area, based on their performance. Learning analytics, which also collects data about learner activities and relates them to other data, such as student performance, is a related development. These developments will be discussed in further detail in Section 8.7.

8.2.4.2 Computer networking

Arpanet in the U.S.A was the first network to use the Internet protocol in 1982. In the late 1970s, Murray Turoff and Roxanne Hiltz at the New Jersey Institute of Technology were experimenting with blended learning, using NJIT’s internal computer network. They combined classroom teaching with online discussion forums, and termed this ‘computer-mediated communication’ (CMC) (Hiltz and Turoff, 1978). At the University of Guelph in Canada, an off-the-shelf software system called CoSy was developed in the 1980s that allowed for online threaded group discussion forums, a predecessor to today’s forums contained in learning management systems. In 1988, the Open University in the United Kingdom offered a course, DT200, that as well as the OU’s traditional media of printed texts, television programs and audio-cassettes, also included an online discussion component using CoSy. Since this course had 1,200 registered students, it was one of the earliest ‘mass’ open online courses. We see then the emerging division between the use of computers for automated or programmed learning, and the use of computer networks to enable students and instructors to communicate with each other.

The World Wide Web was formally launched in 1991. The World Wide Web is basically an application running on the Internet that enables ‘end-users’ to create and link documents, videos or other digital media, without the need for the end-user to transcribe everything into some form of computer code. The first web browser, Mosaic, was made available in 1993. Before the Web, it required lengthy and time-consuming methods to load text, and to find material on the Internet. Several Internet search engines have been developed since 1993, with Google, created in 1999, emerging as one of the primary search engines.

8.2.4.3 Online learning environments

In 1995, the Web enabled the development of the first learning management systems (LMSs), such as WebCT (which later became Blackboard). LMSs provide an online teaching environment, where content can be loaded and organized, as well as providing ‘spaces’ for learning objectives, student activities, assignment questions, and discussion forums. The first fully online courses (for credit) started to appear in 1995, some using LMSs, others just loading text as PDFs or slides. The materials were mainly text and graphics. LMSs became the main means by which online learning was offered until lecture capture systems arrived around 2008.

By 2008, George Siemens, Stephen Downes and Dave Cormier in Canada were using web technology to create the first ‘connectivist’ Massive Open Online Course (MOOC), a community of practice that linked webinar presentations.
and/or blog posts by experts to participants’ blogs and tweets, with just over 2,000 enrollments. The courses were open to anyone and had no formal assessment. In 2012, two Stanford University professors launched a lecture-capture based MOOC on artificial intelligence, attracting more than 100,000 students, and since then MOOCs have expanded rapidly around the world.

8.2.5 Social media

Social media are really a sub-category of computer technology, but their development deserves a section of its own in the history of educational technology. Social media cover a wide range of different technologies, including blogs, wikis, You Tube videos, mobile devices such as phones and tablets, Twitter, Skype and Facebook. Andreas Kaplan and Michael Haenlein (2010) define social media as

*a group of Internet-based applications that ...allow the creation and exchange of user-generated content, based on interactions among people in which they create, share or exchange information and ideas in virtual communities and networks.*

Social media are strongly associated with young people and ‘millenials’ – in other words, many of the students in post-secondary education. At the time of writing social media are only just being integrated into formal education, and to date their main educational value has been in non-formal education, such as fostering online communities of practice, or around the edges of classroom teaching, such as ‘tweets’ during lectures or rating of instructors. It will be argued though that they have much greater potential for learning.

8.2.6 A paradigm shift

It can be seen that education has adopted and adapted technology over a long period of time. There are some useful lessons to be learned from past developments in the use of technology for education, in particular that many claims made for a newly emerging technology are likely to be neither true nor new. Also new technology rarely completely replaces an older technology. Usually the old technology remains, operating within a more specialised ‘niche’, such as radio, or integrated as part of a richer technology environment, such as video in the Internet.

However, what distinguishes the digital age from all previous ages is the rapid pace of technology development and our immersion in technology-based activities in our daily lives. Thus it is fair to describe the impact of the Internet on education as a paradigm shift, at least in terms of educational technology. We are still in the process of absorbing and applying the implications. The next section attempts to pin down more closely the educational significance of different media and technologies.

<table>
<thead>
<tr>
<th>Activity 8.2 What does history tell us?</th>
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<tbody>
<tr>
<td>1. What constitutes an educational technology? How would you classify a recorded lecture from MIT that is accessed as an open educational resource? When is a technology educational and not just a technology?</td>
</tr>
<tr>
<td>2. An early version of the Internet (Arpanet) existed long before 1990, but the combination of Internet protocols and the development of html and the World Wide Web were clearly a turning point in both telecommunications and education (at least for me). What then makes the Internet/the Web a paradigm shift? Or are they just an evolution, an orderly next step in the development of technology?</td>
</tr>
<tr>
<td>3. Is writing a technology? Is a lecture a technology? Does it matter to decide this?</td>
</tr>
</tbody>
</table>
| 4. The more sharp eyed or analytical of you may be asking questions about the categorization or definition of some of the technologies listed above (quite apart from the issue of how to deal with people as a means of communication). For instance computer-mediated communication (CMC) existed before the Internet (from 1978 in
fact), but isn’t it an Internet technology? (It is now, but wasn’t then.) How do social media differ from CMC? Does it make sense to distinguish television technologies such as broadcast, cable, satellite, DVDs or video-conferencing, and is this relevant any more? If so, what distinguishes them and what do they have in common from an educational perspective?

These are some of the issues that will become clearer in the following sections.

References


8.3 Media or technology?

8.3.1. Defining media and technology

Philosophers and scientists have argued about the nature of media and technologies over a very long period. The distinction is challenging because in everyday language use, we tend to use these two terms interchangeably. For instance, television is often referred to as both a medium and a technology. Is the Internet a medium or a technology? And does it matter?

I will argue that there are differences, and it does matter to distinguish between media and technology, especially if we are looking for guidelines on when and how to use media or technologies. There is a danger in looking too much at the raw technology, and not enough at the personal, social and cultural contexts in which we use technology, particularly in education. We shall also see that media and technology represent different ways altogether of thinking about the choice and use of technology in teaching and learning.

8.3.1.1 Technology

There are many definitions of technology (see Wikipedia for a good discussion of this). Essentially definitions of technology range from the basic notion of tools, to systems which employ or exploit technologies. Thus ‘technology refers to tools and machines that may be used to solve real-world problems’ is a simple definition; ‘the current state of humanity’s knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants’ is a more complex and grandiose definition (and has a smugness about it that I think is undeserved – technology often does the opposite of satisfy wants, for instance.).

In terms of educational technology I think we have to consider a broad definition of technology. The technology of the Internet involves more than just a collection of tools, but a system that combines computers, telecommunications, software and rules and procedures or protocols. However, I baulk at the very broad definition of the ‘current state of humanity’s knowledge’. Once a definition begins to encompass many different aspects of life it becomes unwieldy and ambiguous.

I tend to think of technology in education as things or tools used to support teaching and learning. Thus computers, software programs such as a learning management system, or a transmission or communications network, are all technologies. A printed book is a technology. Technology often includes a combination of tools with particular technical links that enable them to work as a technology system, such as the telephone network or the Internet.

However, for me, technologies or even technological systems do not of themselves communicate or create meaning. They just sit there until commanded to do something or until they are activated or until a person starts to interact with the technology. At this point, we start to move into media.

8.3.1.2 Media

Media (plural of medium) is another word that has many definitions and I will argue that it has two distinct meanings relevant for teaching and learning, both of which are different from definitions of technology.

The word ‘medium’ comes from the Latin, meaning in the middle (a median) and also that which intermediates or interprets. Media require an active act of creation of content and/or communication, and someone who receives and understands the communication, as well as the technologies that carry the medium.

Media linked to senses and ‘meaning’.
We use our senses, such as sound and sight, to interpret media. In this sense, we can consider text, graphics, audio and video as media ‘channels’, in that they intermediate ideas and images that convey meaning. Every interaction we have with media, in this sense, is an interpretation of reality, and again usually involves some form of human intervention, such as writing (for text), drawing or design for graphics, talking, scripting or recording for audio and video. Note that there are two types of intervention in media: by the ‘creator’ who constructs information, and by the ‘receiver’, who must also interpret it.

Computing can also be considered a medium in this context. I use the term computing, not computers, since although computing uses computers, computing involves some kind of intervention, construction and interpretation. Computing as a medium would include animations, online social networking, using a search engine, or designing and using simulations. Thus Google uses a search engine as its primary technology, but I classify Google as a medium, since it needs content and content providers, and an end user who defines the parameters of the search, in addition to the technology of computer algorithms to assist the search. Thus the creation, communication and interpretation of meaning are added features that turn a technology into a medium.

Thus in terms of representing knowledge we can think of the following media for educational purposes:

- Text
- Graphics
- Audio
- Video
- Computing

Within each of these media, there are sub-systems, such as

- text: textbooks, novels, poems
- graphics: diagrams, photographs, drawings, posters, graffiti
- audio: sounds, speech
- video: television programs, YouTube clips, ‘talking heads’
- computing: animation, simulations, online discussion forums, virtual worlds.
Furthermore, within these sub-systems there are ways of influencing communication through the use of unique symbol systems, such as story lines and use of characters in novels, composition in photography, voice modulation to create effects in audio, cutting and editing in film and television, and the design of user interfaces or web pages in computing. The study of the relationship between these different symbol systems and the interpretation of meaning is a whole field of study in itself, called semiotics.

From an educational perspective, it is important to understand that media are not neutral or ‘objective’ in how they convey knowledge. They can be designed or used in such a way as to influence (for good or bad) the interpretation of meaning and hence our understanding. Some knowledge therefore of how media work is essential for teaching in a digital age. In particular we need to know how best to design and apply media (rather than technology) to facilitate learning.

**Media as organisations**

The second meaning of media is broader and refers to the industries or significant areas of human activity that are organized around particular technologies, for instance film and movies, television, publishing, and the Internet. Within these different media are particular ways of representing, organizing and communicating knowledge.

Thus for instance within television there are different formats, such as news, documentaries, game shows, action programs, while in publishing there are novels, newspapers, comics, biographies, etc. Sometimes the formats overlap but even then there are symbol systems within a medium that distinguish it from other media. For instance in movies there are cuts, fades, close-ups, and other techniques that are markedly different from those in other media. All these features of media bring with them their own conventions and assist or change the way meaning is extracted or interpreted.

In education we could think of classroom teaching as a medium. Technology or tools are used (e.g. chalk and blackboards, or Powerpoint and a projector) but the key component is the intervention of the teacher and the interaction with the learners in real time and in a fixed time and place. We can also then think of online teaching as a different medium, with computers, the Internet (in the sense of the communication network) and a learning management system as core technologies, but it is the interaction between teachers, learners and online resources within the unique context of the Internet that are the essential component of online learning.

Media of course depend on technology, but technology is only one element of media. Thus we can think of the Internet as merely a technological system, or as a medium that contains unique formats and symbol systems that help convey meaning and knowledge. These formats, symbol systems and unique characteristics (e.g. the 140 character limit in Twitter) are deliberately created and need to be interpreted by both creators and end users. Furthermore, at least with the Internet, people can be at the same time both creators and interpreters of knowledge.

Over time, media have become more complex, with newer media (e.g. television) incorporating some of the components of earlier media (e.g. audio) as well as adding another medium (video). Digital media and the Internet increasingly are incorporating and integrating all previous media, such as text, audio, and video, and adding new media components, such as animation, simulation, and interactivity. When digital media incorporate many of these components they become ‘rich media’. Thus one major advantage of the Internet is that it encompasses all the representational media of text, graphics, audio, video and computing.

Lastly, there is a strong organizational context to media. Industries are often organized around specific media, and hence media use and interpretation is influenced by strong cultural or organizational values. For instance, Schramm (1974) found that broadcasters often have a different set of professional criteria and ways of assessing ‘quality’ in an educational broadcast from those of educators (which made my job of evaluating the programs the BBC made for the Open University very interesting). Today, this professional ‘divide’ can be seen between the differences between computer scientists and educators in terms of values and beliefs with regard to the use of technology for teaching. At its crudest, it comes down to issues of control: who is in charge of using technology for teaching? Who makes the decisions about the design of a MOOC or the use of an animation?
8.3.2 The affordances of media

Figure 8.5 Graphs can represent, in a different way, the same concepts as written descriptions or formulae. Understanding the same thing in different ways generally leads to deeper understanding. Image: © Open University 2013

Different media have different educational effects or affordances. If you just transfer the same teaching to a different medium, you fail to exploit the unique characteristics of that medium. Put more positively, you can do different and often better teaching by adapting it to the medium. That way students will learn more deeply and effectively. To illustrate this, let’s look at an example from early on in my career as a researcher in educational media.

In 1969, I was appointed as a research officer at the Open University in the United Kingdom. At this point the university had just received its royal charter. I was the 20th member of staff appointed. My job was simple: to research into the pilot programs being offered by the National Extension College, which was delivering low cost non-credit distance education programs in partnership with the BBC. (So you think MOOCs are new? The NEC was offering them over 40 years ago).

The NEC was ‘modelling’ the kind of integrated multimedia courses, consisting of a mix of print and broadcast radio and TV, that were to be offered by the Open University when it started.

We sent out questionnaires by mail on a weekly basis to students taking the NEC courses. The questionnaire contained both pre-coded responses, and the opportunity for open-ended comments, and asked students for their responses to the print and broadcast components of the courses. We were looking for what worked and what didn’t work in designing multimedia distance education courses.

When I started analyzing the questionnaires, I was struck particularly by the ‘open-ended’ comments in response to the television and radio broadcasts. Responses to the printed components tended to be ‘cool’: rational, calm, critical, constructive. The responses to the broadcasts were the opposite: ‘hot’, emotional, strongly supportive or strongly critical or even hostile, and rarely critically constructive. Something was going on here.

Since the OU was going to spend 20% of its annual budget on the broadcasts from the BBC, I persuaded the university to appoint me as a lecturer to research into the effectiveness of the television and radio programs, which I did for a period of nearly 20 years.

The initial discovery that different media affected students differently came very quickly, but it took longer to discover in what ways media are different, and even longer why, but here are some of the discoveries I and my colleagues in the Audio-Visual Media Research Group at the OU made (Bates, 1985):
• the BBC producers (all of whom had a degree in the subject area in which they were making programs) thought about knowledge differently from the academics with whom they were working. In particular, they tended to think more visually and more concretely about the subject matter. Thus they tended to make programs that showed concrete examples of concepts or principles in the texts, applications of principles, or how academic concepts worked in real life. Academic learning is about abstraction and higher order levels of thinking. However, abstract concepts are better understood if they can be related to concrete or empirical experiences, from which, indeed, abstract concepts are often drawn. The television programs enabled learners to move backwards and forwards between the abstract and the concrete. Where this was well designed, it really helped a large number of students – but not all.

• students responded very differently to the TV programs in particular. Some loved them, some hated them, and few were indifferent. The ones that hated them wanted the programs to be didactic and repeat or reinforce what was in the printed texts. Interestingly though the TV-haters tended to get lower grades or even fail in the final course exam. The ones that loved the TV programs tended to get higher grades. They were able to see how the programs illustrated the principles in the texts, and the programs ‘stretched’ these students to think more widely or critically about the topics in the course. The exception was math, where borderline students found the TV programs most helpful.

• the BBC producers rarely used talking heads or TV lectures. With radio and later audio-cassettes, some producers and academics integrated the audio with texts, for instance in mathematics, using a radio program and later audio-cassettes to talk the students through equations or formulae in the printed text (similar to Khan Academy lectures on TV).

• using television and radio to develop higher level learning is a skill that can be taught. In the initial foundation (first year) social science course (D100), many of the programs were made in a typical BBC documentary style. Although the programs were accompanied by extensive broadcast notes that attempted to link the broadcasts to the academic texts, many students struggled with these programs. When the course was remade five years later a distinguished academic (Stuart Hall) was used as an ‘anchor’ for all the programs. The first few programs were somewhat like lectures, but in each program Stuart Hall introduced more and more visual clips and helped students analyze each clip. By the end of the course the programs were almost entirely in the documentary format. Students rated the remade programs much higher and used examples from the TV programs much more in their assignments and exams for the remade course.

8.3.3 Why are these findings significant?

At the time (and for many years afterwards) researchers such as Richard Clark (1983) argued that ‘proper’, scientific research showed no significant difference between the use of different media. In particular, there were no differences between classroom teaching and other media such as television or radio or satellite. Even today, we are getting similar findings regarding online learning (e.g. Means et al., 2010).

However, this is because the research methodology that is used by researchers for such comparative studies requires the two conditions being compared to be the same, except for the medium being used (called matched comparisons, or sometimes quasi-experimental studies). Typically, for the comparison to be scientifically rigorous, if you gave lectures in class, then you had to compare lectures on television. If you used another television format, such as a documentary, you were not comparing like with like. Since the classroom was used as the base, for comparison, you had to strip out all the affordances of television – what it could do better than a lecture – in order to compare it. Indeed Clark argued that
when differences in learning were found between the two conditions, the differences were a result of using a different pedagogy in the non-classroom medium.

The critical point is that different media can be used to assist learners to learn in different ways and achieve different outcomes. In a sense, researchers such as Clark were right: the teaching methods matter, but different media can more easily support different ways of teaching than others. In our example, a documentary TV program aims at developing the skills of analysis and the application or recognition of theoretical constructs, whereas a classroom lecture is more focused on getting students to understand and correctly recall the theoretical constructs. Thus requiring the television program to be judged by the same assessment methods as for the classroom lecture unfairly measures the potential value of the TV program. In this example, it may be better to use both methods: didactic teaching to teach understanding, then a documentary approach to apply that understanding. (Note that a television program could do both, but the classroom lecture could not.)

Perhaps even more important is the idea that many media are better than one. This allows learners with different preferences for learning to be accommodated, and to allow subject matter to be taught in different ways through different media, thus leading to deeper understanding or a wider range of skills in using content. On the other hand, this increases costs.

### 8.3.3.1 How do these findings apply to online learning?

Online learning can incorporate a range of different media: text, graphics, audio, video, animation, simulations. We need to understand better the affordances of each medium within the Internet, and use them differently but in an integrated way so as to develop deeper knowledge, and a wider range of learning outcomes and skills. The use of different media also allows for more individualization and personalization of the learning, better suiting learners with different learning styles and needs. Most of all, we should stop trying merely to move classroom teaching to other media such as MOOCs, and start designing online learning so its full potential can be exploited.

### 8.3.3.2 Implications for education

If we are interested in selecting appropriate technologies for teaching and learning, we should not just look at the technical features of a technology, nor even the wider technology system in which it is located, nor even the educational beliefs we bring as a classroom teacher. We also need to examine the unique features of different media, in terms of their formats, symbols systems, and cultural values. These unique features are increasingly referred to as the affordances of media or technology.

The concept of media is much ‘softer’ and ‘richer’ than that of ‘technology’, more open to interpretation and harder to define, but it is a useful concept, in that it can also incorporate the inclusion of face-to-face communication as a medium, and in that it recognises the fact that technology on its own does not lead to the transfer of meaning.

Over time, as new technologies are developed, and are incorporated into media systems, old formats and approaches are carried over from older to newer media. For instance early movies followed quite closely the format and structure of the music hall and theatre, and took several decades to establish their own unique characteristics.

This of course is what we do with technology in education. We try either to incorporate new technology into old formats, as with clickers and lecture capture, or we try to create the classroom in virtual space, as we do with learning management systems. What we are still developing but not yet clearly recognizing are formats, symbols systems and organizational structures that exploit the unique characteristics of the Internet as a medium. It is difficult to see these unique characteristics clearly at this point in time. However, e-portfolios, mobile learning, open educational resources such as animations or simulations, and self-managed learning in large, online social groups are all examples of ways in which we are gradually developing the unique ‘affordances’ of the Internet.

Given the need to create and interpret meaning when using media, trying to use computers to replace or substitute for humans in the education process is likely to be a major mistake, at least until computers have much greater facility to recognize, understand and apply semantics, value systems, and organizational factors, which are all important factors in
‘reading’ different media. But at the same time it is equally a mistake to rely only on the symbol systems, cultural values and organizational structures of classroom teaching as the means of judging the effectiveness or appropriateness of the Internet as an educational medium.

On the other hand, picking horses for courses – the right medium for the job – or adapting teaching to exploit fully the affordances of different media, requires a much better understanding of the strengths and limitations of different media for teaching purposes. However, given the widely different contextual factors influencing learning, the task of media and technology selection becomes infinitely complex. This is why it has proved impossible to develop simple algorithms or decision trees for effective decision making in this area. Nevertheless, there are some guidelines that can be used for identifying the best use of different media within an Internet-dependent society. To develop such guidelines we need to explore in particular the unique educational affordances of text, audio, video and computing, which is the next task of this chapter.

### Activity 8.3 Media or technology?

1. Do you find the distinction between media and technology helpful? If so, how would you classify the following (either medium or technology):
   - newspaper
   - printing press
   - television program
   - Netflix
   - classroom
   - MOOC
   - discussion forum

   Click here for my answers

2. Do you think that knowledge becomes something different when represented by different media? For instance, does an animation of a mathematical function represent something different from a written or printed equation of the same function? Which is the most ‘mathematical’: the formula or the animation?

3. What in your view makes the Internet unique from a teaching perspective, or is it just old wine in new bottles?

4. Text has publishers and newspaper corporations, audio has radio stations, and video has both television companies and YouTube. Is there a comparable organization for the Internet or is it not really a medium in the sense of publishing, radio or television?

### More reading


Bates, A. (2012) Pedagogical roles for video in online learning, Online Learning and Distance Education Resources


If you want to go deeper into the definitions of and differences between media and technology, you might want to read any of the following:

Bates, A. (2011) Marshall McLuhan and his relevance to teaching with technology, [e-learning and distance education resources](http://www.mcgill.ca/teaching-learning), July 20 (for a list of McLuhan references as well as a discussion of his relevance)


LinkedIn: [Media and Learning Discussion Group](https://www.linkedin.com/groups/17039115)

8.4 Broadcast vs communicative media

Broadcast or communicative?

Broadcast: one to many

Communicative: many to many

Figure 8.6 The teacher is the lighter-coloured symbol

8.4.1 Key media characteristics

Understanding the characteristics or affordances of each medium or technology that influence its usefulness for education will help clarify our thinking of the possible benefits or weaknesses of each medium or technology. This will also allow us to see where technologies have common or different features.

There is a wide range of characteristics that we could look at, but I will focus on five that I think are particularly important for education:

- broadcast (one-way) or communicative (two way) media
- synchronous or asynchronous technologies, including live (transient) or recorded (permanent) media
- passive or interactive media
• single or rich media.

We shall see that these characteristics are more dimensional than discrete states, and media or technologies will fit at different points on these dimensions, depending on the way they are designed or used.

**8.4.2 Broadcast or communicative media**

A major structural distinction is between ‘broadcast’ media that are primarily one-to-many and one-way, and those media that are primarily many-to-many or ‘communicative’, allowing for two-way or multiple communication connections. Communicative media include those that give equal ‘power’ of communication between multiple end users.

**8.4.2.1 Broadcast media and technologies**

Television, radio and print for example are primarily broadcast or one-way media, as end users or ‘recipients’ cannot change the ‘message’ (although they may interpret it differently or choose to ignore it). Note that it does not matter really what delivery technology (terrestrial broadcast, satellite, cable, DVD, Internet) is used for television, it remains a ‘broadcast’ or one-way medium. Some Internet technologies are also primarily one way. For instance, an institutional web site is primarily a one-way technology.

One advantage of broadcast media and technologies is that they ensure a common standard of learning materials for all students. This is particularly important in countries where teachers are poorly qualified or of variable quality. Also one-way broadcast media enable the organization to control and manage the information that is being transmitted, ensuring quality control over content. Broadcasting media and technologies are more likely to be favoured by those with an ‘objectivist’ approach to teaching and learning, since the ‘correct’ knowledge can be transmitted to everyone receiving the instruction. One disadvantage is that additional resources are needed to provide interaction with teachers or other learners.

**8.4.2.2 Communicative media and technologies**

The telephone, video-conferencing, e-mail, online discussion forums, most social media and the Internet are examples of communicative media or technologies, in that all users can communicate and interact with each other, and in theory at least have equal power in technology terms. The educational significance of communicative media is that they allow for interaction between learners and teachers, and perhaps even more significantly, between a learner and other learners, without the participants needing to be present in the same place.

**8.4.2.3 Which is which?**

This dimension is not a rigid one, with necessarily clear or unambiguous classifications. Increasingly, technologies are becoming more complex, and able to serve a wide range of functions. In particular the Internet is not so much a single medium as an integrating framework for many different media and technologies with different and often opposite characteristics. Furthermore, most technologies are somewhat flexible in that they can be used in different ways. However, if we stretch a technology too far, for instance trying to make a broadcast medium such as an xMOOC also more communicative, stresses are likely to occur. So I find the dimension still useful, so long as we are not dogmatic about the characteristics of individual media or technologies. This means though looking at each case separately.

Thus I see a learning management system as primarily a broadcast or one-way technology, although it has features such as discussion forums that allow for some forms of multi-way communication. However, it could be argued that the communication functions in an LMS require additional technologies, such as a discussion forum, that just happen to be plugged in to or embedded within the LMS, which is primarily a database with a cool interface. We shall see that
in practice we often have to combine technologies if we want the full range of functions required in education, and this adds cost and complexity.

Web sites can vary on where they are placed on this dimension, depending on their design. For instance, an airline website, while under the full control of the company, has interactive features that allow you to find flights, book flights, reserve seats, and hence, while you may not be able to ‘communicate’ or change the site, you can at least interact with it and to some extent personalize it. However, you cannot change the page showing the choice of flights. This is why I prefer to talk about dimensions. An airline website that allows end user interaction is less of a broadcast medium. However it is not a ‘pure’ communicative medium either. The power is not equal between the airline and the customer, because the airline controls the site.

It should be noted too that some web 2.0 tools (e.g. YouTube and blogs) are also more of a broadcast than a communicative medium, whereas other social media use mainly communicative technologies with some broadcast features (e.g. personal information on a Facebook page). A wiki is clearly more of a ‘communicative’ medium. Again though it needs to be emphasized that intentional intervention by teachers, designers or users of a technology can influence where on the dimension some technologies will be, although there comes a point where the characteristic is so strong that it is difficult to change significantly without introducing other technologies.

The role of the teacher or instructor also tends to be very different when using broadcast or communicative media. In broadcast media, the role of the teacher is central, in that content is chosen and often delivered by the instructor. xMOOCs are an excellent example. However, in communicative media, while the instructor’s role may still be central, as in online collaborative learning or seminars, there are learning contexts where there may be no identified ‘central’ teacher, with contributions coming from all or many members of the community, as in communities of practice or cMOOCs.

Thus it can be seen that ‘power’ is an important aspect of this dimension. What ‘power’ does the end-user or student have in controlling a particular medium or technology? If we look at this from an historical perspective, we have seen a great expansion of technologies in recent years that give increasing power to the end user. The move towards more communicative media and away from broadcast media then has profound implications for education (as for society at large).

8.4.3 Applying the dimension to educational media

We can also apply this analysis to non-technological means of communication, or ‘media’, such as classroom teaching. Lectures have broadcast characteristics, whereas a small seminar group has communicative characteristics. In Figure 8.7, I have placed some common technologies, classroom media and online media along the broadcast/communicative continuum.

When doing this exercise, it is important to note that:

- there is no general normative or evaluative judgement about the continuum. Broadcasting is an excellent way of getting information in a consistent form to a large number of people; interactive communication works well when all members of a group have something equal to contribute to the process of knowledge development and dissemination. The judgement of the appropriateness of the medium or technology will very much depend on the context, and in particular the resources available and the general philosophy of teaching to be applied;
- where a particular medium or technology is placed on the continuum will depend to some extent on the actual design, use or application. For instance, if the lecturer talks for 45 minutes and allows 10 minutes for discussion, an interactive lecture might be further towards broadcasting than if the lecture session is more of a question and answer session;
The continuum of knowledge dissemination

<table>
<thead>
<tr>
<th>Online: xMOOC</th>
<th>online collaborative learning</th>
<th>cMOOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom:</td>
<td>transmissive lecture</td>
<td>interactive lecture</td>
</tr>
<tr>
<td>Technology:</td>
<td>television</td>
<td>computers</td>
</tr>
<tr>
<td></td>
<td>broadcast</td>
<td>communicative</td>
</tr>
<tr>
<td></td>
<td>instructor</td>
<td>learner</td>
</tr>
</tbody>
</table>

Figure 8.7 The continuum of knowledge dissemination

- I have placed ‘computers’ in the middle of the continuum. They can be used as a broadcast medium, such as for programmed learning, or they can be used to support communicative uses, such as online discussion. Their actual placement on the continuum therefore will depend on how we choose to use computers in education.
- the important decision from a teaching perspective is deciding on the desired balance between ‘broadcasting’ and ‘discussion’ or communication. That should then be one factor in driving decisions about the choice of appropriate technologies;
- thus the continuum is a heuristic device to enable a teacher to think about what medium or technology will be most appropriate within any given context, and not a firm analysis of where different types of educational media or technology belong on the continuum.

Thus where a medium or technology ‘fits’ best on a continuum of broadcast vs communicative is one factor to be considered when making decisions about media or technology for teaching and learning.

Activity 8.4 Broadcast or communicative?

From the list below:
• a learning management system
• a blog
• online collaborative learning
• Twitter
• Second Life
• a podcast
• an open textbook

1. Determine which is a medium and which a technology, or which could be both, and under what conditions.

2. Decide where, from your experience, each medium or technology should be placed on Figure 8.7 Write down why.

3. Which were easy to categorize and which difficult?

4. How useful is this continuum in making decisions about which medium or technology to use in your teaching? What would help you to decide?

If you want to share your responses with me and other readers, thus turning this post from a broadcast to a communication, please do so by using the comment box below! My analysis can be accessed here.
Different media and technologies operate differently over space and time. These dimensions are important for both facilitating or inhibiting learning, and for limiting or enabling more flexibility for learners. There are actually two closely related dimensions here:

- 'live' or recorded
- synchronous or asynchronous

**Live or recorded**

These are fairly obvious in their meaning. Live media by definition are face-to-face events, such as lectures, seminars, and one-on-one face-to-face tutorials. A 'live' event requires everyone to be present at the same place and time as everyone else. This could be a rock concert, a sports event or a lecture. Live events, such as for instance a seminar, work well when personal relations are important, such as building trust, or for challenging attitudes or positions that are emotionally or strongly held (either by students or instructors.) The main educational advantage of a live lecture is that it may have a strong emotive quality that inspires or encourages learners beyond the actual transmission of knowledge, or may provide an emotional 'charge' that may help students shift from previously held positions. Live events, by definition, are transient. They may be well remembered, but they cannot be repeated, or if they are, it will be a different experience or a different audience. Thus there is a strong qualitative or affective element about live events.

Recorded media on the other hand are permanently available to those possessing the recording, such as a video-cassette or an audio-cassette. Books and other print formats are also recorded media. The key educational significance of recorded media is that students can access the same learning material an unlimited number of times, and at times that are convenient for the learner.

Live events of course can also be recorded, but as anyone who has watched a live sports event compared to a recording of the same event knows, the experience is different, with usually a lesser emotional charge when watching a recording (especially if you already know the result). Thus one might think of 'live' events as 'hot' and recorded events as 'cool.' Recorded media can of course be emotionally moving, such as a good novel, but the experience is different from actually taking part in the events described.
Synchronous or asynchronous

Synchronous technologies require all those participating in the communication to participate together, at the same time, but not necessarily in the same place.

Thus live events are one example of synchronous media, but unlike live events, technology enables synchronous learning without everyone having to be in the same place, although everyone does have to participate in the event at the same time. A video-conference or a webinar are examples of synchronous technologies which may be broadcast 'live', but not with everyone in the same place. Other synchronous technologies are television or radio broadcasts. You have to be 'there' at the time of transmission, or you miss them. However, the 'there' may be somewhere different from where the teacher is.

Asynchronous technologies enable participants to access information or communicate at different points of time, usually at the time and place of choice of the participant. All recorded media are asynchronous. Books, DVDs, YouTube videos, lectures recorded through lecture capture and available for streaming on demand, and online discussion forums are all asynchronous media or technologies. Learners can log on or access these technologies at times and the place of their own choosing.

Figure 8.8 illustrates the main differences between media in terms of different combinations of time and place.

<table>
<thead>
<tr>
<th>Time</th>
<th>Place</th>
<th>Different</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same</td>
<td>Live (face-to-face) media: lectures, seminars, tutorial, labs, workshops</td>
<td>Webinars Video-conferencing Virtual worlds Remote labs</td>
</tr>
<tr>
<td>Different</td>
<td>Self-managed labs/workshops/studios Library/learning centres</td>
<td>Recorded media: books, cassettes, LMSs, online discussion forums, lecture capture/streamed video, blogs, wikis</td>
</tr>
</tbody>
</table>

Synchronous

Asynchronous

Why does this matter?

Overall there are huge educational benefits associated with asynchronous or recorded media, because the ability to access information or communicate at any time offers the learner more control and flexibility. The educational benefits have been confirmed in a number of studies. For instance, Means et al. (2010) found that students did better on blended learning because they spent more time on task, because the online materials were always available to the students.
Research at the Open University found that students much preferred to listen to radio broadcasts recorded on cassette than to the actual broadcast, even though the content and format was identical (Grundin, 1981; Bates et al., 1981). However, even greater benefits were found when the format of the audio was changed to take advantage of the control characteristics of cassettes (stop, replay). It was found that students learned more from ‘designed’ cassettes than from cassette recordings of broadcasts, especially when the cassettes were co-ordinated or integrated with visual material, such as text or graphics. This was particularly valuable, for instance, in talking students through mathematical formula (Durbridge, 1983).

This research underlines the importance of changing design as one moves from synchronous to asynchronous technologies. Thus we can predict that although there are benefits in recording live lectures through lecture capture in terms of flexibility and access, or having readings available at any time or place, the learning benefits would be even greater if the lecture or text was redesigned for asynchronous use, with built-in activities such as tests and feedback, and points for students to stop the lecture and do some research or extra reading, etc., then returning to the teaching.

The ability to access media asynchronously through recorded and streamed materials is one of the biggest changes in the history of teaching, but the dominant paradigm in higher education is still the live lecture or seminar. There are, as we have seen, some advantages in live media, but they need to be used more carefully to exploit their unique advantages or affordances.

The significance of the Internet

It should be emphasised that broadcast/communicative and synchronous/asynchronous are two separate dimensions. By placing them in a matrix design, we can then assign different technologies to different quadrants, as in Figure 8.9 below. (I have included only a few – you may want to place other technologies on this diagram):

Why the Internet is so important is that it is an encompassing medium that embraces all these other media and technologies, thus offering immense possibilities for teaching and learning. This enables us, if we wish, to be very specific about how we design our teaching so that we can exploit all the characteristics or dimensions of technology through this one medium to fit almost any learning context.

Conclusion

It should be noted at this stage that although I have identified some strengths and weaknesses of the four characteristics of broadcast/communicative/synchronous/asynchronous, we still need an evaluative framework for deciding when to use or combine different technologies. This means developing criteria that will enable us to decide within specific contexts the optimum choice of technologies.

Activity 8.5 Time and space dimensions of technology

1. Does this categorization of technologies make sense to you?
2. Can you easily place other media or technologies into Figures 8.8 and 8.9? What media or technologies don’t fit? Why not?
3. Can you imagine a situation where an audio cassette might be a better choice for teaching and learning than Second Life (assuming students have access to both technologies)? And can you imagine the opposite (of where Second Life would be better than an audio-cassette)? What are the defining criteria or conditions?
The Internet

Broadcast

- lecture
- live TV
- lecture capture
- OERs
- YouTube
- books
- LMS
- e-portfolios
- online discussion forum
- wiki

Synchronous

- video conference
- Elluminate

Asynchronous

Communicative

Second Life

Figure 8.9 The significance of the Internet in terms of media characteristics

References


Grundin, H. 1981) Open University Broadcasting Times and their Impact on Students’ Viewing/Listening Milton Keynes: The Open University Institute of Educational Technology

8.6 Interactivity and media

There is now an overwhelming amount of research evidence to suggest that students learn best when they are ‘active’ in their learning. But what does this mean? And what role can or do new technologies play in supporting active learning?

8.6.1. Types of learner interaction

There are three different ways learners can interact when studying, and each of these ways requires a somewhat different mix of media and technology

8.6.1.1 Interaction with learning materials

This is the interaction generated when students work on a particular medium, such as a printed textbook, a learning management system, or a short video clip, without direct intervention from an instructor or other students. This interaction can be ‘reflective’, without any overt actions, or it can be ‘observable’, in the form of an assessed response, such as a multiple choice test, or as a contribution to a discussion, or as notes to assist memory and comprehension.

Computer technology can greatly facilitate learners’ interaction with learning resources. Self-administered online tests can provide feedback to students on their comprehension or coverage of a subject area. Such tests can also provide feedback to teachers on topic areas where students are having difficulty, and can also be used for grading of students on their comprehension. Using standard test software built into learning management systems, students can be automatically assessed and graded on their comprehension of course materials. More advanced activities might include composing music using software that converts musical notation to audio, entering data to test concepts through online simulations, or participating in games or decision-making scenarios controlled by the computer. Thus computer-managed learner interaction is particularly good for developing comprehension and understanding of concepts and procedures, but it has limitations in developing the higher order learning skills of analysis, synthesis and critical thinking, without additional human intervention of some kind.
There are other ways besides computer-managed learning to facilitate interaction between learners and learning material. Textbooks may include activities set by the author (as in this textbook), or instructors can set student activities around set readings. Other student activities might include reading text or watching videos embedded in a learning management system, conducting a structured approach to finding and analyzing web-based materials, or downloading and editing information from the web to create their own e-portfolios of work. These activities may or may not be assessed, although evidence suggests that students, and in particular students studying online, tend to focus more on assessed activities.

In other words, with good design and adequate resources, technology-based instruction can provide high levels of student interaction with the learning materials. There are strong economic advantages in exploiting the possibilities of learners’ interaction with learning materials, because intense student-interaction with learning resources increases the time students spend on learning, which tends to lead to increased learning (see Means et al., 2010). Perhaps more importantly, such activity, when well designed, can reduce the time the teacher needs to spend on interacting with each student.

### 8.6.1.2 Interaction between students and teacher

Student-teacher interaction is often needed though in order to develop many of the higher order learning outcomes, such as analysis, synthesis, and critical thinking. This is particularly important for developing academic learning, where students are challenged to question ideas, and to acquire deep understanding. This often requires dialogue and conversation, either one-on-one between instructor and students, or between an instructor and a group of students. The role of the teacher in for instance either face-to-face seminars or online collaborative learning is therefore critical.

Some technologies, such as online discussion forums, enable or encourage such dialogue or discourse between students and instructors at a distance. The main limitation of student-teacher interaction is that it can be time-demanding for the teacher, and therefore does not scale easily.

### 8.6.1.3 Student – student interaction

High quality student-student interaction can be provided equally well both in face-to-face and online learning contexts. Asynchronous online discussion forums built into learning management systems can enable this kind of interaction. Connectivist MOOCs and communities of practice also enable student-student interaction.

Again though quality depends on good design. Merely putting students together in a group, whether online or face-to-face, is not likely to lead to either high levels of participation or high quality learning without careful thought being given to the educational goals of discussion within a course, the topics for discussion and their relationship to assess-
ment and learning outcomes, and without strong preparation of the students by the instructor for self-directed discussions (see Chapter 6, Section 4, for more on this.)

In a technologically rich learning environment, then, a key decision for a teacher or course designer is choosing the best mix of these three different kinds of interaction, taking into consideration the epistemological approach, the amount of time available for both students and instructor, and the desired learning outcomes. Technology can enable all three kinds of interaction.

8.6.2 The interactive characteristics of media and technologies

Different technologies can enhance or inhibit each of these types of interactivity. This again means looking at the dimension of interactivity as it applies to different media and technology. This dimension has three components or points on the dimension in terms of the extent an active response from a user is required when a medium or technology is used for teaching.

8.6.2.1 Inherent interactivity

Some media are inherently ‘active’ in that they ‘push’ learners to respond. An example is adaptive learning, where students cannot progress to the next stage of learning without interacting through a test that ascertains whether they have learned sufficiently to progress to the next stage, or what ‘corrective’ learning they still need to do. Behaviourist computer-based learning is inherently interactive, as it forces learners to respond. It is not surprising that technologies that control how a learner responds are often associated with more behaviourist approaches to teaching and learning.

8.6.2.2 Designed interactivity

Although some media or technologies are not inherently interactive, they can be explicitly designed to encourage interaction with learners. For instance, although a web page is not inherently interactive, it can be designed to be interactive by adding a comment box or by requiring users to enter information or make choices. In particular, teachers or instructors can add or suggest activities within a particular medium. A podcast can be designed so that students stop the podcast every few minutes to do an activity based on the content of the podcast. This approach can be applied just as much to textbooks, where activities can be included, as to web pages.

In many cases, though, a medium will require the intervention of a teacher or instructor to both set activities
around the learning materials and to provide appropriate feedback, thus adding to rather than reducing the workload of instructors. Thus where instructors have to intervene either to design activities or to provide feedback, the cost or time demands on the instructor are likely to be greater than if the other two kinds of interaction are used.

### 8.6.2.3 User-generated interaction

Some media may not have explicit interaction built in, but end users may still voluntarily interact with the medium, either cognitively and/or through some physical response. For instance someone in an art gallery may cognitively or emotionally respond to a particular painting (while others may just glance at it or pass it by). Students may choose to make sketches or drawings from the painting. Learners may respond in similar ways to reading a novel or poem. The creators of the work may in fact deliberately design the work to encourage reflection or analysis, but not in explicit ways, leaving the interpretation of a work to the viewer or reader. (This of course is a constructivist approach to learning.) Media that encourage learners independently to be active without the necessary intervention of a teacher or instructor also have cost advantages, although the quality of the interaction will be more difficult to monitor or assess.

### 8.6.2.4 Who’s in control?

Thus one dimension of interactivity is control: to what extent is interaction controlled or enabled by the technology, by the creators/instructors, or by the users/learners? It can be seen that this is a complex dimension, once again influenced by epistemological positions, and also by design decisions on the teacher’s part. These categories of interactivity are in no way ‘fixed’, with different levels or types of interaction possible within the same medium or technology. In the end, interaction needs to be linked to desired learning outcomes. What kind of interaction will best lead to a particular type of learning outcome, and what technology or medium best provides this kind of interaction?

### 8.6.3 Interaction and feedback

Feedback is an important aspect of interaction, and timely and appropriate feedback on learner activities is often essential for effective learning. In particular to what extent is feedback possible within a particular medium? Although for instance a learner may respond actively to a poem in a book, feedback on that interaction is usually not available just from the reading. Some other medium will need to be used to provide that feedback, such as a face-to-face poetry class or an online discussion forum. On the other hand, with computer-based learning, once a student has responded to a multiple-choice question, the computer can mark the question and give almost instant feedback. However, with some technologies such as print, providing appropriate or immediate feedback to learners on their activities may be difficult or impossible. Although ‘model’ or ‘correct’ answers might be provided in a text on another page, quality feedback on activities must be provided by a teacher or instructor when using a printed medium.

Thus media and technologies again differ in their capacity to provide various kinds of feedback. From a teaching perspective, it is important to be clear about what kind of feedback is likely to be most effective, and then the most effective way to provide that feedback. In particular, under what circumstances is it appropriate to automate feedback, and when should feedback be provided by a teacher, instructor or perhaps a teaching assistant?

### 8.6.4 Analysing the interactive qualities of different media

In Figure 8.11 I have analysed the interactive qualities of different educational media along two different dimensions: different types of student interaction; and characteristics of the medium, in terms of whether interaction is built into the medium, or needs to be added through deliberate design, or whether it is left to the learner to decide how to interact. I have allocated a number of different media here according to the type of learner activity they help generate.
I have allocated a number of different media here according to the type of learner activity they help generate. The actual location though of some of these media will be dependent on design decisions made by the instructor. For instance, a podcast could be accompanied by an activity (designed), or just be a straight broadcast, with the student left to interpret its meaning and purpose in the course (learner-generated). In some cases, an activity may be triggered by one medium (such as a podcast) but the actual activity and the feedback may take place in another medium (such as through an online assessment).

**8.6.5 Summary**

Thus it can be seen that media and technology are somewhat slippery when it comes to categorising them in terms of interaction, because instructors and learners often have a choice in how the medium will actually be used, and that will affect how learner interaction and feedback takes place within a single medium. Thus once again the quality of the design of the interactive experiences is as important as the medium of choice for enabling the activity, although an inap-
propriate choice of technology can reduce the level of activity and/or the quality of the interactions. In reality teachers and learners are likely to use a combination of media and technologies to ensure high quality interactivity. However, using a number of different media is likely to increase cost and workload for both instructors and learners.

Once again, there is no evaluative judgement on my part in terms of which media or characteristics provide the 'best' interactivity. The choice of medium should depend on the kind of activities that are judged important by an instructor within the overall context of the teaching. The purpose of this analysis is to sensitize instructors to the differences between educational media in generating or facilitating different types of interactivity, so that they can make informed decisions. In this case, though, there are no clear media or technology 'winners' in terms of interactivity. Design decisions are likely to be more important than technology choice. Nevertheless, technology can enable students separated from their instructors still to get quality activities and feedback, and when appropriately used, technology used to support activities can result in more time on task for students.

### Activity 8.6 Using media to promote student activity

1. Go to YouTube and type in your subject area into the 'search' box.
2. Choose a YouTube video from the list that comes up that you might recommend to your students to watch.
3. What kind of interaction would the YouTube video require from your students? Does it force them to respond in some way (inherent)?
4. In what way are they likely to respond to the YouTube on their own, e.g. make notes, do an activity, think about the topic (learner-generated)?
5. What activity could you suggest that they do, after they have watched the YouTube video (designed)? What type of knowledge or skill would that activity help develop? What medium or technology would students use to do the activity?
6. How would students get feedback on the activity that you set? What medium or technology would they and/or you use for getting and giving feedback on their activity?
7. How much work for you would that activity cause? Would the work be both manageable and worthwhile? Could the activity be scaled for larger numbers of students?
8. How could the YouTube video have been designed to generate more or better activity from viewers/students?

If you want to share your response, please use the comment box below. To see how I did this activity, click here (to come).
8.7 Media richness

8.7.1 The historical development of media richness

In Section 8.2, ‘A short history of educational technology’, the development of different media in education was outlined, beginning with oral teaching and learning, moving on to written or textual communication, then to video, and finally computing. Each of these means of communication has usually been accompanied by an increase in the richness of the medium, in terms of how many senses and interpretative abilities are needed to process information. Another way of defining the richness of media is by the symbol systems employed to communicate through the medium. Thus textual material from an early stage incorporated graphics and drawings as well as words. Television or video incorporates audio as well as still and moving images. Computing now can incorporate text, audio, video, animations, simulations, computing, and networking, all through the Internet.

8.7.2 The continuum of media richness

Once again then there is a continuum in terms of media richness, as illustrated in Figure 8. above. Also once again, design of a particular medium can influence where on the continuum it would be placed. For instance in Figure 8.1, different forms of teaching using video are represented in blue. Ted Talks are usually mainly talking heads, a televised lecture, as are often xMOOCs (but not all). The Khan Academy uses dynamic graphics as well as voice over commentary, and Armando Hasudungan’s You Tube video on the structure of bacteria uses hand drawings as well as voice over commentary. Educational TV broadcasts are likely to use an even wider range of video techniques.
However, although the richness of video can be increased or decreased by the way it is used, video is always going to be richer in media terms than radio or textbooks. Radio is never going to be a rich medium in terms of its symbols systems, and even talking head video is richer symbolically than radio. Again, there is no normative or evaluative judgment here. Radio can be ‘rich’ in the sense of fully exploiting the characteristics or symbol systems of the medium. A well produced radio program is more likely to be educationally effective than a badly produced video. But in terms of representation of knowledge, the possibilities of radio in terms of media richness will always be less than the possibilities of video.

### 8.7.3 The educational value of media richness

But how rich should media be for teaching and learning? From a teaching perspective, rich media have advantages over a single medium of communication, because rich media enable the teacher to do more. For example, many activities that previously required learners to be present at a particular time and place to observe processes or procedures such as demonstrating mathematical reasoning, experiments, medical procedures, or stripping a carburetor, can now be recorded and made available to learners to view at any time. Sometimes, phenomena that are too expensive or too difficult to show in a classroom can be shown through animation, simulations, video recordings or virtual reality. Furthermore, each learner can get the same view as all the other learners, and can view the process many times until they have mastery. Good preparation before recording can ensure that the processes are demonstrated correctly and clearly. The combination of voice over video enables learning through multiple senses. Even simple combinations, such as the use of audio over a sequence of still frames in a text, have been found more effective than learning through a single medium of communication (see for instance, Durbridge, 1984). The Khan Academy videos have exploited very effectively the power of audio combined with dynamic graphics. Computing adds another element of richness, in the ability to network learners or to respond to learner input.

From a learner’s perspective, though, some caution is needed with rich media. Two particularly important concepts are cognitive overload and Vygotsky’s Zone of Proximal Development. Cognitive overload results when students are
presented with too much information at too complex a level or too quickly for them to properly absorb it (Sweller, 1988). Vygotsky’s Zone of Proximal Development or ZPD is the difference between what a learner can do without help and what can be done with help. Rich media may contain a great deal of information compressed into a very short time period and its value will depend to a large extent on the learner’s level of preparation for interpreting it. For instance, a documentary video may be valuable for demonstrating the complexity of human behaviour or complex industrial systems, but learners may need either preparation in terms of what to look for, or to identify concepts or principles that may be illustrated within the documentary. On the other hand, interpretation of rich media is a skill that can be explicitly taught through demonstration and examples (Bates and Gallagher, 1977). Although YouTube videos are limited in length to around eight minutes mainly for technical reasons, they are also more easily absorbed than a continuous video of 50 minutes. Thus again design is important for helping learners to make full educational use of rich media.

8.7.4 Simple or rich media?

It is a natural tendency when choosing media for teaching to opt for the ‘richest’ or most powerful medium. Why would I use a podcast rather than a video? There are in fact several reasons:

- cost and ease of use: it may just be quicker and simpler to use a podcast, especially if it can achieve the same learning objective
- there may be too many distractions in a rich medium for students to grasp the essential point of the teaching. For instance, video recording a busy intersection to look at traffic flow may include all kinds of distractions for the viewer from the actual observation of traffic patterns. A simple diagram or an animation that focuses only on the phenomenon to be observed might be better
- the rich medium may be inappropriate for the learning task. For instance, if students are to follow and critique a particular argument or chain of reasoning, text may work better than a video of a lecturer talking about the chain of reasoning.

In general, it is usually a useful guideline always to look for the simplest medium first then only opt for a more complex or richer medium if the simple medium can’t deliver the learning goals as adequately. However, consideration needs to be given to media richness as a criterion when making choices about media or technology.

This is the last of the characteristics of media and technology that can influence decisions about teaching and learning. The next section will provide an overview and summary.

Activity 8.7 How rich is your medium?

1. Do you agree that: ‘it is a useful guideline always to look for the simplest medium first’.
2. How important do you think the richness of medium is when making decisions about the use of media and technology?
3. Do you agree with the placement of different media on this continuum. If not, why not?

If you want to share your response, please use the comment box below.
References


8.8 Understanding the foundations of educational media

I am aware that this chapter may appear somewhat abstract and theoretical, but in any subject domain, it is important to understand the foundations that underpin practice. This applies with even more force to understanding media and technology in education, because it is such a dynamic field that changes all the time. What seem to be the major media developments this year are likely to be eclipsed by new developments in technology next year. In such a shifting sea, it is therefore necessary to look at some guiding concepts or principles that are likely to remain constant, whatever changes take place over the years.

So in summary here are my main navigation stars, the main points that I have been emphasising, throughout this chapter.

<table>
<thead>
<tr>
<th>Key Takeaways</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Technologies are merely tools that can be used in a variety of ways. What matters more is how technologies are applied. The same technology can be applied in different ways, even or especially in education. So in judging the value of a technology, we need to look more closely at the ways in which it is being or could be used. In essence this means focusing more on media – which represent the more holistic use of technologies – than on individual tools or technologies themselves, while still recognising that technology is an essential component of almost all media.</td>
</tr>
<tr>
<td>2. By focusing on media rather than technologies, we can then include face-to-face teaching as a medium, enabling comparisons with more technology-based media to be made along a number of dimensions or characteristics.</td>
</tr>
<tr>
<td>3. Recognising that in education media are usually used in combination, the six key building blocks of media are:</td>
</tr>
<tr>
<td>3.1 face-to-face teaching</td>
</tr>
<tr>
<td>3.2 text</td>
</tr>
<tr>
<td>3.3 (still) graphics</td>
</tr>
<tr>
<td>3.4 audio (including speech)</td>
</tr>
<tr>
<td>3.5 video</td>
</tr>
<tr>
<td>3.6 computing (including animation, simulations and virtual reality)</td>
</tr>
<tr>
<td>4. Media differ in terms of their formats, symbols systems, and cultural values. These unique features are increasingly referred to as the affordances of media or technology. Thus different media can be used to assist learners to learn in different ways and achieve different outcomes, thus also individualising learning more.</td>
</tr>
<tr>
<td>5. There are many dimensions along which some technologies are similar and others are different. By focusing on these dimensions, we have a basis for analysing new media and technologies, to see where they ‘fit’ within the existing landscape, and to evaluate their potential benefits or limitations for teaching and learning.</td>
</tr>
</tbody>
</table>
6. There are probably other characteristics or dimensions of educational media that might also be identified, but I believe these four key characteristics or dimensions to be the most important:
   6.1 broadcast vs communicative
   6.2 synchronous (live) vs asynchronous (recorded)
   6.3 passive vs interactive
   6.4 single vs rich media

7. However, the identification of where a particular medium fits along any specific characteristic or dimension will depend in most cases on how that medium is designed. At the same time, there is usually a limit to how far a technology can be forced along one of these dimensions; there is likely to be a single, 'natural' position on each dimension, subject to good design, in terms of exploiting the educational affordances of the medium.

8. These characteristics or dimensions of media then need to be evaluated against the learning goals and outcomes desired, while recognising that a new educational medium or application might enable goals to be achieved that had not been previously considered possible.

9. Over time, technologies have tended to become more communicative, asynchronous, interactive and rich in media, thus offering teachers and learners more powerful tools for teaching and learning.

10. The appropriateness of decisions made by teachers (and increasingly learners) about how to use a particular medium, i.e. design decisions, are likely to be more important than the choice of the medium itself. Hence good teaching/good design in terms of for instance student activities might save a poor choice in technology, but technology will never save poor teaching.

11. If we look carefully at the characteristics of educational media, we shall see that technology is more important in helping to make decisions about modes of delivery (face-to-face, blended or distance) than about teaching methods or pedagogy. This issue will be discussed in more detail in Chapter 10.

12. The Internet is an extremely powerful medium because through a combination of tools and media it can encompass all the characteristics and dimensions of educational media.

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Activity 8.8 Analysing your current use of technology

1. Take one of the courses you are teaching at the moment. How could you make your teaching more communicative, asynchronous, interactive and rich in media. What media or technologies would help you do this?

2. Write down what you would see as (a) the advantages (b) the disadvantages of changing your teaching in this way.

3. Do you think applying the four dimensions described here will be useful when deciding whether or not to use a new technology? If not, why not?

The next chapter should provide more feedback on your answers.
Under development

Under development:
  9. Deciding about technologies for teaching and learning
  10. Modes of delivery
  11. Nine steps to quality teaching in a digital age
  12. Design templates
  13. Training and development of teachers and instructors
  14. Conclusions
8.7 The dimensions of interaction and media richness

The last two characteristics of media and technology relevant to education that I wish to discuss are interaction and media richness. These two are not closely linked so should be treated as separate dimensions.

Interaction

Media and technologies vary in the extent to which they encourage and support learner activities. Instructors can build in activities for learners through most media and technologies, but for some media, the technology itself forces interaction. There are three different types of student interaction in learning:

- interaction with learning materials
- interaction between learner and teacher/instructor/tutor
- interaction between learners.

Technology can be used to facilitate or increase interaction in all three types.

Interaction with learning materials

The simplest form of interaction with learning materials is reading, listening, viewing and in some cases touching. However, that interaction can be structured by the instructor to encourage reflection or critical analysis, to enhance comprehension or understanding, or to enable practice leading to mastery. The extent to which learners interact with learning materials is very much an issue of design, such as providing appropriate activities, raising appropriate questions for consideration by the learners, and providing timely and accurate feedback, irrespective of the media or technology used for teaching.

Different media require different strategies to support learner interaction, and the way in which different media can be designed to. As in this book, activities can be inserted into text, but text is not good for giving direct feedback adapted to a learner’s response to an activity. Learners can also easily skip suggested activities or merely look up the answers later. Computers on the other hand can more easily control both the feedback to learners based on their responses and control the feedback so learners cannot progress without doing the activity properly or successfully.

However, computers are currently limited in terms of interaction to measuring comprehension or making simple comparisons through multiple choice questions, or relatively specific processes or procedures such as coding in computer science. The higher the level of cognitive thinking, the more limited computers become at providing an accurate analysis of students responses and the level of feedback required.
Activity 8.1 How many technologies can you see in Figure 8.1?

Well, this is an unfair question, partly because the photo doesn’t show all the technologies, and also because you wouldn’t know what software or services were included, but just for the record, here’s my list:

**Hardware**
1. Laptop computer
2. Music CD
3. Book: yes, a printed book is a technological artefact! It doesn’t have to be digital to be a technology.
4. Mobile phone
5. Satellite receiver/ converter
6. Television monitor
7. DVD player
8. Apple TV box
9. Audio-visual receiver/ control box with 7 channels, 1080p HDMI, Dolby and DTS format support
10. Loudspeakers (3 in picture, including a woofer, back right)
11. Remote control (one: for all equipment except computer, mobile phone and book)

**Software**
Almost impossible to list and unobservable anyway, but would include iTunes, iPhoto (uses photos from iPhoto library as a screen saver for the TV monitor when music is playing), digital conversion in the A/V receiver, etc., etc.

**Networks**
Wi-fi
Internet
Telephone
Radio
Satellite TV (could have been cable, or broadband telephone, but isn’t)

**Services**
Satellite broadcast television channels
Radio stations (global choice, via Sonos)
Apple TV (including Netflix and other streaming services)
Sonos music (including Deezer, a service similar to Netflix for music)

**Necessary for integration**
Single remote control (eHarmony)
Audio-visual receiver
Apple TV
Apple Mac Pro laptop computer
Mobile phone (controls Sonos and iTunes)

**My wish for the future:** one portable box, please!!!!!!!

I think whoever owns this home entertainment system could do with a model for technology selection (OK, I’ll admit it, it’s mine). Or is it that the home entertainment industry needs to get its act together? But I digress.
Activity 8.3 How would you classify the following (either medium or technology)?

My answer:

<table>
<thead>
<tr>
<th>Category</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>newspaper</td>
<td>medium</td>
</tr>
<tr>
<td>printing press</td>
<td>technology</td>
</tr>
<tr>
<td>television program</td>
<td>medium</td>
</tr>
<tr>
<td>Netflix</td>
<td>either: technology for delivery; medium for services</td>
</tr>
<tr>
<td>classroom</td>
<td>technology</td>
</tr>
<tr>
<td>MOOC</td>
<td>medium</td>
</tr>
<tr>
<td>discussion forum</td>
<td>either: technology for the software; medium for its actual use</td>
</tr>
</tbody>
</table>

Thus it can be seen that the context in which the term is used can influence its categorization.
Activity 8.4 Broadcast or communicative

From the list below:

- a learning management system
- a blog
- online collaborative learning
- Twitter
- Second Life
- a podcast
- an open textbook

1. Determine which is a medium and which a technology, or which could be both, and under what conditions.

<table>
<thead>
<tr>
<th>Medium/Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>learning management system</td>
<td>either: technology as software, medium when used for course delivery</td>
</tr>
<tr>
<td>blog</td>
<td>medium (WordPress or other blog software is the technology)</td>
</tr>
<tr>
<td>online collaborative learning</td>
<td>medium</td>
</tr>
<tr>
<td>Twitter</td>
<td>either, but mainly a medium</td>
</tr>
<tr>
<td>Second Life</td>
<td>medium</td>
</tr>
<tr>
<td>podcast</td>
<td>medium</td>
</tr>
<tr>
<td>open textbook</td>
<td>medium</td>
</tr>
</tbody>
</table>

2. Decide where, from your experience, each medium or technology should be placed on Figure 8.7 Write down why.
3. Which were easy to categorize and which difficult?

Difficult:

- online collaborative learning, because it is highly communicative but the teacher has a good deal of control over the medium
- Twitter, because it is definitely under the control of the learner, but it is also as much a broadcast as a communicative medium.

With both these, I gave more importance to the broadcast/communicative dimension compared with the control dimension.
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This is where you can add appendices or other back matter.