4.6.2 What are communities of practice?

4.6.2.1 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

4.6.2.2 What are communities of practice?

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.

4.6.2.3 Characteristics

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.

4.6.2.4 Innovation and change

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.

2.6.2.5 Technologies

Technology provides a wide range of tools that can support communities of practice, as indicated by Wenger (2014) in the diagram below:

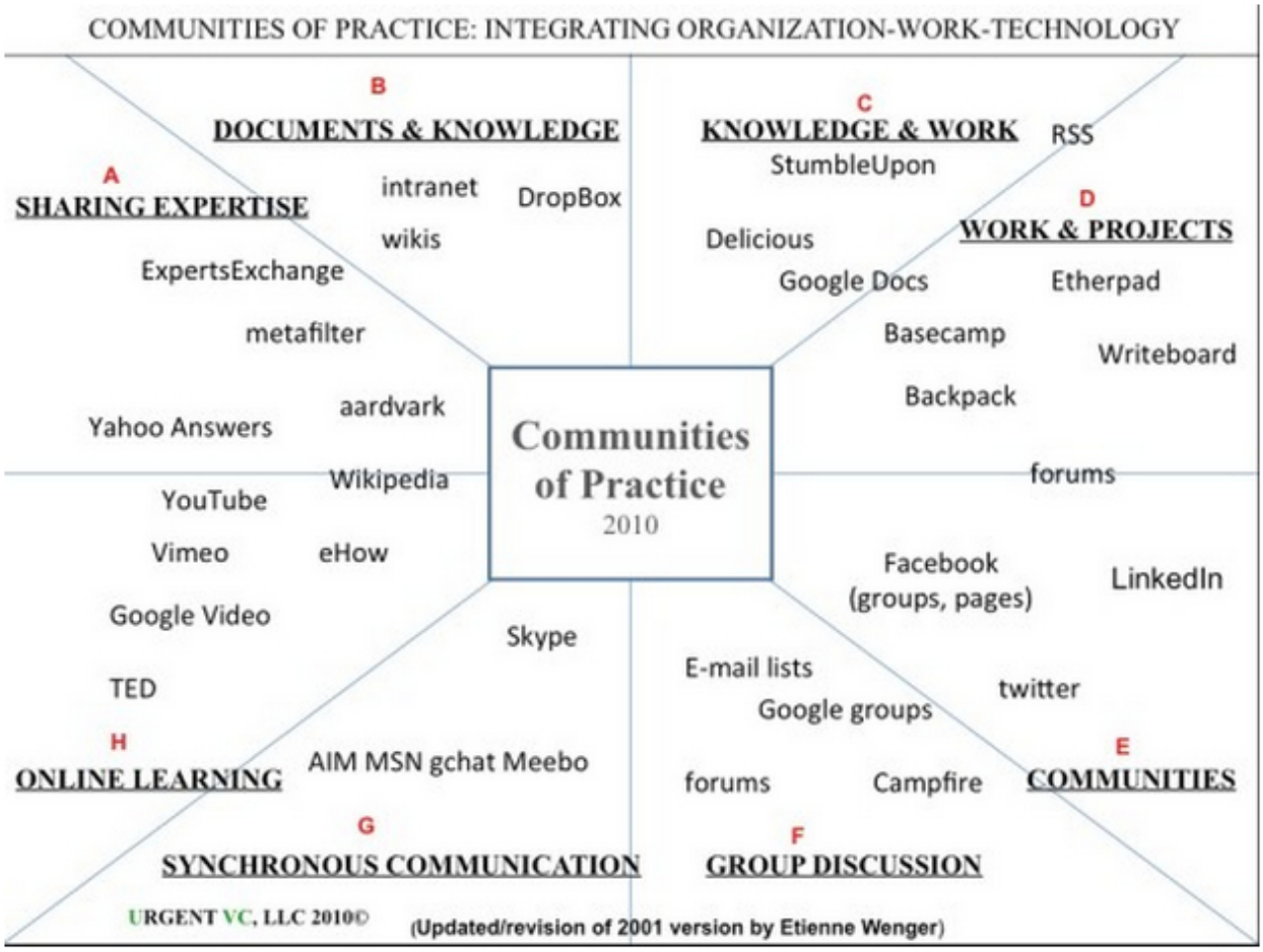

Figure 4.6.2 Tools that support communities of practice
Image: Wenger, 2014

4.6.3 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:

4.6.3.1 Design for evolution

Ensure 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.

4.6.3.2 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.

4.6.3.3 Encourage and accept different levels of participation

Different levels of participation include:

- the ‘core’ (most active members),
- those who participate regularly but do not take a leading role in active contributions,
- hose (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.

4.6.3.4 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.

4.6.3.5 Focus on value

Attempts should be made explicitly to identify, through feedback and discussion, the contributions that the community most values.

4.6.3.6 Combine familiarity and excitement

Focus both on shared, common concerns and perspectives, but also on the introduction of radical or challenging perspectives for discussion or action.

4.6.3.7 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.

4.6.4 Critical factors for success

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 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.

4.6.5 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 5, but it is worth discussing here the connection between MOOCs and communities of practice. The more instructionist xMOOCs are not really developed as communities of practice, because they use mainly a transmissive pedagogy, from experts to those considered less expert.

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.

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.

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Update and further reading

Wenger, E., Trayner, B. and de Laat, M. (2011)*Promoting and assessing value creation in communities and networks: a conceptual framework* Heerlen NL: The Open University of the Netherlands

This document presents a conceptual foundation for promoting and assessing value creation in communities and networks. By value creation we mean the value of the learning enabled by community involvement and networking.

For an interesting critique of this paper, see:

Dingyloudi, F. and Strijbos, J. (2015) Examining value creation in a community of learning practice: Methodological reflections on story-telling and story-reading *Seminar.net*, Vol. 11, No.3

Activity 4.6 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?

For my (not very deep) thoughts on these questions, click on the podcast below.

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=134

Scenario E: ETEC 522: Ventures in e-Learning

Figure 4 E Image: Harper Adams University

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.

4.7 'Agile' Design: flexible designs for learning

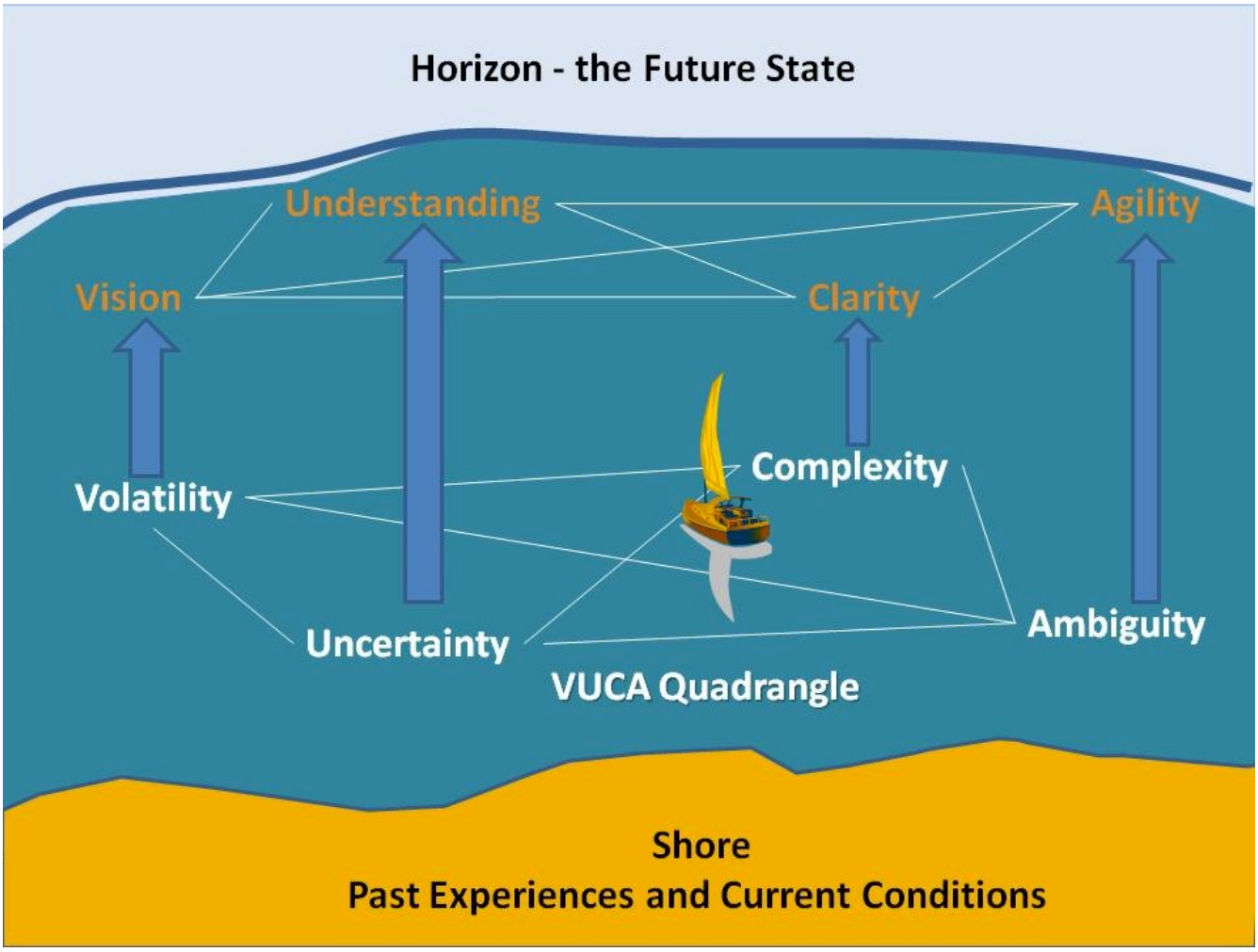

Figure 4.7.1 A volatile, uncertain, complex and ambiguous world
Image: © Carol Mase, Free Management Library, 2011, used with permission

4.7.1 The need for more agile 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 students 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.

4.7.2 Core features of agile design models

Describing the design features of this model is a challenge, for two reasons. First, there is no single approach to agile design. The whole point 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 agile 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 protyping 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 agile design, but they lack some of the most important characteristics outlined below:

4.7.2.1 Light and nimble

If ADDIE is a 100-piece orchestra, with a complex score and long rehearsals, then agile design is 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.

4.7.2.2 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 in Scenario F, 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.

4.7.2.3 The design attempts to exploit the affordances of either existing or emerging technologies

Agile 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.

4.7.2.4 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 agile design shaped by overarching principles of best practice. Most successful agile 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 (see Appendix 1). 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.

4.7.2.5 Experiential, open and applied learning

Usually agile 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, much 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.

4.7.3 Strengths and weaknesses of flexible design models

The main advantage of agile 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 agile 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. Agile design enables courses to be developed and offered quickly and at much lower initial cost than ADDIE-based approaches.

However, agile 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 agile approach to design for learning with 'agile' design for computer software. Indeed it could be argued that most of the things in agile 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 agile design, but campus-based, with quite a different overall program from ETEC 522, is the Integrated Science program at McMaster University.)

Certainly agile 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 agile designs for learning to grow over the coming years, because they are more likely to meet the needs of a VUCA world.

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Activity 4.7 Taking risks with 'agile' design

1. Do you think a 'agile'/flexible design approach will increase or undermine academic excellence? What are your reasons?

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?

For my comments on this activity, click on the podcast below:

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=139

4.8 Making decisions about teaching methods

Figure 4.8.1 Making decisions about which design model to choose

4.8.1 Choosing a method

Chapters 3 and 4 cover a range of different teaching methods and design models. There are many more

that could have been included. I will be discussing open pedagogy in Chapter 11, Section 4. MOOCs are also a notable omission. However, the design models behind MOOCs require a full chapter of their own (Chapter 5.)

Your choice of teaching method and the design of the teaching within that method will depend very much on the context in which you are teaching. However, a key criterion should be the suitability of the method and/or 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 teaching methods covered in Chapters 3 and 4 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 teaching method? I set out below in Figure 4.8.2 one way of doing this. I have chosen five criteria as headings along the top of the table:

4.8.1.1 Epistemological basis

What epistemology does this method suggest? Does the method suggest a view of knowledge as content that must be learned, does the method suggest a rigid ('correct') way of designing learning (objectivist)? Or does the method suggest that learning is a dynamic process and knowledge needs to be discovered and is constantly changing (constructivist)? Does the method 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 method epistemologically neutral, in that one could use the same method to teach from different epistemological positions?

4.8.1.2 Industrial (20th century) or digital (21st century)

Does this method 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?

Alternatively, does the method encourage the development of the soft skills and the effective management of knowledge needed in a digital world? Does the method 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?

4.8.1.3 Academic quality

Does the method lead to deep understanding and transformative learning? Does it enable students to become experts in their chosen subject domain?

4.8.1.4 Flexibility

Does the method 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 or your time 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 methods or design models. Where I think a method or design 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!)

Design model	*Epistemology*	*20th century learning*	*21st century learning*	*Academic quality*	*Flexibility*
Transmissive lectures	Objectivist	**	*	**	*
Interactive lectures/seminars	Constructivist	***	**	***	*
Classroom-type online learning	Objectivist	n/a	*	*	***
Online collaborative learning	Constructivist	n/a	***	***	***
ADDIE	Mainly objectivist	***	**	***	**
Experiential learning	Constructivist	**	***	**	***
Competency-based learning	Objectivist	n/a	**	**	***
Communities of practice	Connectivist	**	**	*	***
x MOOCs	Objectivist	n/a	*	**	***
cMOOCs	Connectivist	n/a	**	*	***
Agile design	Constructivist	n/a	***	**	***

Figure 4.8.2 Choosing design models

It can be seen that the only method 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 4.8.2 as a heuristic device and not as a general recommendation.

4.8.2 Design models and the quality of teaching and learning

Lastly, the review of different methods indicate some of the key issues around quality:

- first, what students learn is more likely to be influenced by choosing an appropriate teaching method for the context in which you are teaching, than by focusing on a particular technology or delivery method (face-to-face or online). 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 teaching methods 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 teaching method is most likely to help develop these skills in your students?
- third, quality depends not only on the choice of an appropriate teaching method, 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 methods. Following core design principles is critical for the successful use of any particular teaching method. Also there is considerable research on what the conditions are for success in using some of the newer methods or design models. The findings from such research need to be applied when implementing a particular method (this is discussed further throughout the book, but specifically in Chapter 12);
- lastly students *and* teachers get better with practice. If you are moving to a new method of teaching or design model, give yourself (and your students) time to get comfortable with it. It will probably take two or three courses where the new method or design 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.

There are still two major teaching methods to be discussed, Open Pedagogy in Chapter 11, Section 4, and MOOCs, which needs their own chapter (next).

For my personal comments on some of the issues raised in this chapter, please click on the podcast below.

An audio element has been excluded from this version of the text. You can listen to it online here: https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=143

Activity 4.8 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 properly prepared for the future?

2. What teaching method 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?

No feedback is provided on this activity; it is for your personal reflection.

Key Takeaways (Chapters 3 and 4)

1. Traditional classroom teaching, and especially transmissive lectures, were designed for another age. Although lectures have served us well, we are now in a different age that requires different methods.

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

3. There is no one teaching method or 'best' design model for all circumstances. The choice of teaching method needs to take account of the context in which it will be applied, but nevertheless, some methods 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. Teaching methods 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 methods of teaching that are light and nimble.

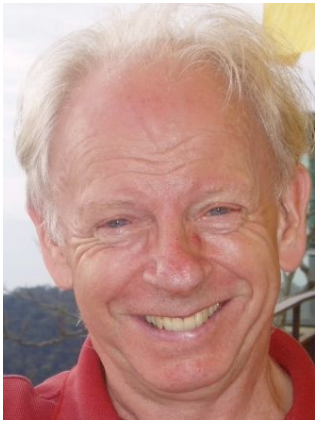
Chapter 5: MOOCs

Purpose of the chapter

It has been claimed that 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 you should be able to:

- understand the differences between various kinds of MOOCs, and between MOOCs and other forms of online and open learning;
- 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.



For a my personal introduction to this chapter, please click on the podcast below.

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What is covered in this chapter

This chapter covers the following topics:

Also in this chapter you will find the following activities:

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 nor 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. There are currently 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.

5. 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

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.

5.1 Brief history

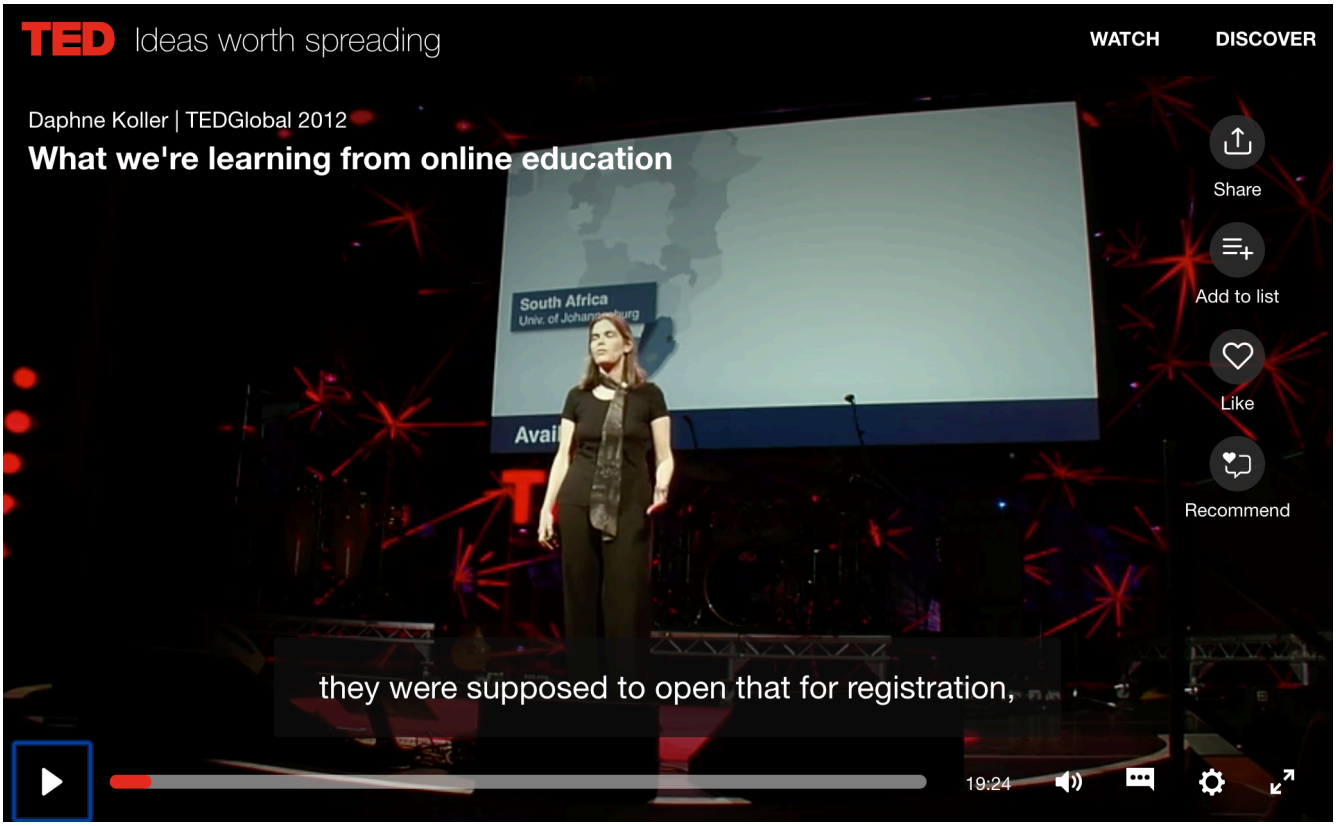

Figure 5.1.1 Daphne Koller's TED Talk, 2012
To see this YouTube video, click on the graphic. For a response to this video, see: 'What's right and what's wrong with Coursera-style MOOCs'.

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 in 2013 changed direction to focus 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 March, 2019 there were more than 11,000 MOOC courses from 900 universities globally, with just over 100 million registrations (Shah and Pickard, 2019). The big change in 2017-2018 was a move to MOOC-based degrees, with seven universities announcing 15 degrees in 2017, and in 2018, 30 more universities joined in, and launched more than 45 degrees (Johnson, 2019).

In addition to full degrees, EdX and Coursera both offer multiple micro-credentials, each with their own branding. Overall, 630 micro-credentials existed at the end of 2018, but most of the new credentials came from just two credentials, Coursera specialization, and edX professional certificate (Johnson, 2019).

References

Downes, S. (2012) Massively Open Online Courses are here to stay, Stephen's Web, July 20

Johnson, S. (2019) Much ado about MOOCs: Where are we in the evolution of MOOCs? *Edsurge On Air*, 26 February

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5.2 What is a MOOC?

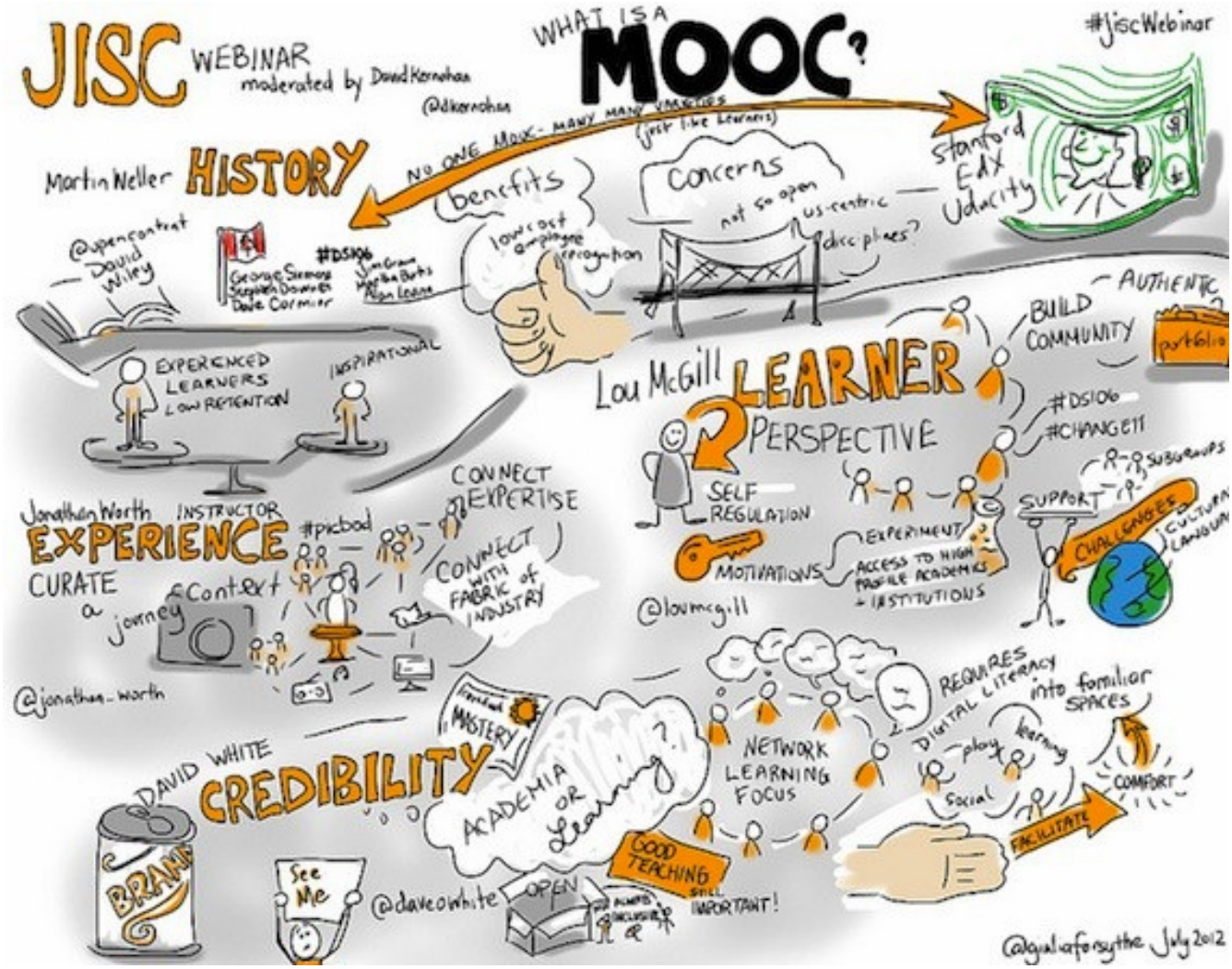

Figure 5.2.1 Making sense of MOOCs © Giulia Forsythe, 2012 and JISC, 2012

5.2.1 MOOCS: a massive disruption?

Probably no development in teaching in recent years has been as controversial as the development of Massive Open Online Courses (MOOCs). In 2013, the writer Thomas Friedman 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 a digital age.

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.

5.2.2 Key characteristics

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

5.2.2.1 Massive

By 2019, Coursera claimed over 35 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.

5.2.2.2 Open

At least for the initial MOOCs, access was free for participants, although an increasing number of MOOCs are charging a fee for assessment leading to a badge or certificate or other fees. For instance, in 2019 Coursera was charging between US$29-$99 per course.

There are no pre-requisites for participants other than access to a computer/mobile device and the

Internet. However, broadband access is essential for MOOCs that use video streaming, which severely limits their potential for widening access to higher education in the least developed countries.

There is another significant way in which MOOCs through Coursera and some other MOOC platforms are not fully open (see Chapter 11 for more on what constitutes 'open' in education). 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.

Indeed, there are many other kinds of online material that are also open and free over the Internet, such as open textbooks and open educational resources, often in ways that are more accessible for reuse than MOOC material (see Chapter 11).

5.2.2.3 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 Section 5.3.

Again though it should be noted that MOOCs are not unique in offering courses online. In 2017, there were 6.3 million students in the USA alone taking online courses *for credit*, as part of regular degree programs (Seaman et. al, 2018).

5.2.2.4 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 in most cases been accepted for admission to universities or for advanced standing or credit, even (or especially) by the institutions offering the MOOCs.

5.2.3 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 for participants (although not always free).

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Friedman, T. (2013) Revolution Hits the Universities *New York Times,* January 26

Seaman, J.E., Allen, I.E., and Seaman, J. (2018) *Grade Increase: Tracking Distance Education in the United States* Wellesley MA: The Babson Survey Research Group

Activity 5.2

1. When is a MOOC not a MOOC? What are the essential characteristics for a course to be a MOOC?
2. Can you find examples of MOOCs from providers within your own state or province? Do they differ in any way from the main MOOC platforms such as Coursera or edX? In what ways?
3. Are they an inferior or low quality form of education? If so, why? What criteria would you use for judging the quality of a MOOC? Write down your answers then check these when you have read the rest of this chapter and see if you have changed your mind.

For my feedback on these questions click the podcast below

An audio element has been excluded from this version of the text. You can listen to it online here: https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=150

5.3 A Taxonomy of MOOCs

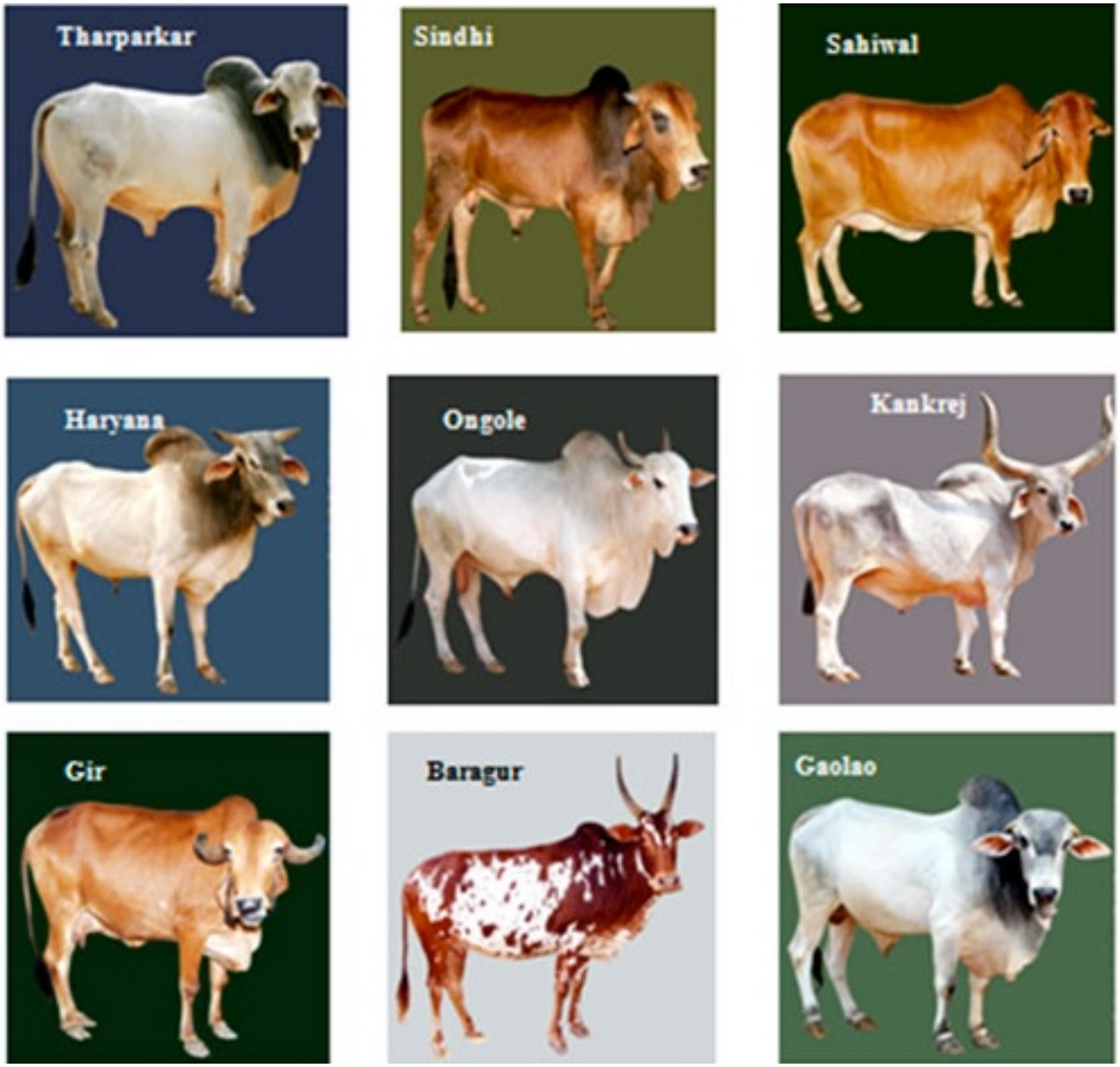

Figure 5.3 There are many variations of the basic MOOC design
Image: © Dairy Cattle, India, 2014© Dairy Cattle, India, 2014

In this section the main MOOC designs will be analysed. However, MOOCs are still a relatively new phenomenon, and design models are still evolving.

5.3.1 xMOOCs

MOOCs developed initially by Stanford University professors and a little later by MIT and Harvard instructors are based primarily on a strongly behaviourist, 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 assessment. These MOOCs are offered through special cloud-based software platforms such as Coursera, edX and FutureLearn.

xMOOCs is a term coined by Stephen Downes (2012) for courses developed by Coursera, Udacity and edX. At the time of writing (2019) xMOOCs are by far the most common MOOC. Instructors have considerable flexibility in the design of the course, so there is considerable variation in the details, but in general xMOOCs have the following common design features:

5.3.1.1 Specially designed platform software

Most very large xMOOCs use specially designed platform software such as Coursera, edX or FutureLearn 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. The software platform also allows the companies that provide the software to collect and analyse student data.

However, more and more smaller institutions are offering their own xMOOCs through using or adapting their continuing education online registration process, their own video servers, and 'off-the-shelf' automated feedback, testing and marking tools.

5.3.1.2 Video lectures

xMOOCs use the standard lecture mode, 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. As well, xMOOC *courses* 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 them and streaming them on demand), full studio production, or desk-top recording by the instructor.

5.3.1.3 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 most cases these will be computer-marked.

5.3.1.4 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.

5.3.1.5 Supporting materials

Sometimes copies of slides, supplementary audio files, urls to other resources, and online articles may be included for downloading by participants.

5.3.1.6 A shared comment/discussion space

These are places where participants can post questions, ask for help, or comment on the content of the course.

5.3.1.7 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. 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 comments to identify common areas of concern shared by a number of participants then the instructor and/or the teaching assistants will respond. However, in most cases, participants moderate each other's comments or questions.

5.3.1.8 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 in most cases not been recognised for credit or admission purposes even by the institutions offering a MOOC – even when the lectures are the same as for on-campus students. Little evidence exists to date about employer acceptance of MOOC qualifications (see for instance, Banks and Meinart, 2016 or Gatuguta-Gitau, 2017). However, with the increasing development of partnerships between major employers and MOOC providers to develop microcredentials, this may change (see for example, Gordon, 2018).

5.3.1.9 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. For examples of the use of learning analytics in MOOCs, see Laveti et al., 2017 or Eradze and Tammets, 2017.

5.3.1.10 xMOOCs Summary

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. Thus there is a highly behaviouristic/objectivist epistemology underlying xMOOCs.

5.3.2 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.

5.3.2.1 Key design principles for cMOOCs

Downes (2014) has identified four key design principles for cMOOCs:

- **autonomy of the learner:** although whoever organises the MOOC will usually choose a main topic and invite participants, there is no formal curriculum; participants decide what to discuss, what to read, and what they wish to contribute towards the topic;
- **diversity:** in the tools used, the range of participants, their knowledge levels, and the 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 the sharing and flow of knowledge between participants.

5.3.2.2 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, at the moment the following are key design practices 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 openly accessible '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. Thus the use of loosely linked or connected social media is a key design component of 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. Indeed, there may be no formally identified instructor. In practice though cMOOC organisers (who themselves tend to have some expertise in the topic of the MOOC) 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 which form the basis of discussion and debate. 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) by 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.

5.3.2.3 cMOOCs summary

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.

cMOOCs have a very different educational philosophy from xMOOCs. Downes and Siemens have argued that cMOOCs reflect a new theory of learning, 'connectivism', based on exploiting online social networks (see Chapter 2.6). cMOOCs certainly reflect a constructivist epistemology.

5.3.3 Other variations of MOOCs

I have deliberately focused on the differences in design between xMOOCs and cMOOCs, and Mackness (2103) 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. Pilli and Admiraal (2016) have identified 27 types of MOOC, including:

- *cMOOCs;*
- *xMOOCs;*
- *BOOCs* (a big open online course) – a cross between an xMOOC and a cMOOC;
- *COOC*s (community open online courses) – small-scale, non-profit courses that corporations open online to provide courses for customers and/or employees
- *DOCCs* (distributed open collaborative course): this involves 17 universities sharing and adapting the same basic MOOC;
- *LOOC* s(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;

The MOOCs developed by the University of British Columbia 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.

5.3.4 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 (see Chapter 4, Section 4);
- 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.

It is likely that innovation in MOOC design and the way MOOCs are used will continue. In particular, different kinds of MOOC come and go. Finding extant examples of some of the types of MOOC listed in Section 5.3.3 has been difficult in revising this chapter.

However, some of these developments also indicate a good deal of confusion around the definition and goals of MOOCs, especially regarding massiveness and open-ness. 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, often the result of the initiative of an individual instructor, are to be welcomed in principle, 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 philosophy, 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 to 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. For more on this topic, see Chapter 11.

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Activity 5.3: 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?

For my comments on these questions click on the podcast below:

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=154

5.4 Strengths and weaknesses of MOOCs

Figure 5.4.1 MOOC users tend to be male, well-educated, with about 40-60% from other countries. Image: Depositphotos, 2019

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

5.4.1 The research on MOOCs

At the time of writing (2019), MOOCs are still less than ten years old, whereas online courses for credit have been around for more than 20 years. The latter have been subject to much more independent research, although this prior research was largely ignored in the design of the early MOOCs. A lot 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.

In this chapter, I have drawn on available evidence-based research 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, rather than something based on evidence-based research.

Lastly, it should be remembered in this evaluation 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?

5.4.2 Open and free education

5.4.2.1 The 'open-ness' of MOOCs

MOOCs, particularly xMOOCs, deliver high quality content from some of the world's best universities 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 education. Who could argue against this?

However, MOOCs are 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. There are also lessons we can learn from these earlier forms of open and free education that also apply to MOOCs.

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.

5.4.2.2 A replacement for conventional education?

It is worth noting that these earlier forms of open and free education 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, MOOCs work best when people are already reasonably well educated. There is no reason to believe then 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.

5.4.2.3 The answer for education in developing countries?

There have been many attempts to use educational broadcasting and satellite broadcasting in developing countries to open up education for the masses (see Bates, 1984), and they all substantially failed 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 face-to-face support for learners without high levels of education;

- the need to adapt content to the culture and needs 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 developing countries is not for university courses from high-level Stanford University professors, but for low cost, good quality high school education.

Although mobile phones and to a lesser extent tablets are widespread in Africa, they are relatively expensive to use. For instance, it costs US$2 to download a typical YouTube video – equivalent to a day's salary for many Africans. Streamed 50 minute video lectures then have limited applicability.

Lastly, it is frankly immoral to allow people in developing countries to believe that successful completion of MOOCs will lead to a recognised degree or to university entrance in the USA or in any other economically advanced country, at least under present circumstances.

This is not to say that MOOCs could not be valuable in developing countries, but this will mean:

- being realistic as to what they can actually deliver;
- working in partnership with educational institutions and systems and other partners in developing countries;
- 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.

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 5.4.8.

5.4.3 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 per cent 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.

5.4.4 Persistence and commitment: the onion hypothesis

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 per cent);
- **only viewed**: non-certified registrants who access the courseware, accessing less than half of the available chapters (56 per cent);
- **only explored**: non-certified registrants who access more than half of the available chapters in the courseware, but did not get a certificate (4 per cent);
- **certified**: registrants who earn a certificate in the course (5 per cent).

Hill (2013) has identified five types of participants in Coursera courses:

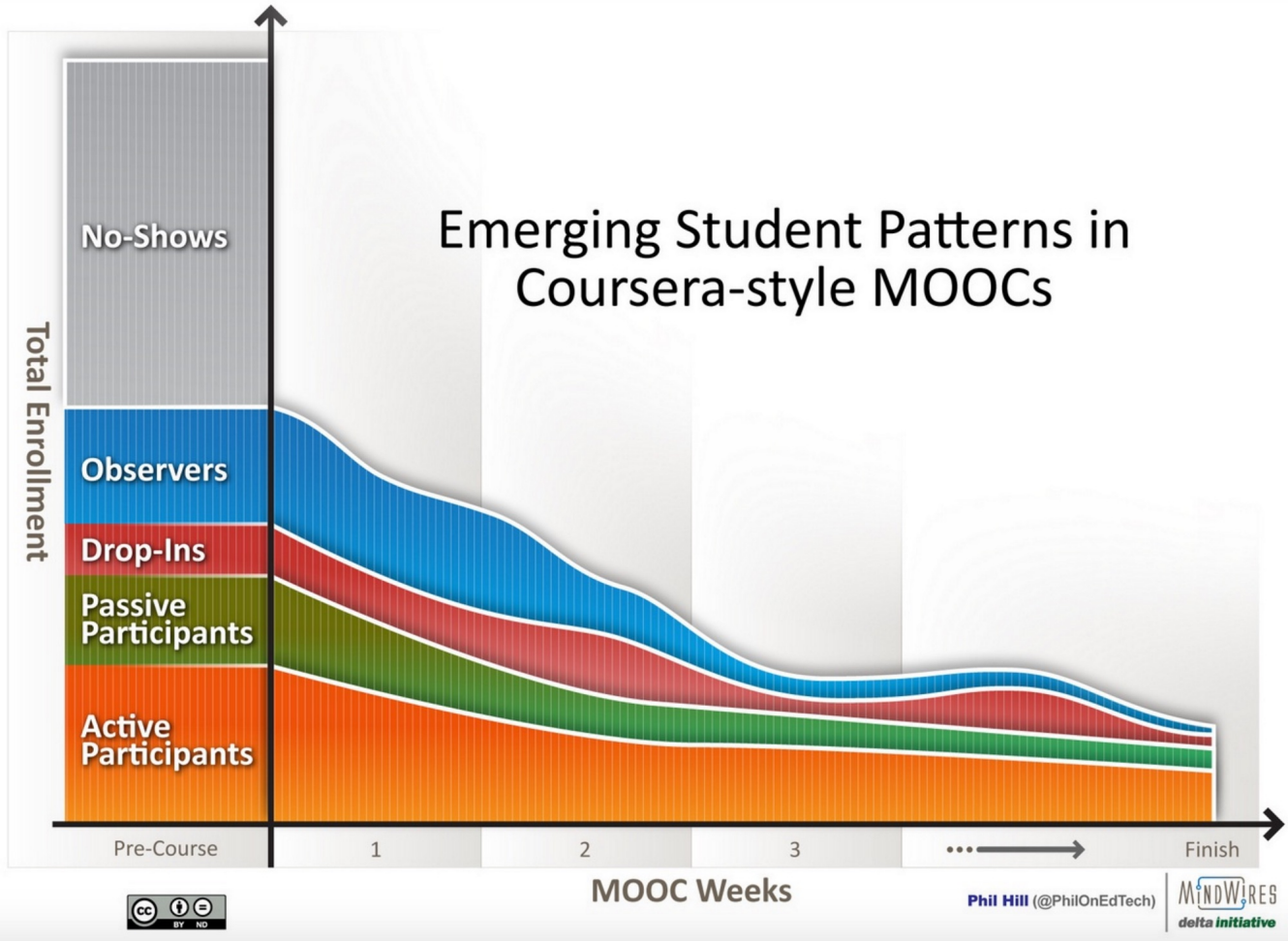


Figure 5.4.2 Image: Phil Hill, 2013

Engle (2014) found similar patterns (also replicated in other studies) for the University of British Columbia MOOCs on Coursera :

- 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 per cent 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).

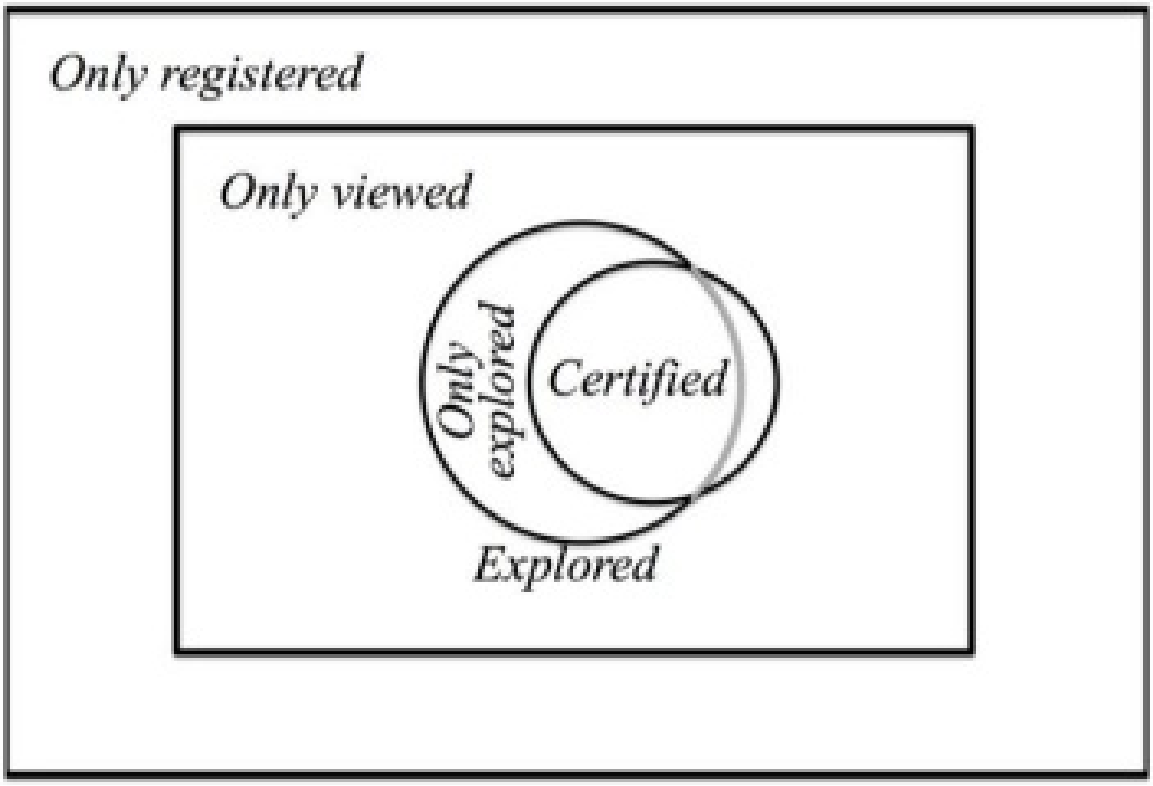
Milligan et al. (2013) found a similar pattern of commitment in cMOOCs, from interviewing a small sample of participants (29 out of 2,300 registrants) about halfway through a cMOOC:

- 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 (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:

Four Mutually Exclusive and Exhaustive Categories of Course Registrants (see Figure 2)



Only Registered: Registrants who never access the courseware.

Only Viewed: Non-certified registrants who access the courseware, accessing less than half of the available chapters.

Only Explored: Non-certified Registrants who access more than half of the available chapters in the courseware.

Certified: Registrants who earn a certificate in the course.

Figure 5.4.3 Level of participation in MOOCs © Ho et al., 2014

This is remarkably similar to what I wrote in 1984 about the onion hypothesis of educational broadcasting in Britain (Bates, 1984):

> (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.

5.4.5 What do students learn in MOOCs?

This is a much more difficult question to answer, because so little of the research to date (2019) 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.

5.4.5.1 Conceptual learning

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. Colvin and colleagues 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 (for more on the 'no significant difference' phenomenon in media comparisons, see Chapter 10, Section 2.2). 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.

5.4.5.2 The student experience

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 conceptual analysis required for academic learning. There is evidence from studies of credit-based online learning that 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, and so on, are being met, and to ensure the necessary input and guidance to seek deeper understanding (see in particular Harasim, 2017).

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, Lave and Wenger, 1991, or Barkley, Major and Cross, 2014), and these findings certainly have not been generally applied to the management of MOOC discussions.

5.4.5.3 Networked and collaborative learning

One counter argument is that cMOOCs in particular develop a new form of learning based on networking and collaboration that is essentially different from academic learning, and cMOOCs 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. cMOOCs 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. All 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.

5.4.5.4 The need for learner support

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. The US State Department organized MOOC camps through US missions and consulates abroad to mentor MOOC participants. The camps included 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, paid 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. For instance, the University of Edinburgh experimented with an automated 'teacherbot' that crawled through student and instructor Twitter posts associated with a MOOC and directed predetermined comments to students to prompt discussion and reflection (Bayne, 2015). These results and approaches are consistent with prior research on the importance of instructor presence for successful online learning in credit-based courses (see Chapter 4.4.3).

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.

5.4.6 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 6, Section 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.

5.4.6.1 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.

5.4.6.2 Peer assessment

Another 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 assessing other participants.

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. 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 another 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 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.

5.4.6.3 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 longer essays where higher level intellectual skills are demanded.

5.4.6.4 Badges, certificates and microcredentials

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. However, 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.

MOOC-based microcredentials are a more recent development.A microcredential is any one of a number of new certifications that covers more than a single course but is less than a full degree. Pickard (2018) provides an analysis of more than 450 MOOC-based microcredentials. Pickard states:

> *Microcredentials can be seen as part of a trend toward modularity and stackability in higher education, the idea being that each little piece of an education can be consumed on its own or can be aggregated with other pieces up to something larger. Each course is made of units, each unit is made of lessons; courses can stack up to Specializations or XSeries; these can stack up to partial*

degrees such as MicroMasters, or all the way up to full degrees (though only some microcredentials are structured as pieces of degrees).

However, in her analysis, Pickard found that in the micro-credentials offered through the main MOOC platforms, such as Coursera, edX, Udacity and FutureLearn.;

- *student fees range from US$250 to US$17,000;*
- *some microcredentials, though not all, offer some opportunity to earn credit towards a degree program. Typically, university credit is awarded if and only if a student goes on to enroll in the particular degree program connected with the microcredential;*
- *they are not accredited, recognized, or evaluated by third party organizations (except insofar as they pertain to university degree programs). This variability and lack of standardization poses a problem for both learners and employers, as it makes it difficult to compare the various microcredentials;*
- *with so much variability, how would a prospective learner choose among the various options? Furthermore, without a detailed understanding of these options, how would an employer interpret or compare these microcredentials when they come up on a resume?*

Nevertheless, in a digital age, both workers and employers will increasingly look for ways to 'accredit' smaller units of learning than a degree, but in ways that they can be stacked towards eventually a full degree. The issue is whether tying this to the MOOC movement is the best way to go.

Surely a better way would be to develop microcredentials as part of or in parallel with a regular online masters program. For instance as early as 2003, the University of British Columbia in its online Master of Educational Technology was allowing students to take single courses at a time, or the five foundation courses for a post-graduate certificate, or add four more courses and a project to the certificate for a full Master's degree. Such microcredentials would not be MOOCs, unless (a) they are open to anyone and (b) they are free or at such a low cost anyone can take them. Then the issue becomes whether the institution will accept such MOOC-like credentials as part of a full degree. If not, employers are unlikely to recognise such microcredentials, because they will not know what they are worth.

5.4.6.5 The intent behind assessment

To evaluate assessment in MOOCs requires an examination of the intent behind assessment. There are many different purposes behind assessment (see Chapter 6, Section 8). Peer assessment and immediate feedback on computer-marked tests can be extremely valuable for *formative* assessment or feedback, 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 (for example, 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.

5.4.7 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.

5.4.8 Costs and economies of scale

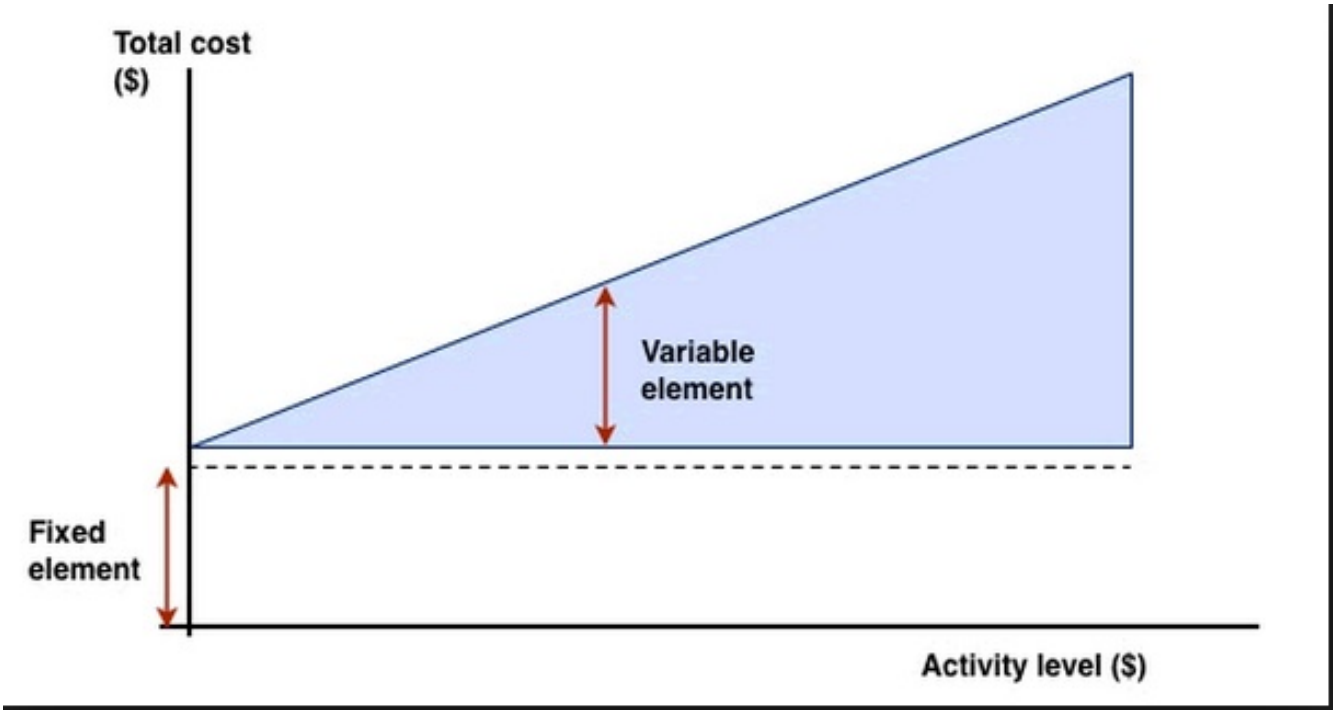


Figure 5.4.8 The MOOC value proposition is that MOOCs can eliminate the variable costs of course delivery. Image: © OpenTuition.com, 2014

One main strength claimed for MOOCs is that they are free to participants. Once again 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.

5.4.8.1 The cost of MOOC production and delivery

There is still very little information to date on the actual costs of designing and delivering a MOOC as there are not enough published studies to draw firm conclusions about the costs of MOOCs. However 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. 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 per cent 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 per cent) 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 (that is, 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.

5.4.8.2 The comparative costs of credit-based online courses

The main cost factors or variables in *credit-based* online and distance learning are relatively well understood, from previous research by Rumble (2001) and Hülsmann (2003). Using a similar costing methodology, I tracked and analysed the cost of an online master's 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.

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 per cent 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. Thus in credit-based online learning, delivery costs tend to be more than double the development costs over the life of a program.

The main difference then 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.

5.4.8.3 Opportunity costs

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.

5.4.8.4 Comparing the cost of MOOCs with online credit courses

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 MOOC unit costs are very low, combining both production and delivery costs. 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. 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. 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.

5.4.8.5 Costs versus outputs

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. MOOCs then 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.

5.4.8.6 MOOC business models and cost-benefits

In terms of sustainable business models, Baker and Passmore (2016) examined several different possible business models to support MOOCs (but do not offer any actual costing). 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 or from 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.

5.4.9 Summary of strengths and weaknesses

The main points of this analysis of the strengths and weaknesses of MOOCs can be summarised as follows:

5.4.9.1 Strengths

- MOOCs, particularly xMOOCs, deliver high quality content from some of the world's best universities for free or at little cost to anyone with a computer and an Internet connection;
- MOOCs can be useful for opening access to high quality content, particularly in developing 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;
- 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.

5.4.9.2 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 completing 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 digital 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.

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Activity 5.4 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?

I give my own personal views on these questions in the podcast below, but I'd like you to come to your own conclusions before listening to my response, because there are no right or wrong answers here:

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=159

5.5 Political, social and economic drivers of MOOCs

Figure 5.5 MOOC mania
Image: © Park Ridge Underground, 2010

5.5.1 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 understandably feel 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.

5.5.2 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.

5.5.3 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 one in three students in the USA were were taking online courses (Allen and Seaman, 2014). Furthermore, at least in Canada, the online courses were often getting good completion rates and matching on-campus courses for quality (Ontario, 2011).

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. At the same time, the involvement of the Ivy League universities in online learning for the first time gave credibility to MOOCs, and, inadvertently, online learning as a whole.

5.5.4 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, 2016).

However, although online learning in credit courses had been quietly absorbed into the mainstream of university teaching, without any signs of major disruption, MOOCs were a potentially massive change, evidence at long last for the theory of disruption in the education sector.

5.5.5 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 completed MOOCs.

5.5.6 It's the economy, stupid!

Of all the reasons for MOOC mania, Bill Clinton's famous election slogan resonates the most. 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 cent per annum over the last 10 years, compared with an inflation rate of 4 per cent per annum. Here at last was a possible way to rein in the high cost of higher education. By 2015 though the economy in the USA had picked up and revenues were flowing back into state coffers, and so the immediate pressure for more radical solutions to the cost of higher education began to ease.

5.5.7 The future of MOOCs

It will be interesting to see if MOOC mania continues as the economy grows. Class Central provides ongoing monitoring of developments in MOOCs around the world. The overall numbers up to 2019 are impressive but the number of learners added in 2018 was just 20 million, which was less than 23 million for the previous two years (Shah, 2019). So the rate at which new users are coming into the MOOC space is decreasing.

However, MOOCs continue to evolve. For a start, there has been a slow growth in complete degrees that can be offered through MOOCs. In 2018 there were 45 degrees on offer. While this is a significant development, though, the numbers are still quite small, given the number of conventional degrees available worldwide. The other main market is corporate training. Business models are also evolving with revenues continuing to increase into 2018, with Coursera alone recording $140 million in revenues.

However, although the number of MOOC courses offered continues to increase, the average number of students is decreasing as more choices become available.

The rate of adoption also varies considerably by country. For instance in 2017, only 18% of Canadian post-secondary institutions were offering MOOCs, compared with 82% that were offering fully online courses for credit (Donovan et al., 2018). However, the growth of MOOCs in China, India and Europe continues apace. What is not clear is whether the institutions providing MOOCs are getting any direct financial returns for their investments as distinct from the platform providers.

5.5.8 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 basic 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 for institutions 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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For a more light-hearted look at MOOC mania see:

North Korea Launches Two MOOCs

"What should we do about MOOCs?" – the Board of Governors discusses

NOTE: Both the two blog posts above are satirical: they are fictional!

Activity 5.5 Assessing the importance of MOOCs

1. Do you think MOOCs have improved or weakened public acceptance of online learning? Why?
2. On a scale of 1 to 10, where 1 is no importance and 10 is extremely important, where would you rank MOOCs in terms of their importance for the future of higher education? Why?
3. Do you think MOOCs will improve to the point where they are a serious alternative to other forms of higher education, or do you think they will never be a real challenge to conventional university teaching? What are your reasons?

Once again, my views should carry no more weight than yours on these questions, as they are value rather than fact based, but here are my thoughts, for what they are worth:

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=162

5.6 Why MOOCs are only part of the answer

Image: Your Training Edge, 2015

5.6.1 The importance of context and design

I am frequently labelled 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, 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 Alzheimer's 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.

5.6.2 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 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, both on campus, such as problem- or inquiry-based learning, and online using more constructivist approaches in credit courses, such as online collaborative learning. However 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.

However xMOOCs are valuable 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. They are not a replacement though for either conventional education or the current design of online credit programs. 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.

5.6.3 Undermining the public higher education system?

The real danger is that xMOOCs may be used to undermine what is admittedly an expensive public higher education system. If elite universities can deliver MOOCs for free, why do we need low quality and high cost state universities? The risk is a sharply divided two tier system, with a relatively small number of campus-based elite universities catering to the rich and privileged, and developing the knowledge and skills that will provide rich rewards, and the masses being fed xMOOC-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).

Content accounts for less than 15 per cent of the total cost over five years for credit-based online programs; 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. On their own, 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 all.

5.6.3 The potential of cMOOCs

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 every participant has the power to define and solve the problems being tackled.

Scenario F that ends this chapter is an example of how cMOOCs could be used for such 'good civil ventures.' In Scenario F, the MOOC is not a replacement for formal education, but a rocket that needs formal education as its launch pad. 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, there is the danger that even cMOOCs could be manipulated by corporate or government interests.

5.6.5 In conclusion

Having said that, there is enormous scope for improvements within the public higher education system. MOOCs, open education and new media offer promising ways to bring about some much needed improvements. Scenario F (next) is one possible way in which MOOCs could bring about much needed social change.

However, MOOCs must build 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 5.6: 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 per cent 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?

Since there are many pros and cons regarding MOOCs, I am not going to give direct feedback on this activity, because the 'best' briefing will take account of local contexts, such as existing online provision for credit courses, learning technology support and enrolment goals, for instance.

Chapter 5: 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 nor 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. There are currently 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.

5. 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

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.

5.6.6 Next

This completes the discussion about different design models for teaching and learning. The next chapter looks at the importance of building an effective learning environment in which these different design models can best operate.

But first, Scenario F, which envisions what MOOCs could look like in the future.

Scenario F: How to cope with being old

Figure F 1. Image: WhatSheSaidradio.com

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 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. So 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.]

Chapter 6: Building an effective learning environment

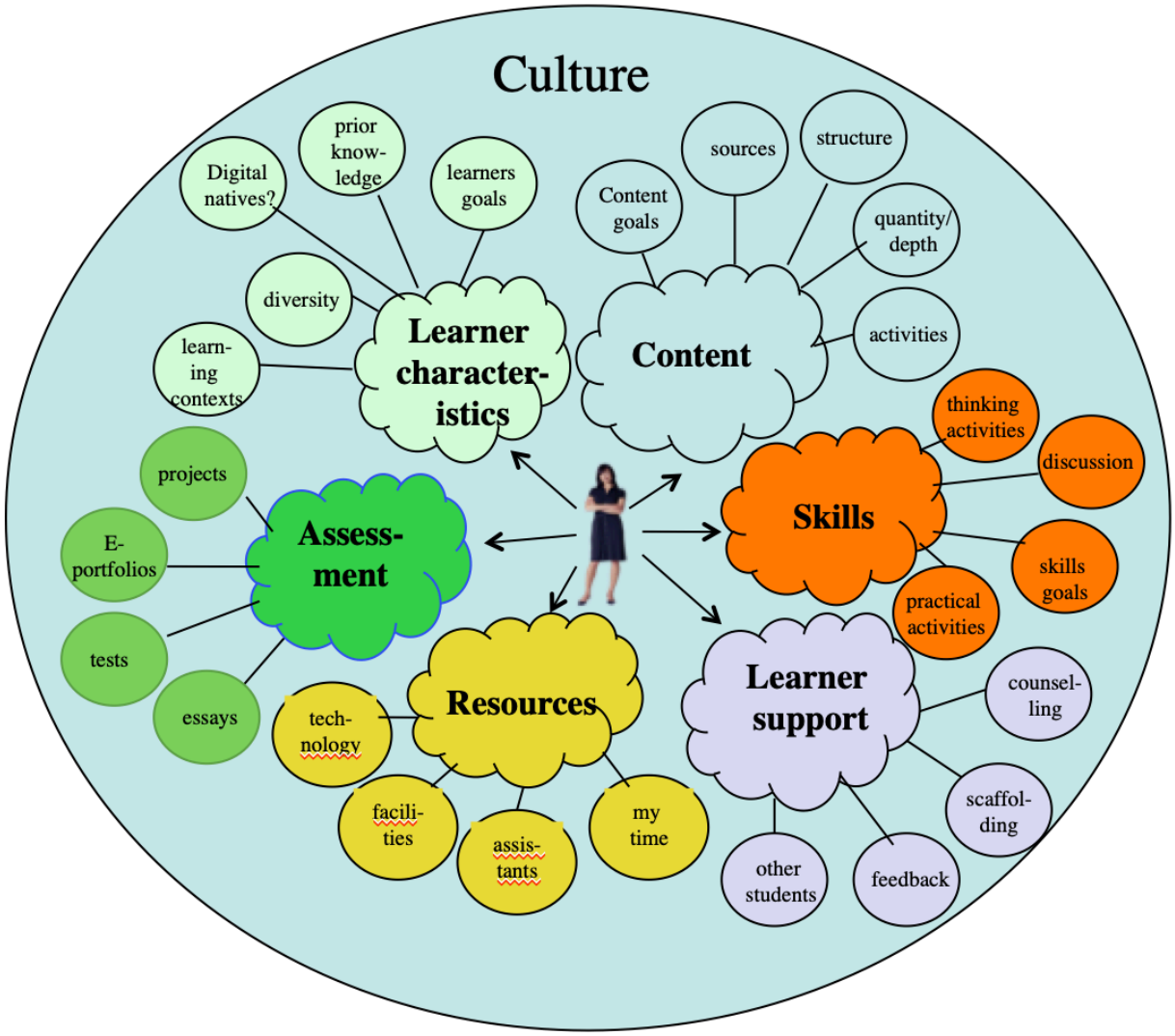

Figure 6.1 An example of a learning environment

Purpose of this appendix

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

Building a comprehensive and effective learning environment is an important condition for implementing teaching and learning for the digital age. This appendix 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:

Also in this chapter you will find the following activities:

Key Takeaways

1. Context – the learning environment – will influence or determine teaching strategies, as well as epistemology and pedagogy
2. Thus to be able to design effective teaching, it is necessary to create an effective learning environment.
3. Effective learning environments will have a number of different components, and these components will vary, depending on context and the epistemology that drives teaching
4. The aim of building an effective learning environment is to enable more flexible models of learning design to be created and applied.

6.1 Integrating design principles within a rich learning environment

Nature as a learning environment

6.1.1 The importance of creating an effective learning environment

Chapters 1 to 5 provide a set of methods for teaching in a digital age. These methods though will not operate in a vacuum. Both teachers and learners are faced with a rapidly changing world, with new technology, new teaching approaches and external pressures from government, employers, parents, and the media. It is easy to be tossed around in such a stormy environment. Learning always takes place

within a context that can influence how and what we learn. Good teachers and instructors try to shape the environment in which they are teaching to create the right conditions for learning. This becomes even more important in a volatile, uncertain, complex and ambiguous world.

6.1.2 Learning environments and epistemology

First though we need to examine two very different approaches to teaching and learning. One approach starts with an objectivist view of the world. Knowledge is like coal. It is there to be mined by the teacher and transported to the learner. The learner's job is to acquire that coal or knowledge and then use it as necessary, either with or without the help of the teacher. This seems to me to be the approach of most xMOOCs and most classroom lectures. There is little attention if any paid to the conditions in which such learning will best take place.

Another approach starts from the assumption that learning is a fundamental human activity. Humans have become the dominant species because they have a need and above all an inherited ability to learn. If we had not been reasonably good at learning, we would have been killed off early in the earth's history by faster, bigger and more ferocious animals. The ability not only to learn, but to learn in abstract and conscious ways, is therefore part of human nature.

If that is the case, a teacher's job is not to do the learning for the student, but to build a rich environment that facilitates the kind of learning that will benefit the learner. It is not a question of pouring knowledge into a student's head, but enabling the learner to develop concepts, think critically, and apply and evaluate what they have learned, by providing opportunities and experiences that are relevant to such goals.

The analogy here is gardening. Humans are like plants: all we need to do is to provide the right conditions for them to grow: the right soil, sufficient sunshine and water, and help eliminating pests and weeds. In terms of humans, this means providing security, and the best conditions for learning. This is a very constructivist view of the world. This seems to me to be the approach of most cMOOCs and most early childhood education. However, there is little attention paid to priorities or to efficiency in learning.

A second premise is that knowledge is not fixed or static, but is continually developing. Our concept of heat changes and becomes richer as we grow older and become more educated, from understanding heat through touch, to providing a quantitative way of measuring it, to understanding its physical properties, to being able to apply that knowledge to solving problems, such as designing refrigerators. In a knowledge-based society, knowledge is constantly developing and growing, and our understanding is always developing.

6.1.3 What learning environments do we want?

Why thinking about effective learning environments is important is because most teachers currently inherit a teaching environment, usually based on a campus, physical classrooms, regularly scheduled lessons, with the expectation of the teacher in control at the front of the class. However, new technologies provide us with the opportunity to design other kinds of learning environments. What do we want to be: coal miners – or gardeners? Or something else? My own view is that the ideal learning environment is somewhere in between coal mining and gardening. Most learners require structure and guidance, but within an environment that enables freedom and exploration.

In developing an effective learning environment, there are another two issues that need to be addressed:

- First, it is the learner who has to do the learning.
- Second, any learning environment is much more than the technology used to support it.

With regard to the first, teachers cannot do the learning for the learner. All teachers or instructors can do is to create and manage an environment that enables and encourages learning. My focus then in terms of building an effective learning environment is on what the teacher or instructor can do, because in the end that is all they can control. However, the focus of what the teacher does should be on the learner, and what the learner needs. That of course will require good communication between the learners and the teacher.

For this reason, I want to examine some of the fundamental components of most effective teaching environments. Not only will this provide some general guidance for the design of teaching, it will also allow consideration of technology-based learning environments that can fundamentally differ from traditional campus-based environments, while at the same time ensuring conditions for successful learning. I set out these components or conditions in the following sections.

Activity 6.1 Your current students' learning environment

1. If you are currently teaching, describe briefly the student learning environment within which they are learning. What are the restrictions, if any, on their learning as a result of this environment?
2. What do you think are the most important components for effective learning within this environment (as well as your teaching)?
3. Are you more of a coal miner or a gardener in your approach to teaching?

There is no feedback from me on this activity. It is for your own reflection.

6.2 What is a learning environment?

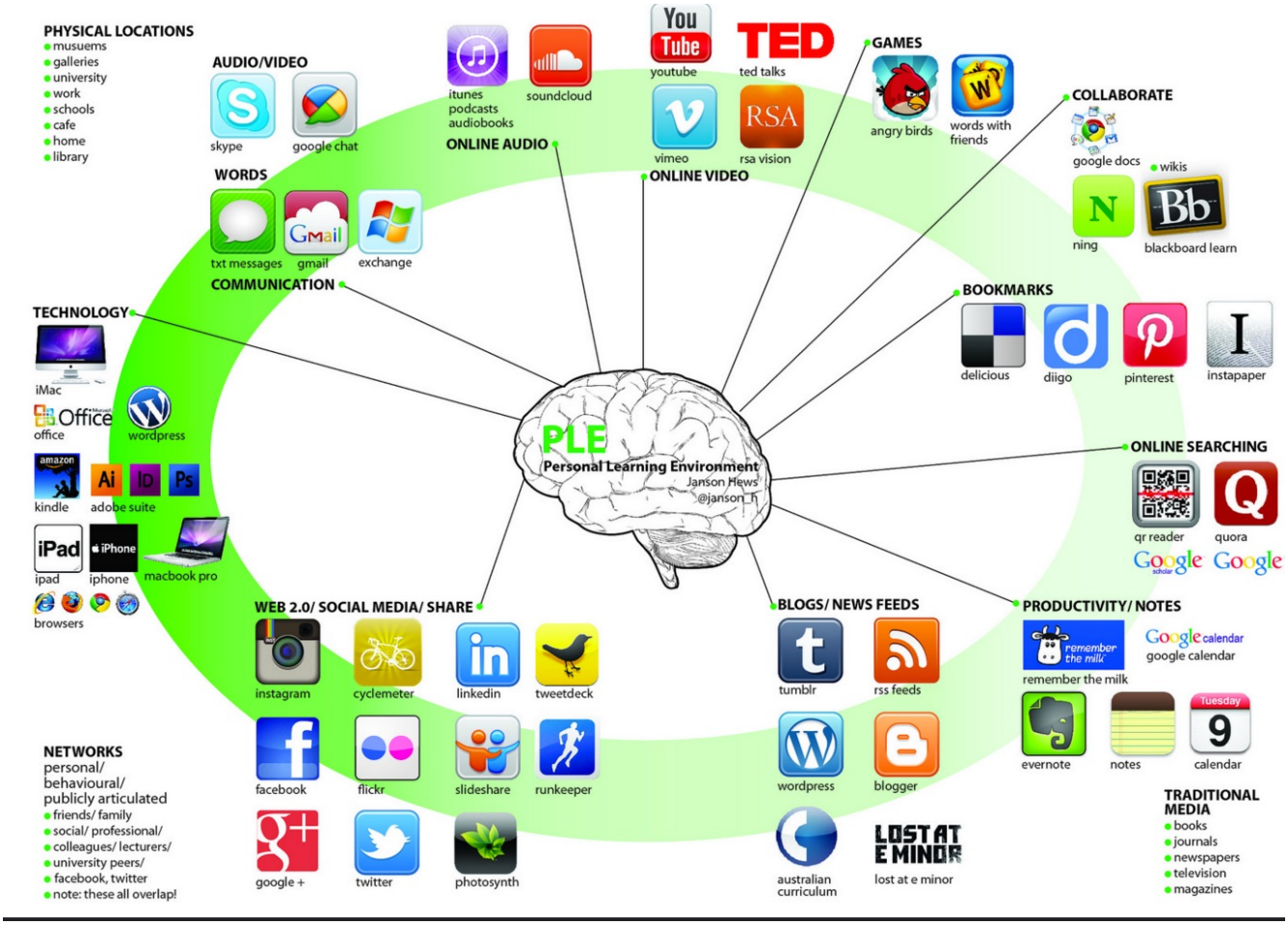

Figure 6.2.1 A technology-based personal learning environment
Image: Jason Hews, Flikr

6.2.1 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.

6.2.2 Types of learning environments

Here are some examples of different learning environments:

- a school or college campus
- an online course
- military training
- friends, family and work
- nature
- personal, technology-based, learning environments

Nevertheless I will argue that despite the differences in context, there are certain elements or components that will be found in most effective learning environments.

6.2.3 Components of an effective learning environment

Developing a total learning environment for students in a particular course or program is probably the most creative part of teaching. Although 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 learning environments such as learning management systems, learning environments are broader than just these physical components. They will also include:

- the characteristics of the learners and their means of inter-communication;
- the goals for teaching and learning;
- the activities that support learning;
- the resources that are available, such as textbooks, technology, or learning spaces;
- the assessment strategies that will best measure and drive learning;
- the culture that infuses the learning environment.

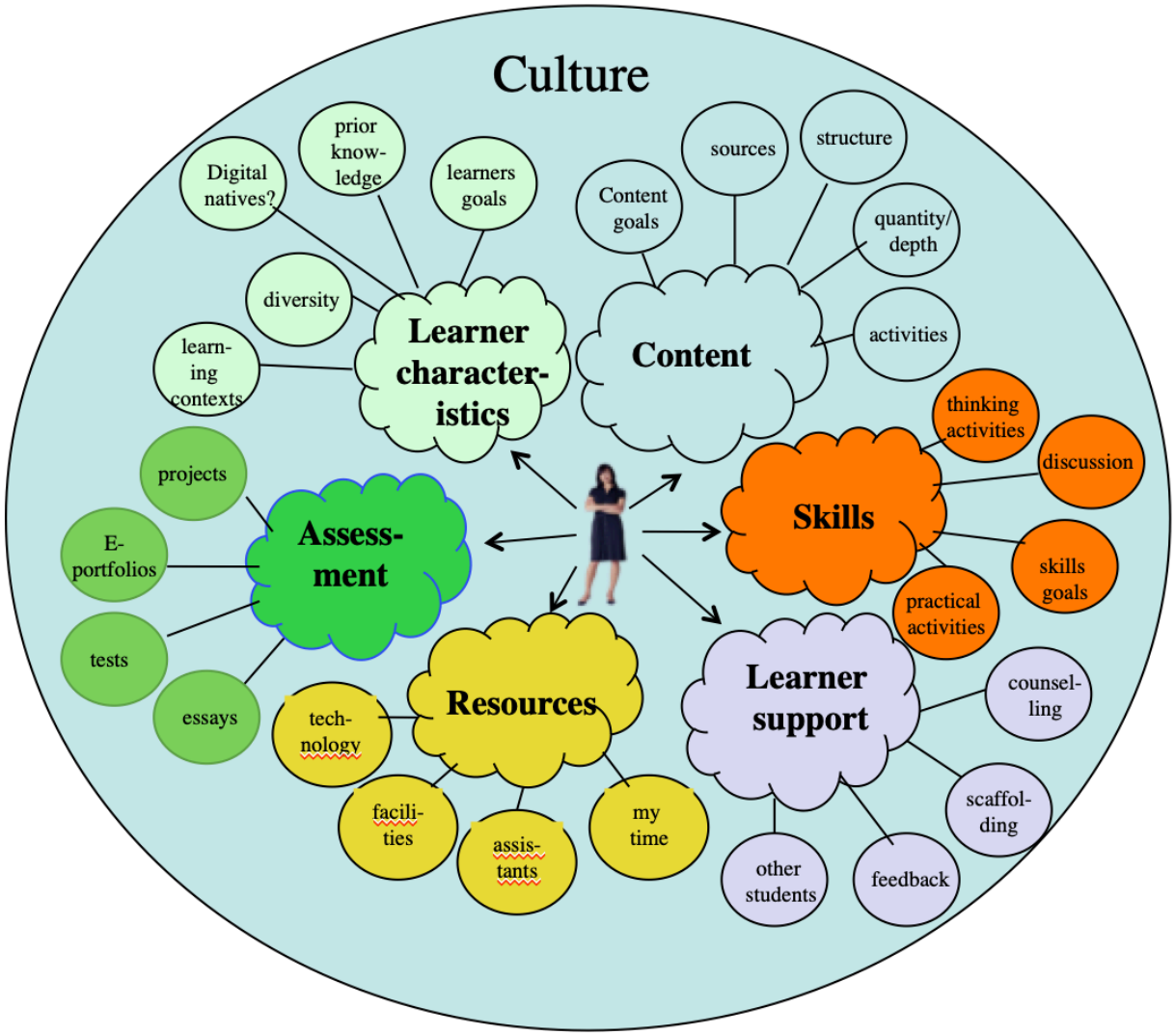

Figure 6.2.2 An example of a learning environment

Figure 6.2.2 illustrates one possible learning environment from the perspective of a teacher or instructor. A teacher 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, and so on) where the real decisions need to be made.

I have listed just a few components in Figure 6.2.2 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 often capable of creating their own, personal, relatively autonomous learning environments.

The significant point is that it is important to identify those components that need to be considered in teaching a course or program. 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 in the following sections, with a focus on the components of a learning environment that are particularly relevant for a digital age.

Activity 6.2 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? Could you design a similar model of a learning environment from the perspective of a learner? What would be the main differences?
2. In order to create the learning environment for HIST 305 in Scenario D, 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 6.2.2?
4. What is missing in Figure 6.2.1 – the technology-based personal learning environment? For what kind of purpose would it work really well?
5. Does thinking about the whole learning environment overly complicate the teaching endeavour? Why not just get on with it?

For my feedback on this activity, click on the podcast below.

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https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=360

6.3 Learner characteristics

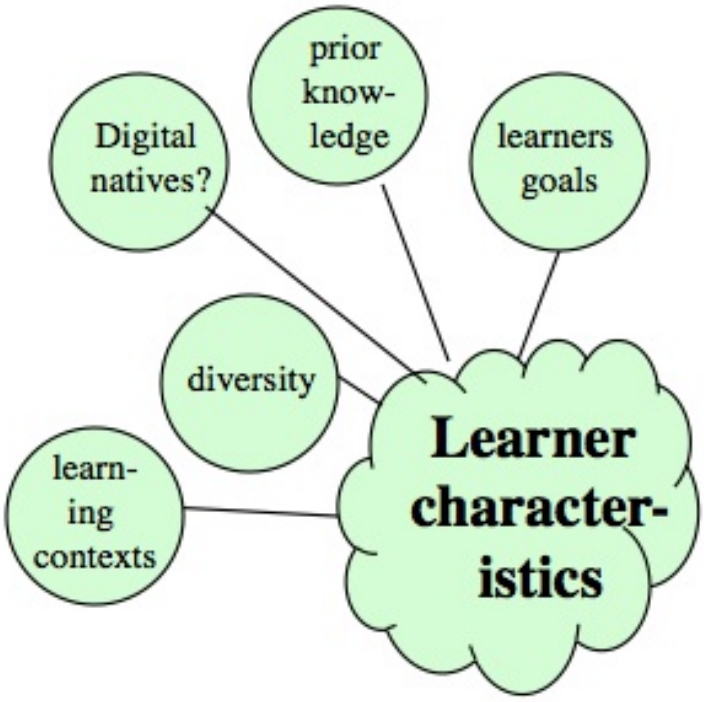

Figure 6.3 Learner characteristics

Probably nothing more reflects teaching in a digital age than the change in learner characteristics from the industrial age.

6.3.1 Increased diversity

I noted in Chapter 1 (Section 6) 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.

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.

6.3.2 The work and home context

Two factors make the work and home context an important consideration in the design of teaching and learning: students 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, 2010); and the age range of students continues to spread, with the average age of students slowly increasing (in 2016, at the University of British Columbia Vancouver, the average age of undergraduates was 21, and the mean age for graduate students was 31 – UBC, 2017.)

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 graduate 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.

6.3.3 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.

6.3.4 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. At the same time, some 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.

6.3.5 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, 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. (For more on the issue of digital natives, see Chapter 9, Section 2.3)

6.3.6 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.

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University of British Columbia (2017) *2016/2017 Annual Report on Enrolment* Vancouver BC: University of British Columbia

Vygotsky, L. (1978) *Mind in Society: Development of Higher Psychological Processes* Cambridge MA: Harvard University Press

Activity 6.3 Who are your students?

1. How would you characterise the students you are teaching: full-time students from high school; students who are working part-time; or students working full-time? How would a typical class of yours break down between these three groups? Do you have the information necessary to do this analysis?

2. Do you think students think or study differently these days because of social media? How does that affect their studying? Do you feel you need to respond in some way to this?

3. How much variance is there between your students in prior knowledge and/or language ability? How does this affect the way you teach?

You may want to read Chapter 9, Section 2 and Chapter 10, Section 3 before you answer these questions.

This exercise is mainly for your reflection, but I do have a few comments on these issues in the podcast below:

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6.4 Managing content

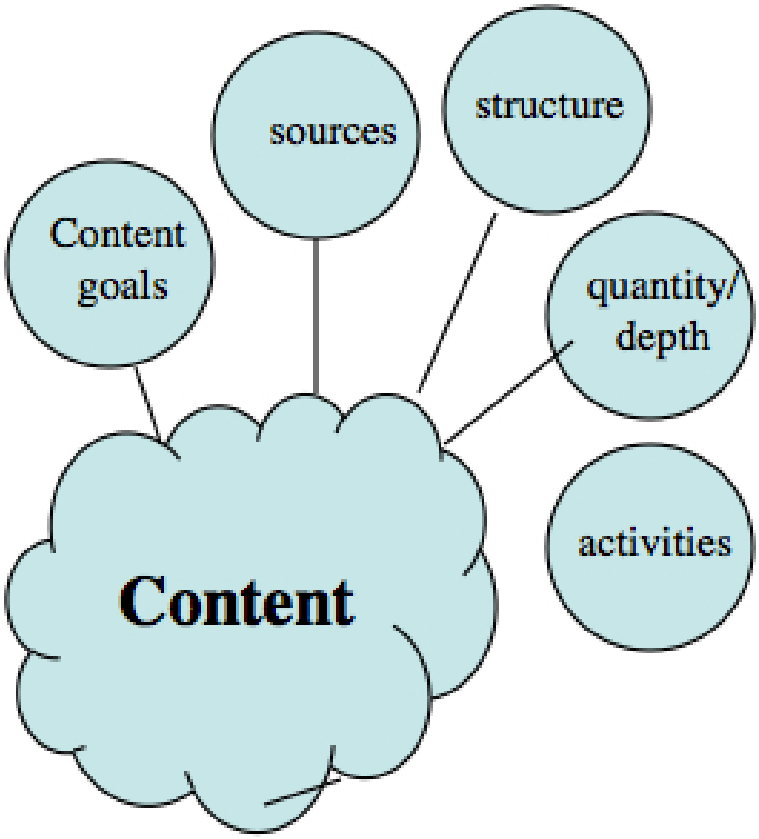

Figure 6.4.1 Managing content

6.4.1 The importance of content

For most teachers and instructors, content is often the key focus when designing courses. 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 organising and delivering content.

The case for balancing content with skills development is made several times through this book, 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 is essential for meeting the learning outcomes for this course, and what desirable but not necessarily obligatory?’

6.4.2 Goals for content

Especially in post-secondary education, instructors tend to take content for granted – this is what we teach. However, 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. As content is now so easy to access, do we need only to draw on content as and when needed, such as to solve problems, or make decisions? In many cases, of course, skills depend essentially on prior knowledge, so it is not an either/or question.

Probably more important than the teacher or 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 depends of course on having very clear goals for the course or program as a whole.

6.4.3 Quantity and depth

Figure A.4.2 Is there too much content in your course?
Image: © handyguyspodcast.com

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.

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.

6.4.4 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. 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.

6.4.5 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. (You can see how this mirrors an industrial manufacturing process). However, new technologies provide alternative means to structure content. Learning management systems such as Blackboard or Moodle still enable instructors to select and sequence content material, but students can access this – and other – content 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.

6.4.6 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.

6.4.7 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.

Activity 6.4 Managing content

1. Look at the overall content in one of the courses or classes you are teaching.
    - How much choice do you have over the content in this course? (In at least two ways: the choice of topics; the way content is approached. For instance often in high schools in many economically advanced countries, the curriculum is decided at a state or provincial level, but within that, teachers have a good deal of freedom about how to teach that curriculum.)
    - What purpose does this content serve? Does it have value in its own right or is it there to serve other purposes (such as skills development)?
    - What would be the best source of this content for students: textbook, lecture, online search, other, all of these? Why?
    - What activities are provided to enable students to learn or apply the content in this course? Given the goals of this course, are the activities appropriate?
    - How does the content in this course link to content in related courses (both prior and subsequent to this course)? Is it essential to what follows, does it duplicate what students have covered elsewhere? How do you know this? (e.g. is there a curriculum development process?)
    - Given the goals or learning outcomes for this course, what content could be removed without compromising the achievement of these goals?

There is no feedback on this activity.

6.5 Developing skills

Figure 6.5 Skills

6.5.1 Skills in a digital age

In Chapter 1, Section 1.2, I listed some of the skills that graduates need in a digital age, and argued that consequently a greater focus is now needed 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.

6.5.2 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. Skills development is discussed throughout the book, but particularly in:

- Chapter 1, Section 2
- Chapter 3, Section 5 and Section 6
- Chapter 4, Section 5
- Chapter 11, Section 4

6.5.3 Thinking activities

These include activities that enable students to practice a range of skills, such as critical thinking, problem solving, and decision-making. 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. With practice and experience, for instance, our critical thinking skills should be much better at 65 than at 25 (although some might call that 'wisdom').

A major challenge over a full program is to ensure a steady progression in the level of a skill, so, for instance, a student's critical thinking skills are better when they graduate than when they started the program. This means identifying what level of skill they have before entering a course, as well as measuring it when they leave. 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 intellectual skills can be developed and assessed, 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.

6.5.4 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 (Scenario D), 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.

6.5.5 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. The role of discussion is covered more fully in Chapter 3, Section 4, Chapter 4, Section 4 and Chapter 12, Section 10.

6.5.6 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;
- 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.

Activity 6.5 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?

For feedback in the first two questions, click on the podcast below.

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https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=370

6.6 Learner support

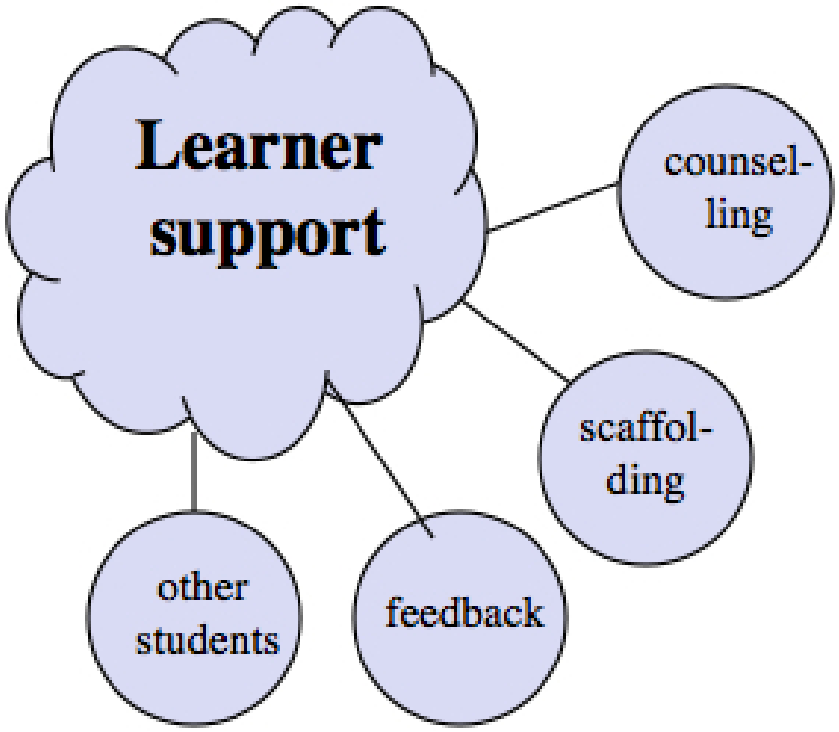

Figure 6.6.1 Learner support

6.6.1 Learner support within a learning environment

Learner support focuses on forms of assistance to learners beyond the delivery of content, skills development, or formal assessment. Learner support covers a wide range of functions, and is discussed throughout the book, but particularly in:

- Chapter 3, Section 7
- Chapter 4, Section 4
- Chapter 9, Section 6
- Chapter 12, Section 10.

Brindley et al. (2004) provide an extensive overview of the full range of activities in providing learner

support for online and distance education learners. Here though my focus is limited to indicating why it is an essential element of an effective learning environment, and to describe briefly some of the main sub-components of learner support.

6.6.2 Scaffolding

Figure 6.6.2 Learner support

I use the term scaffolding to cover the many functions in diagnosing and responding to learners' difficulties, including:

- helping students when they struggle with new concepts or ideas;
- helping students to gain a deeper 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;
- 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. These activities tend not to be pre-planned, requiring a good deal of spontaneity and responsiveness on the part of the teacher or instructor.

However, more recently there have been examples of automated learner support, such as virtual assistants or chatbots (for a review of research on chatbots in education, see Winkler and Söllner, 2018).

Also learning analytics have been used to determine a student's performance and where necessary to direct them to further readings or work (see for instance, Vesin et al., 2018).

Scaffolding is usually a means of individualising the learning, enabling student differences in learning to be better accommodated as they occur.

6.6.3 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 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.

6.6.4 Counselling

As well as direct support within their academic studying, learners often need help and guidance on administrative or personal issues, such as financial difficulties, or 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. Although such services may be available outside the provision of a particular course, this potential source of help needs to be considered in the design of an effective learning environment, with the aim of doing all that can be done to ensure that students can manage external pressures while meeting the academic standards of a program.

6.6.5 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.

6.6.6 Why learner support is so important

We shall see in Chapter 12 that good design can substantially reduce demand for learner support, by ensuring clarity and by 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 in their studying. 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 (see, for instance, Shea et al., 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 the kind of MOOCs that focus on 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, effective learner support is essential for student success.

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Activity 6.6 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 computers or AI 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?

For my feedback on these questions click on the podcast below:

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6.7 Resources

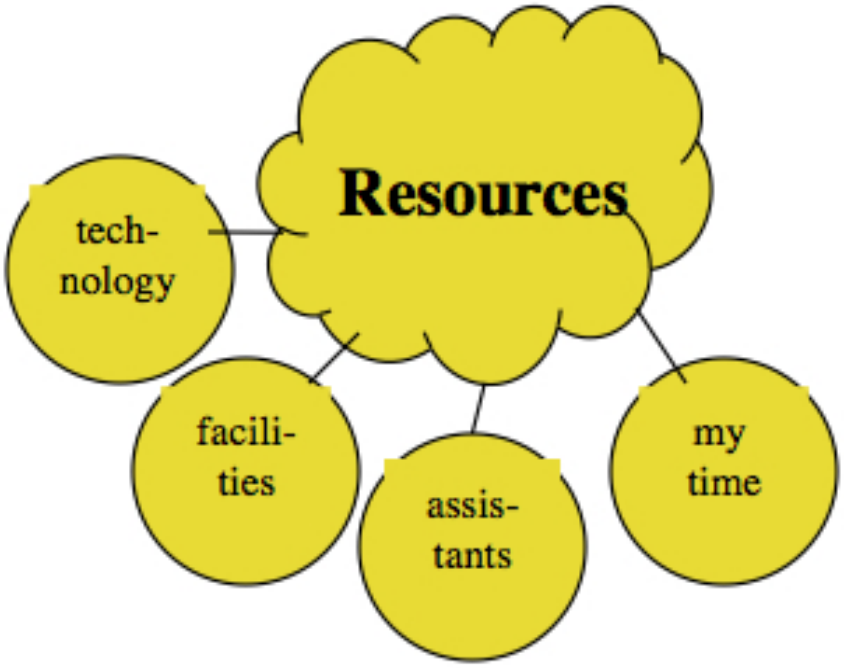


Figure 6.7.1 Resources

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. Securing appropriate resources is often one of the most challenging tasks for many teachers and instructors. The role of resources in the design of learning is also discussed throughout the book, but particularly in:

- Chapter 1, Section 5
- Chapter 9, Section 7
- Chapter 10, Section 4.2
- Chapter 12, Section 6
- Chapter 13, Section 3
- Chapter 13, Section 4

Here the focus is just on outlining the overall role of resources in creating an effective learning environment.

6.7.1 Teaching assistance

Teaching assistance is the equivalent for instructors to what learner support is for students. Adjunct or sessional instructors, teaching assistants, librarians, faculty development workshops, and technical support staff, including instructional designers, media producers and IT technical support are all forms of teaching assistance.

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 ability of the teaching assistants. 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.) One model is for the senior professor to record lectures which students view in their own time, then for students to meet in sub-groups with a teaching assistant or assistants to clarify concepts, discuss topics, or other class activities. These sub-groups may meet either face-to-face or online.

There are also opportunities to increase resources through the use of technology. Online learning may bring in more new students (for instance from outside the normal catchment area) and hence more revenues through government grants for the extra students and/or direct tuition revenue, so there may be economies of scale which would enable the institution to hire more core faculty or sessionals from the extra revenues generated by the additional online students.

Indeed, there are now examples of fully online masters' programs more than covering their 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, even though its tuition fees are the same as those for masters' programs offered on campus – see Bates and Sangra, 2011).

Thus resources (or the lack of them) can have a profound influence on the effectiveness of a learning environment.

6.7.2 Facilities

Physical facilities available to an instructor and students include classrooms, labs, and the library. These are the more traditional components of a learning environment. However, physical facilities also can constrain the design of learning, 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. For instance learning management systems such as Blackboard or Moodle provide a structured online environment, but they too come with their own constraints.

6.7.3 Technology

Classroom technology such as whiteboards, projectors and computers for presentation are traditional technology support. I would also include textbooks here because we will see in Chapter 8 that they are a form of technology. However, the development of new technologies, and especially learning management systems, lecture capture, video streaming, and social media, have radical implications for the design of teaching and learning. This is discussed in much more depth in Chapters 7, 8 and 9, 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.

6.7.4 The instructor's time

This is 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, good design takes into account the time available for teaching (see Chapter 12, Section 9 in particular).

6.7.5 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 is discussed in more detail in Chapter 13, Section 5. At the same time, expectations need to be realistic. Providing adequate learner support with an instructor:student ratio of 1:200 or more 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.)

References

Bates, A. and Sangrà, A. (2011) *Managing Technology in Higher Education: Strategies for Transforming Teaching and Learning* San Francisco: Jossey Bass

Activity 6.7 What resources matter?

1. Are there other resources that influence the design of an effective learning environment that I should have included?
2. 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?
3. 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 (not so much the principle, but the practice.). 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 in schools, 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?

No podcast from me – this activity is for your personal reflection – my views are stated above.

6.8 Assessment of learning

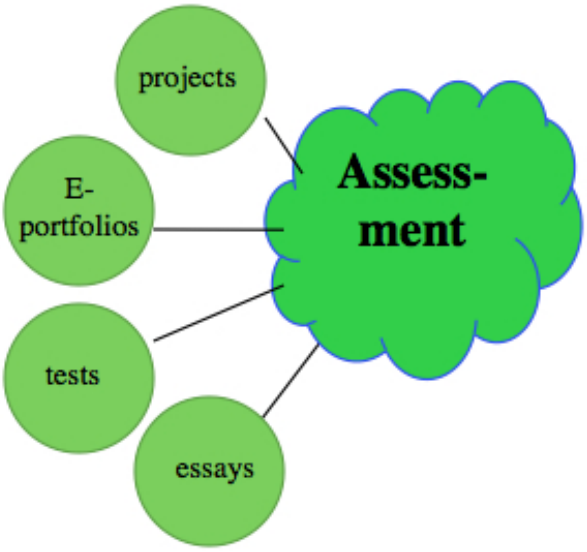


Figure 6.8.1 Assessment

'I was struck by the way assessment always came at the end, not only in the unit of work but also in teachers' planning….Assessment was almost an afterthought…

Teachers…are being caught between competing purposes of …assessment and are often confused and frustrated by the difficulties that they experience as they try to reconcile the demands.'

Earle, 2003

6.8.1 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.

Assessment again is discussed throughout the book, but particularly in:

- Scenario C
- Chapter 5, Section 4.6
- Chapter 8.7 c

- Chapter 11, Section 4.3
- Chapter 12, Section 11.

However, assessment requires a section on its own. 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 meet the assessment requirements (which for most students means in as little time as possible). Therefore decisions about methods of assessment will in most contexts be fundamental to building an effective learning environment.

6.8.2 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):

- to improve and extend students' learning;
- to assess students' knowledge and competence in terms of desired learning goals or outcomes;
- to provide the teacher/instructor with feedback on the effectiveness of their teaching and how it might be improved;
- to provide information for employers about what the student knows and/or can do;
- to filter students for further study, jobs or professional advancement;
- for institutional accountability and/or financial purposes.

I leave it to you to decide the order of importance of these reasons for creating an effective learning environment.

6.8.3 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 on assessing knowledge of content. Thus continuous or formative assessment will be as important a consideration 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:

6.8.3.1 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.

6.8.3.2 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 is cost-effective for these purposes. This form of testing though tends to be limited for assessing higher-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.

6.8.3.3 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, especially at a higher education level. For more discussion of automated essay marking, see Chapter 8.7c.4.4

6.8.3.4 Peer assessment

This is a very large and specialised topic, which I touched on in Chapter 5, Section 4.6.2. There are three main advantages of peer assessment:

- if conducted properly, it can be an excellent pedagogical benefit to student learning as it requires students to think critically about what they have learned in order to judge other students’ work. It enables them to see other students’ perspectives on the concepts and ideas, thus widening and deepening their understanding;
- it enables learner support to be scaled up, allowing instructors to handle larger numbers of students;
- it develops a core 21st century skill of peer evaluation that will be critical when working in a digital society.

However, if not done properly, peer assessment can have disastrous consequences. I am not a specialist in this area but I have used peer assessment in online learning, but only at a graduate level. These are some of the lessons I learned:

- There must be an intrinsic benefit to students doing the assessment. They must see how this will be useful to their own learning.
- The instructor must give clear criteria or rubrics for assessment, preferably with examples of good or poor answers.
- Students should be rewarded either with marks or praise by the instructor for excellent peer reviews.
- Students must know that the instructor will not only monitor the peer assessments but also will take responsibility for final decisions on student-awarded grades or marks and will over-rule poor assessments by students.
- Don't put all your eggs in one basket. It is wise to have a parallel or independent method of assessment, such as multiple-choice tests or having half the total course assessment done in more traditional ways.

Thus there are best practices that must be followed. Anyone intending to use peer assessment should prepare themselves properly by looking carefully into the literature. Macdonald (2015) or Topping (2018) offer guides for teachers. For an example of the successful use of peer assessment at a post-secondary level, see Peer Evaluation as a Learning and Assessment Strategy at the School of Business at Simon Fraser University

6.8.3.5 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, and the assessment process can be labour-intensive, but project work is one of the best ways to assess the high level skills needed in a digital age.

'Assessing student project work' by Melinda Kolk on The Creative Educator web site provides an excellent guideline on assessing student project work. Although intended for k-12 teachers, it is also very appropriate for post-secondary educators.

6.8.3.6 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.

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

These enable the practice and evaluation 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, activities that require a combination of manual and cognitive skills (see the training of Canadian Border Service officers at Loyalist College, Ontario).

Figure 6.8.2 Virtual world border crossing, Loyalist College, Ontario

Simulations and serious or educational games (discussed more extensively in Chapter 13) 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. Because students' actions and decision-making are recorded, authentic assessment is embedded in the process.

6.8.4 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. 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 will become even more closely integrated and contiguous.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.

References

Earle, L. (2003) *Assessment as Learning* Thousand Oaks CA: Corwin Press

Macdonald, B. (2015) *Peer assessment that works: A guide for teachers* Lanham MD: Rowan and Littlefield

Topping, K. (2108) *Using Peer Assessment to Inspire Reflection and Learning* London UK: Routledge

Activity 6. 8 What assessments work in a digital age?

1. Are there other methods of assessment relevant to a digital age that I should have included?
2. 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?
3. 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?
4. Would it be helpful to think about assessment right at the start of course planning, rather than at the end? Is this feasible?
5. In Scenario D, '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?

For my comments on this activity, click on the podcast below:

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=380

6.9 Culture and learning environments

Figure 6.9.1 Old Sun Anglican Aboriginal School, Southern Alberta: note the Union Jack on the board at the back.

6.9.1 The importance of culture

Within every learning environment there is a prevailing culture that influences all the other components. In most learning environments, culture is often taken for granted or may be even beyond the consciousness of learners or even teachers. I will try to show why faculty, instructors and teachers should pay special attention to cultural factors, so that they can make conscious decisions about how the different components of a learning environment are implemented. Although the concept of culture may seem a little abstract at this stage, I will show how critical it is for designing an effective online learning environment,

6.9.2 Defining culture

I define culture as

> *the dominant values and beliefs that influence decision-making.*

The choice of content, the skills and attitudes that are promoted, the relationship between instructors and students, and many other aspects of a learning environment, will all be deeply influenced by the

prevailing culture of an institution or class (used to mean any grouping of students and a teacher). Thus in a learning environment, every one of the components I described will be influenced by the dominant culture.

For instance, parents tend to place their children in schools that reflect their owns values and beliefs, and so the characteristics of learners in that school will also often be influenced by the culture not only of their parents but also of their school. This is one of the many ways that culture can be self-reinforcing.

6.9.3 Identifying cultures

I first noticed the impact of different cultures many years ago, when I was doing research in the U.K. on the administration of large comprehensive (high) schools. Given that these schools had deliberately been created by a left-of-centre government in Britain in the 1960s to provide equal access to secondary education for all, and that these schools had many things in common (their large size – often with 1,500 students or more, their curricula, the idea that every student should have the same educational opportunities) one would have expected that they all would have had a similar prevailing culture. However, I visited over 50 such schools to collect information on the how they were managed and the key issues they faced, and every one was different.

Some were created from formerly highly selective grammar schools, and operated on a strict system of sorting students by tests, so that each year successful students would go up a level and the ‘weakest’ students would drop down a level, in order to identify the best prospects for university. Here the dominant value was academic excellence.

Some schools were single sex (I am still puzzled by how a school segregated by sex could be considered ‘comprehensive’). One of the key objectives of a girls’ school I visited was to teach girls about ‘poise’. (This led to a very confused miscommunication between me and the headmistress, as I initially thought she had said ‘boys’.) Here the dominant value was on developing ‘ladylike qualities’.

Others were inner city schools, where the focus was often on bringing the best out of each child, whatever their abilities. In such schools, each class would contain children with as wide a range of abilities as possible, but they were often rowdy, raucous places in comparison to the more elite-oriented institutions. Here the emphasis was on inclusiveness and equal opportunity.

The differing cultures of each of these schools was so strong I could sometimes detect it just by walking in the door, by the way students reacted with staff and each other in the corridors, or even by the way the students walked (or ran).

6.9.4 Culture and learning environments

Whether you consider culture to be a good or bad influence in a learning environment will depend on whether you share or reject the underlying values and beliefs of the dominant culture.

Residential schools in Canada into which aboriginal children were often forcibly placed are a prime example of how culture drives the way schools operate. The main purpose of such schools was deliberately to destroy aboriginal cultures and replace them with a religious-influenced Western culture. In these schools children were punished for being what they were. In such schools, all the other components of their learning environment were used to reinforce the dominant culture that was being imposed.

Although the outcomes for most children that attended these schools have turned out to be disastrous, those responsible (state and church working together) truly believed they were doing the right thing. We

are still struggling in Canada to ‘do the right thing’ for aboriginal education, but any successful solution must take into account aboriginal cultures, as well as the surrounding predominant ‘Western’ culture.

Culture is perhaps more nebulous in higher education institutions, but it is still a powerful influence, differing not just between institutions but often between academic departments within the same institution.

6.9.5 Culture and new learning environments

Because prevailing cultures are often so dominant, they are very difficult to change. It is particularly difficult for a single individual to change a dominant culture. Even charismatic leaders will struggle, as many university presidents have found.

However, as new technologies allow us to develop new learning environments, instructors now have a rare opportunity consciously to create a culture that can support those values and beliefs that they consider to be important for today’s learners.

For instance, in an online learning environment, I consciously attempt to create a culture that reflects the following:

- mutual respect (between instructor and students, and especially between students)
- open-ness to differing views and opinions; respect for diversity
- evidence-based argument and reasoning
- making learning engaging and fun
- making explicit and encouraging the underlying values and epistemology of a subject discipline
- transparency in assessment (e.g. rubrics and criteria)
- recognition of and respect for the personalities of each student in the class
- collaboration and mutual support.

The above cultural elements of course reflect *my* beliefs and values; yours may well be different. However, it is important that you are aware of your beliefs and values, so that you can design the learning environment in a way that best supports them.

You may also consider these cultural elements to be more like learning outcomes but I disagree. These cultural elements are broader and more general, and reflect what I believe are really necessary conditions for building an effective learning environment in a digital age.

Lastly you may question the right of an instructor to impose their personal cultural conditions on a learning environment. For myself, I have no problems with this. As a subject expert or professional in teaching, you are usually in a better position than learners to know the learning requirements and the cultural elements that will best achieve these. In any case, if you believe that learners should have more say in determining the culture in which they learn, that too is your choice and could be accommodated within the culture.

6.9.6 Summary

Culture is a critical component of any learning environment. It is important to be aware of the influence

of culture within any particular learning context, and to try and shape that culture as much as possible towards supporting the kind of learning environment that you believe will be most effective. However, changing a pre-existing, dominant culture is very difficult. Nevertheless, new technologies enable new learning environments to be developed, and thus provide an opportunity to develop the kind of culture within that learning environment that will best serve your learners.

However, in every learning environment there will be cultural elements that prevail through all components, which is why I have added culture as a background to all the components of a learning environment in the graphic below.

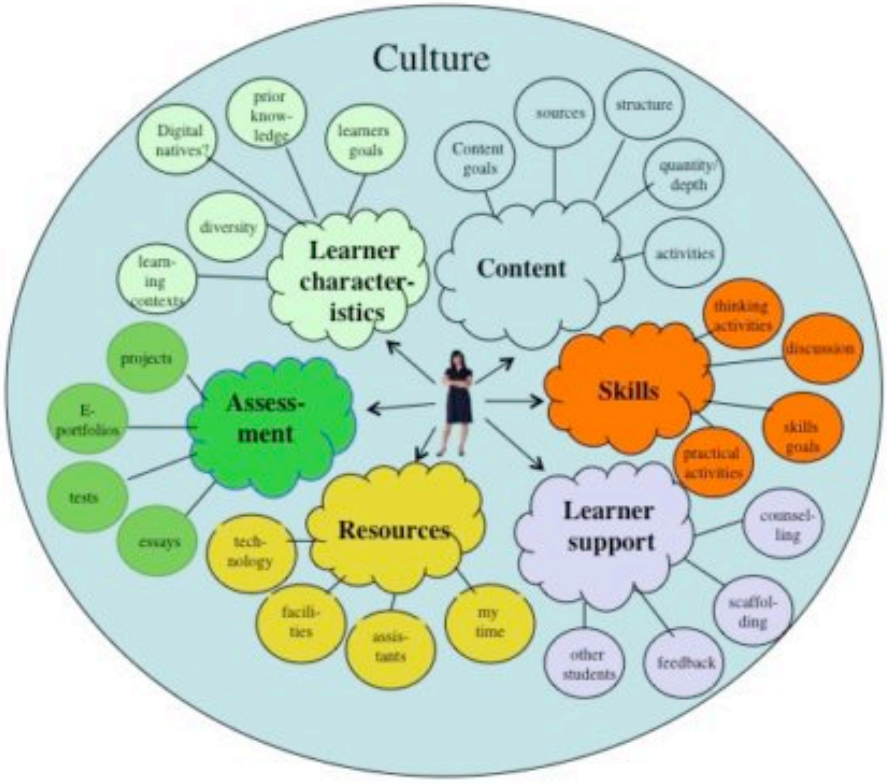


Figure 6.9.2: All the components of an effective learning environment

6.9.7 Next

Section 6.10 provides a brief conclusion to this chapter on building effective learning environments.

Activity 6.9 Considering culture in a learning environment

1. Do you agree with my definition of ‘culture’ as used in describing an effective learning environment? If not, how would you define it? Would you use another term for what I am

discussing?

2. Can you describe the culture of the institution in which you work? What are its prime characteristics or goals? Or are there many cultures?
3. Can you describe the culture within your own class or classes? What do you 'inherit' and what can you create or change?
4. Do you share my views on the importance of understanding the culture within a learning environment? Or is culture something a teacher should/can ignore?
5. What would be the ideal culture for your classes/teaching? How could you foster or create such a culture?

These questions are for your reflection. There is no feedback provided for this activity.

6.10 Conclusions

Figure 6.10 What kind of learning environment do you want to create? Image: Vidyo.com

There is no one way to build an effective learning environment. The learning environment needs to be appropriate for the context in which students will learn. However, before even beginning to design a course or program, we should be thinking of what this learning environment could look like. Whatever the learning environment, though, the learners must do the learning. We need to make sure that learners are able to work within an environment that helps them do this. In other words, our job as teachers is to create the conditions for success.

One component within an effective learning environment that I have not discussed is the actual teacher (although in Figure 6.9.2 you will see that she is at the centre of the learning environment). In some sense the importance of a teacher or instructor within a learning environment is a given, but really the rest of the book is about the role of the teacher within this environment. Also by concentrating on the other components, this chapter enables the possibility of a learning environment without an actual teacher, although someone such as a teacher or educator or even an individual learner (but definitely *not* a computer scientist) may need to be responsible for the design and maintenance of such a learning environment.

Technology now enables us to build a wide variety of effective learning environments that can differ significantly from the traditional classroom. But technology alone is not enough. Many technology-based learning environments are bereft of some of the key components that make an effective learning environment. An effective learning environment needs to include the other components for learner

success. This is not to say that self-managing learners cannot build their own effective, personal learning environments, but they need to consider the other components as well as the technology.

Activity 6.10 Designing your own learning environment

1. Describe the current learning environment in which you are teaching a particular course or program.
2. What are the main components to which you give the most attention?
3. Would you make changes to that learning environment as a result of reading this chapter? Why?
4. Now: can you design a completely different learning environment that would better fit the needs of the course and your students? For instance if you moved your course from classroom to online, or from fully online to blended, how would you accommodate the main components of this learning environment? Or could you re-design the learning environment within the current mode of delivery? If so, what elements would you change, and what would you keep?

I provide no feedback for this activity. It is for your own reflection.

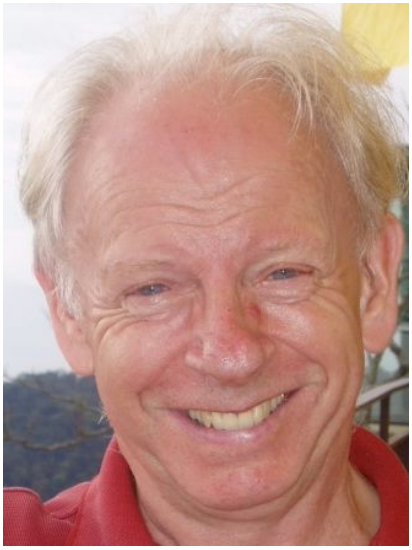
This concludes Part 1 of the book, which focuses on the fundamentals of teaching and learning in a digital age. Part 2 of the book (Chapters 7-13) pays special attention to the impact of digital technologies on teaching and learning, starting with Chapter 7, which examines the nature and role of media and technologies in education.

Chapter 7: 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.



For a my personal introduction to the next few chapters, please click on the podcast below.

An audio element has been excluded from this version of the text. You can listen to it online here: https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=168

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 three chapters that discuss media choice and use.

In this chapter, which focuses on the foundations of educational technology, you will cover the following topics

- 7.1 Choosing technologies for teaching and learning: the challenge
- 7.2 A short history of educational technology
- 7.3 Media or technology?
- 7.4. Assessing media affordances: the SAMR model
- 7.5 Broadcast vs communicative media
- 7.6 The time and space dimensions of media
- 7.7 Media richness
- 7.8 Understanding the foundations of educational media

Also in this chapter you will find the following activities:

- Activity 7.1 How do you currently make decisions about what technology to use for teaching?
- Activity 7.2 What does history tell us?
- Activity 7.3 Media or technology?
- Activity 7.4. Assessing the SAMR model
- Activity 7.5 Broadcast or communicative?
- Activity 7.6 Time and space dimensions of technology
- Activity 7.7 How rich is your medium?
- Activity 7.8 Analysing your current use of technology

Key Takeaways

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. Recognising that in education media are usually used in combination, the six key building blocks of media are:
    1. face-to-face teaching

2. text
3. (still) graphics
4. audio (including speech)
5. video
6. computing (including animation, simulations and virtual reality).

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.
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.
6. There are probably other characteristics or dimensions of educational media that might also be identified, but three key characteristics or dimensions are particularly important:
    - broadcast vs communicative
    - synchronous (live) vs asynchronous (recorded)
    - 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. On the other hand, 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, media have tended to become more communicative, asynchronous, and 'rich', thus offering teachers and learners more powerful tools for teaching and learning.
10. 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.

7.1 Choosing technologies for teaching and learning: the challenge

Figure 7.1 How many technologies can you identify in this home entertainment system? Image: Tony Bates, 2014

7.1 Defining the role of technology in education

Even an electronics engineer will be hard pressed to identify all the technologies in the photo 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, laptop computer)
- software? (e.g. computer operating system, channel selection)
- networks? (e.g. Internet, cable)
- services? (e.g. television, telephone)

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 too many to list (although I make an attempt in the feedback on Activity 7.1 at the end of the book. Nevertheless it is a futile exercise as I was forced to change the whole system a couple of years later due to technological 'upgrades' by the service provider.)

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?

7.2 The need for decision models

The aim of this and the next two chapters 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 complexity.

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 quickly, 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 pedagogical 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 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 increasingly caught between technological determinism (inappropriate applications of artificial intelligence, for instance) or the total rejection of technology for teaching because it is so complex.Thus we need some models to guide their selection and use.

We shall also see though that even with such models or frameworks for decision-making, there are in fact still some fundamental, unanswered questions regarding the use of 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?

Nevertheless, if we consider a teacher facing a group of students and a curriculum to teach, or a learner seeking to develop their own learning, there is need for practical guidance *now* about when to use one technology or another. In this and the next two chapters I will provide some theoretical 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 6.1 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?

- Use a theory or set of principles for making such a decision? If so, what are these?

2. Is justifying your use of technology (or lack of it) in teaching easy to do? What are the reasons for your answer?

3. How many technologies can you see in Figure 7.1? List them

For my answer to question 3, see Feedback on Activity 7.1 at the end of the book. There is no feedback on questions 1 and 2.

7.2 A short history of educational technology

Figure 7.2.1 Charlton Heston as Moses. Are the tablets of stone an educational technology? (See Selwood, 2014, for a discussion of the possible language of the Ten Commandments)
Image: Allstar/Cinetext/Paramount

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. What I'm giving you here is the postage stamp version of ed tech history, and a personal one at that.

7.2.1 Oral communication

One of the earliest means of formal teaching was oral – through 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. Lectures go back at least as far as the ancient Greeks. Demosthenes (384-322 BC) was an outstanding orator whose speeches influenced the politics of Athens.

Nevertheless, by the fifth century B.C, written documents existed in considerable numbers in ancient Greece. If we believe Plato, 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 Manguel, 1996

I can just hear some of my former colleagues saying the same thing about social media.

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.

7.2.2 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 development of the Renaissance and the Enlightenment, and the 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 program still exists today in the form of the University of London Worldwide. 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 and video streaming is now changing that.

7.2.3 Broadcasting and video

Figure 7.2.3 BBC television studio and radio transmitter, Alexandra Palace, London

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. 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, 1984). 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).

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 became

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.

7.2.4 Computer technologies

7.2.4.1 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 2, Section 3). 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. PLATO was 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 7.7.

7.2.4.2 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' or 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 Word 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.

7.2.4.3 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.

7.2.5 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 in Chapters 8, 9 and 10 that they have much greater potential for learning.

7.2.6 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.

Activity 7.2 What does history tell us?

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?

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?

3. Is writing a technology? Is a lecture a technology? Does it matter to decide this?

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.

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7.3 Media or technology?

Figure 7.3.1 A book: medium or technology?

7.3.1. 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 them. There is a danger, particularly in education, in looking too much at the raw technology, and not enough at the personal, social and cultural contexts in which we use technology. The terms ‘media’ and ‘technology’ represent different ways altogether of thinking about the choice and use of technology in teaching and learning.

7.3.2 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 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.

Figure 7.3.2 Don't just sit there – DO something!
Image: © Alex Dawson, Flickr, 2006

7.3.3 Media

Media (plural of medium) is another word that has many definitions.

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.

The term 'media' has two distinct meanings relevant for teaching and learning, both of which are different from definitions of technology

7.3.3.1 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.

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 of a particular medium (e.g. the 280 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.

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 coding, 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.

In terms of representing knowledge it is useful to think of the following media for educational purposes within which there are sub-systems (only some examples given):

- **Text:** textbooks, novels, poems
- **Graphics:** diagrams, photographs, drawings, posters, graffiti
- **Audio:** sounds, speech, podcasts, radio programs
- **Video and film:** television programs, movies, 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.

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.

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.

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.

7.3.3.2 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, and so on. 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.

Lastly, there is a strong cultural context to media organisations. For instance, Schramm (1972) 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?

7.3.4 The affordances of media

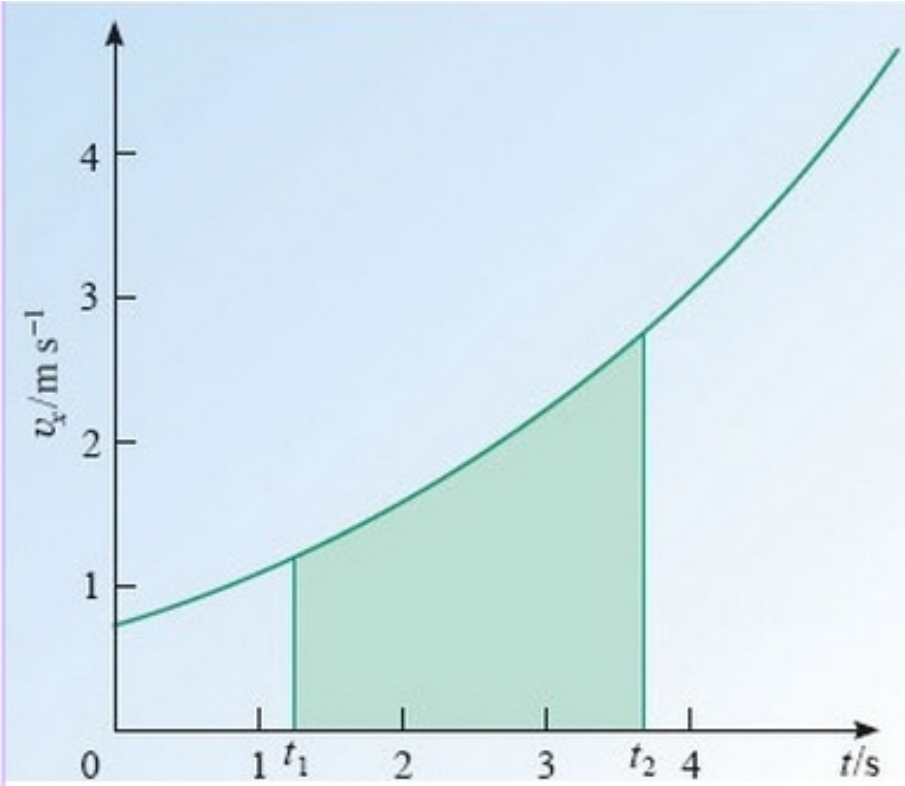

Figure 7.3.3 Graphs can represent, in a different way, the same concepts as written descriptions or formulae. Understanding the same thing in different ways generally leads to deeper understanding.
Image: © Open University 2013

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.

7.3.4.1 A personal story

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 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. 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.

My colleague and I 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.

7.3.4.2 Findings from the research: how media differ

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 made by my colleagues and me in the Audio-Visual Media Research Group at the OU (Bates, 1984):

- 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 today on video);

- 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.

7.3.4.3 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 one sense, researchers such as Clark were right: the teaching methods matter, but different media can more easily support different ways of learning 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.

7.3.5 How do these findings apply to digital learning?

Digital 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 digital learning so its full potential can be exploited.

7.3.6 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 'media' is a useful concept, in that it can also incorporate the inclusion of face-to-face communication as a medium. Another reason to distinguish between media and technology is to recognise that technology on its own does not of itself lead to the transfer of meaning .

As new technologies are developed, and are incorporated into media systems, old formats and approaches are carried over from older to newer media. Education is no exception. New technology is 'accommodated' to old formats, as with clickers and lecture capture, or we try to create the classroom in virtual space, as with learning management systems. However, new formats, symbols systems and organizational structures that exploit the unique characteristics of the Internet as a medium are gradually being discovered. It is sometimes 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.

More significantly, it is likely to be a major mistake to use computers to replace or substitute for humans in the educational process, given the need to create and interpret meaning when using media, at least until computers have much greater facility to recognize, understand and apply semantics, value systems, and organizational features, which are all important components of '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.

Thus we need a much better understanding of the strengths and limitations of different media for teaching purposes if we are successfully to select the right medium for the job. 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 6.3 Media or technology?

1. Do you find the distinction between media and technology helpful? If so, how would you classify the following (medium or technology):

- newspaper
- printing press
- television program

- Netflix
- classroom
- MOOC
- discussion forum

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?

For feedback on this activity, click on the podcast below:

An audio element has been excluded from this version of the text. You can listen to it online here: *https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=178*

More reading

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7.4 Assessing media affordances: the SAMR model

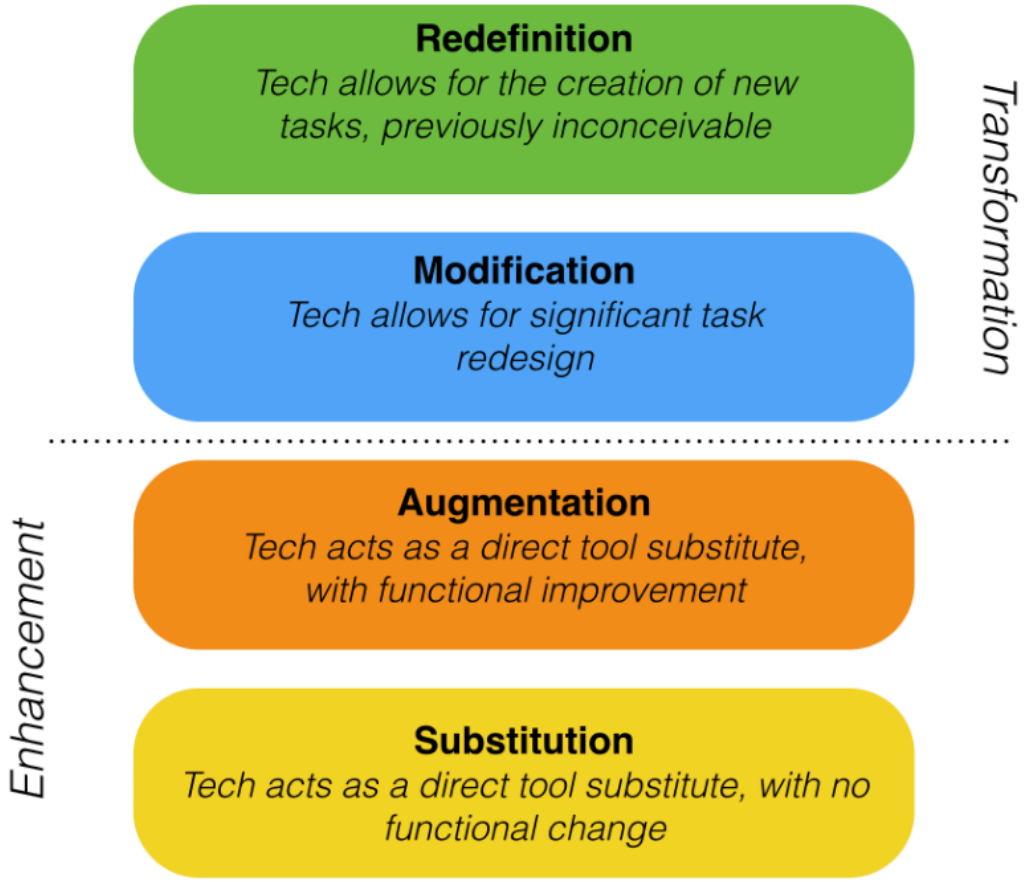

Figure 7.4 The SAMR model Image: Ruben Puentedura

7.4.1 Exploiting the affordances of a medium

It was noted in the previous section that video technology can be used as a straight replacement for a face-to-face lecture by merely substituting the face-to-face delivery with online delivery. The mode of delivery has changed but not the pedagogy. The full affordances of the medium of video have not been exploited.

On the other hand, using video to show a documentary can bring powerful examples of situations

to which can be applied the ideas and concepts covered in an academic course. A documentary thus has the potential to make better use of the affordances of video than recording a lecture because the learning experience from watching a documentary is different from watching a lecture; at the same time, using a documentary video will require a different approach to teaching than using a lecture and will probably have different outcomes. With the video lecture students will focus on comprehension and understanding; with the documentary the students' focus will be on analysing and critiquing the material.

7.4.2 The SAMR model

A good way to assess whether a particular application of media or technology is making full use of the affordances of a medium is to apply the SAMR model developed by Dr. Ruben Puentedura, a technology consultant based in the USA.

Puentedura suggests four 'levels' of technology application in education:

- **substitution**: *a direct tool substitute, with no functional change*, for example, a video recording of a classroom lecture on water quality, made available for downloading by students; students are assessed on the content of the lecture by written exams at the end of the course.
- **augmentation**: *a direct tool substitute, with functional improvement*, for example, the video lecture is embedded in an LMS, and edited into four sections, with online multiple-choice questions at the end of each section for students to answer.
- **modification**: *significant task redesign*, for example, the instructor provides video recordings of water being tested, and asks students to analyse each of the recordings in terms of the principles taught in the course in the form of essay-type questions that are assessed.
- **redefinition**: *creation of new tasks, inconceivable without the use of technology*, for example, the instructor provides readings and online guidance through the LMS, and students are asked to record with their mobile phones how they selected samples of water for testing quality, and integrate their findings and analysis in the form of an e-portfolio of their work.

In the first two levels, substitution and augmentation, video is used to enhance the method of teaching but it is only where video is used in the final two stages, modification and redefinition, that teaching is actually transformed. Significantly, Puentedura links the modification and transformation levels to the development of Bloom's higher order '21st century' skills such as analysis, evaluation and creativity (Puentedura, 2014). For a more detailed description of the model and how it works, see the video: Introduction to the SAMR model.

7.4.3 Strengths and limitations of the model

First, I was unable to find any research that validated this model. It has a powerful feel of common sense behind it, but it would be good to see it more empirically validated, although there are many examples of its actual use, particularly in teacher education in the k-12 sector (you can find some examples collected by Kelly Walsh here. For a more critical response to the SAMR model, see Linderoth, 2013).

Second, while the model is a useful means of evaluating whether a use of technology merely enhances or radically changes teaching, it doesn't help much with the hard part, and that is imagining the

transformative ways in which a technology could be used in the first place. Nevertheless it is a good heuristic device to get you to think about the best way to use technology in teaching.

Third, there will be situations where substitution and augmentation will still be a perfectly justifiable use of technology, for instance for students with disabilities, or to increase accessibility to learning materials.

On balance, it is a very useful model by which an instructor can evaluate a potential or actual use of technology. In particular it focuses on the way students will need to interact with the technology and the ways technology can be used to assist the development of 21st century skills. At the same time, we still need to understand how and why media and technology could be used to transform teaching in the first place. The first step then is to understand better the unique properties of different technologies, which is the subject of the next section.

References

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Activity 7.4: Assessing the SAMR model

1. If you are using any technology in your teaching, where does it fit in the SAMR framework in comparison with in-person teacher-student interaction? What could you change to make the technology 'move up the ladder'?
2. Do you *have to* exploit fully the affordances of a medium? If so, why?

For feedback on this activity, click on the podcast below

An audio element has been excluded from this version of the text. You can listen to it online here:
https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=1237

7.5 Broadcast vs communicative media

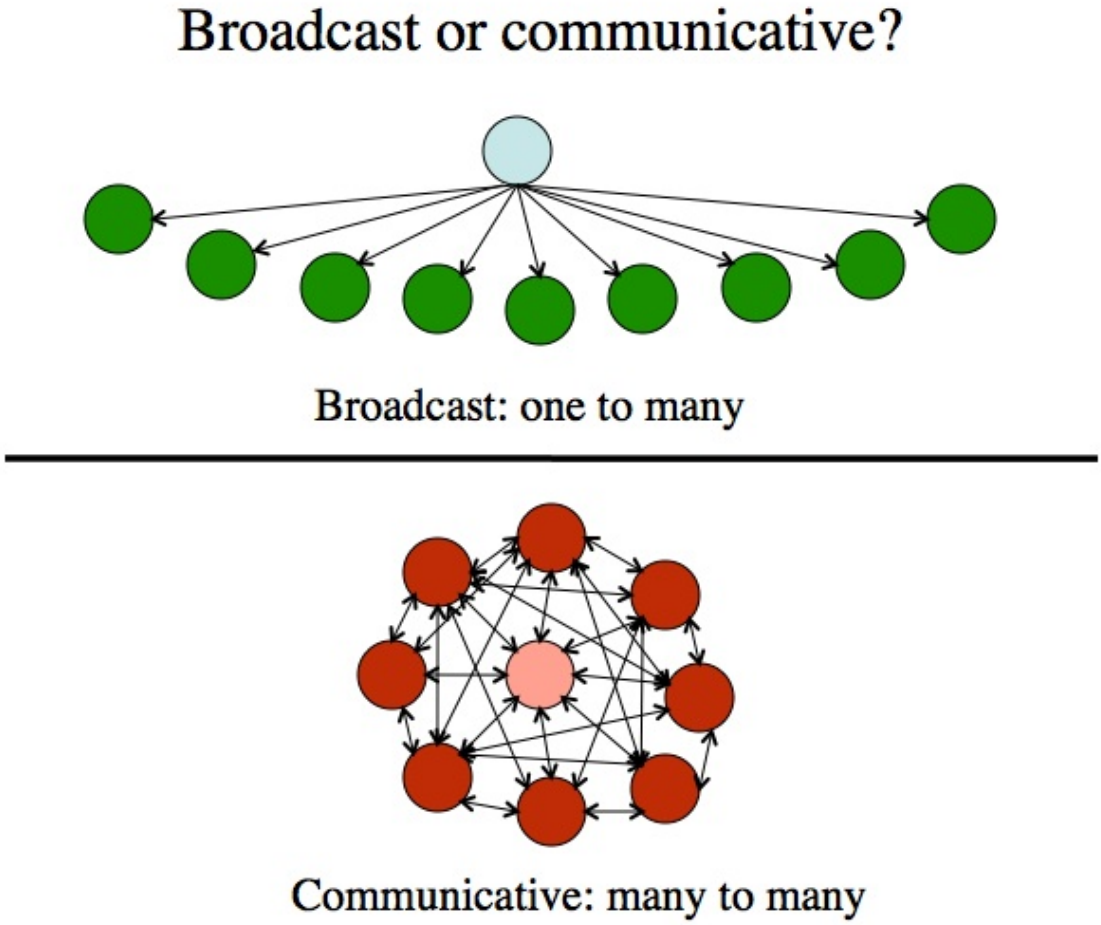

Figure 7.5 The teacher is the lighter-coloured symbol

7.5.1 Key media characteristics

It will help clarify the possible benefits or weaknesses for education of each medium if we understand the characteristics or affordances of each medium. To do this we need to identify where media have common or different features.

There is a wide range of media characteristics or affordances that we could look at, but I will focus on three that are particularly important for education:

- whether media are broadcast (one-way) or communicative (two way);
- whether media are synchronous or asynchronous, including live (transient) or recorded (permanent);
- whether media are single or rich.

We shall see that these characteristics are more dimensional than discrete states, and different media will fit at different points on these dimensions, but the exact point on the continuum will depend to some extent on the way they are designed or used. In this section I will focus on the broadcast/communicative dimension. The other two characteristics will be discussed in subsequent sections

7.5.2 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.

7.5.2.1 Broadcast media

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 between learners.

7.5.2.2 Communicative media

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.

7.5.2.3 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 web site, 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 web site 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 social media (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 (for example, 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).

7.5.3 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 7.5.3, I have placed some common technologies, classroom media and online media along the broadcast/communicative continuum.

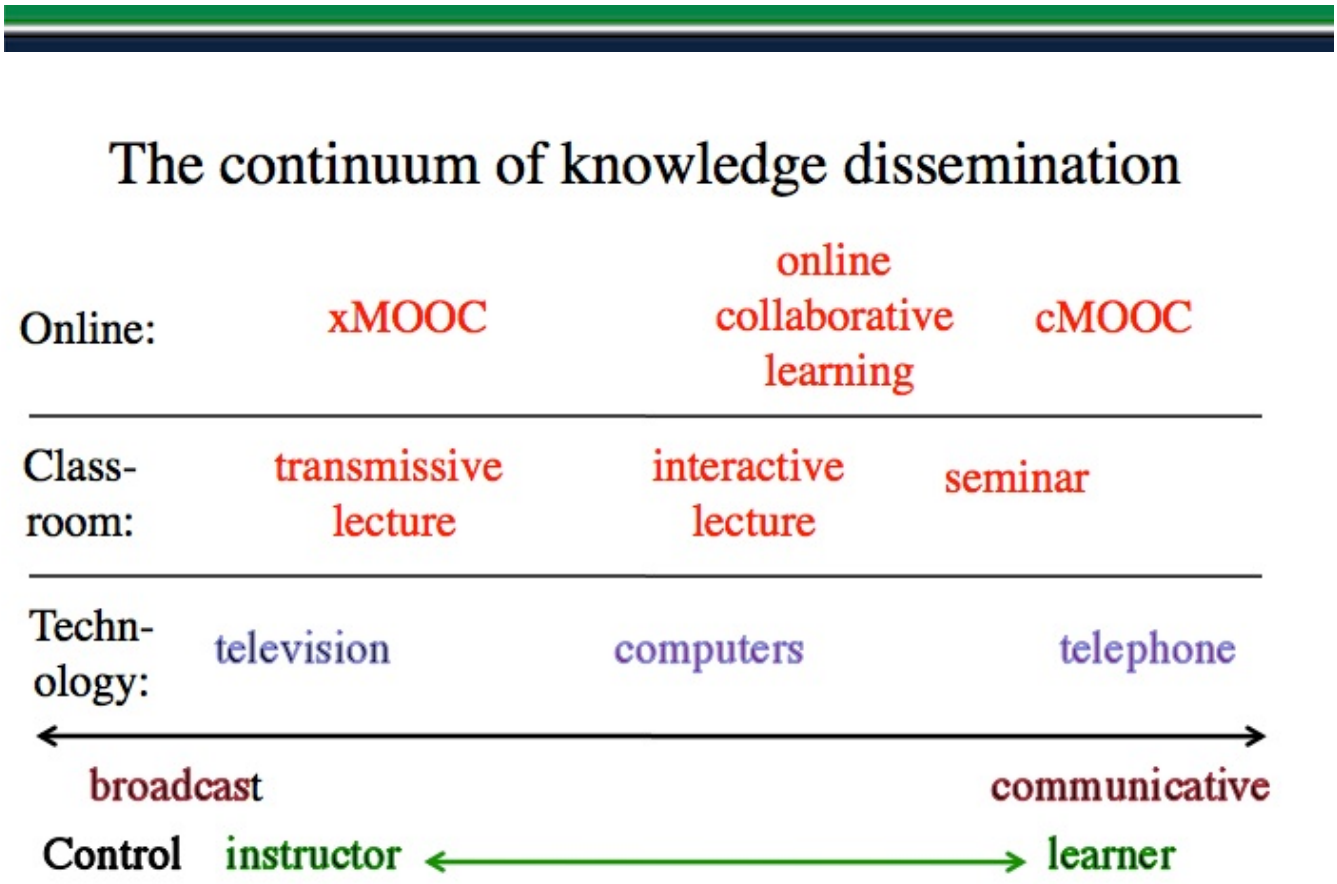

Figure 7.5.3 The continuum of knowledge dissemination

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;

- 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;
- 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 7.5 Broadcast or communicative?

From the list below:

- a blog
- online collaborative learning
- Twitter
- virtual worlds
- 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 7.5.3. 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?

My analysis can be accessed by clicking here.

7.6 The time and space dimensions of media

Figure 7.6.1 Audio cassettes are a recorded, asynchronous technology

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

7.6.1 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.

7.6.2 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, on-demand You Tube 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 7.6.2 illustrates the main differences between media in terms of different combinations of time and place.

		Place		
		Same	**Different**	
Time	**Same**	*Live (face-to-face) media*: lectures, seminars, tutorial, labs, workshops	Webinars Video-conferencing Virtual worlds Remote labs	**Synchronous**
	Different	Self-managed labs/workshops/ studios Library/learning centres	*Recorded media*: books, cassettes, LMSs, online discussion forums, lecture capture/ streamed video, blogs, wikis	**Asynchronous**

Figure 7.6.2 The separation of teachers/instructors from learners by time and space

7.6.3 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 at 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 formulae (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, then returning to the teaching.

The ability to access learning materials on demand (recorded lectures or webinars, learning management systems, web sites, social media) is particularly important for increasing access and flexibility for learners, especially those working as well as studying, for those with young families, or for students with long commutes. Thus there should be clearly justified pedagogical benefits that could not be provided by the use of technology if students must be present either in the same place or at the same time as an instructor. In particular, what are the social or pedagogical reasons why students should come to the school or campus or be present at a set time when so much teaching and learning can now be done asynchronously?

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, and direct inter-personal contact, but they need to be used more selectively to exploit their unique advantages or affordances.

7.6.4 The significance of the Internet

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 7.6.4 below. (I have included only a few – you may want to place other technologies on this diagram):

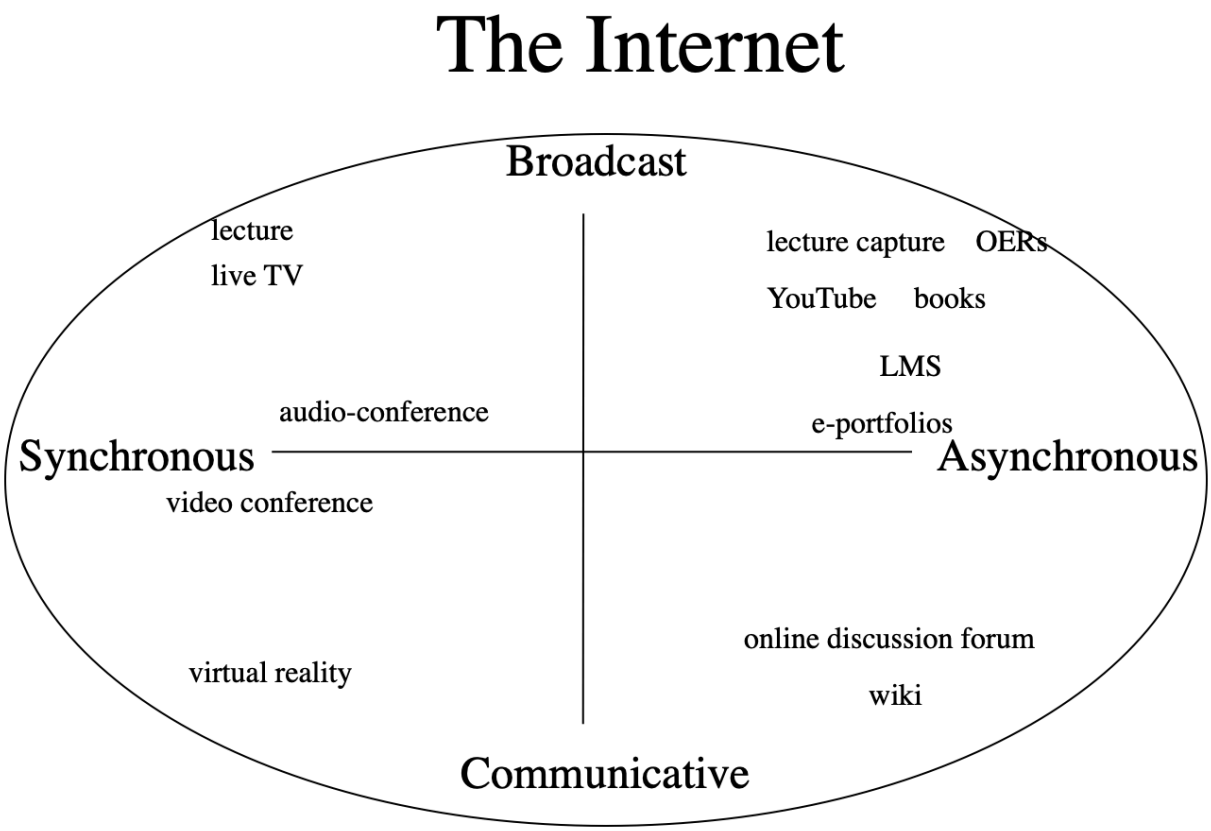

Figure 7.6.4 The significance of the Internet in terms of media characteristics

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 to fit almost any learning context through this one medium.

7.6.5 Conclusion

It should be noted at this stage that although I have identified some strengths and weaknesses of the four characteristics of broadcast/communicative, and synchronous/asynchronous media, 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.

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Activity 7.6 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 7.6.2 and 7.6.4? What media or technologies don't fit? Why not?

3. Can you imagine a situation where a podcast might be a better choice for teaching and learning than virtual reality (assuming students have access to both technologies)? And can you imagine the opposite (of where virtual reality would be better than an audio-cassette)? What are the defining criteria or conditions?

For my comments on the last question, click on the podcast below:

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https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=187

7.7 Media richness

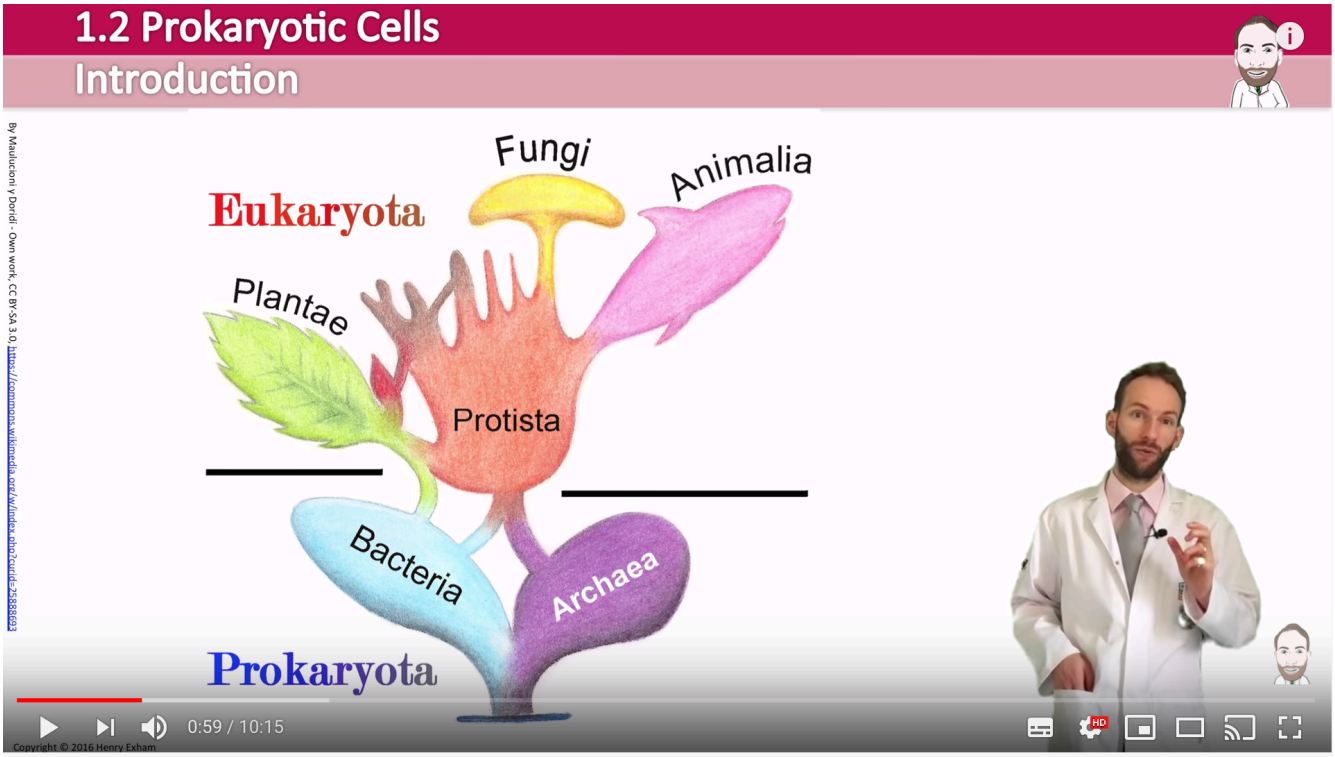

Figure 7.7.1 Making sense of biology: MrExham

7.7.1 The historical development of media richness

In Section 7.2, '[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.

7.7.2 The continuum of media richness

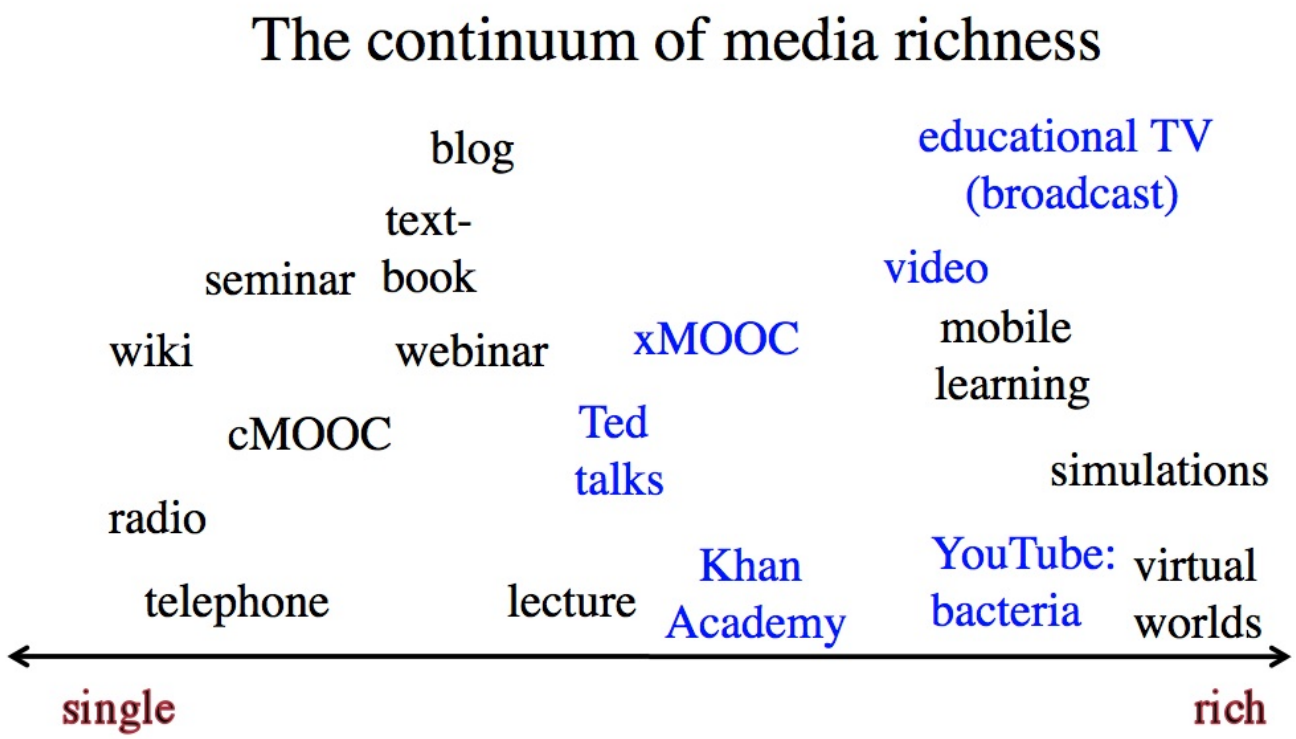

Figure 7.7.2 The continuum of media richness

Once again then there is a continuum in terms of media richness, as illustrated in Figure 7.7.2 above. Also once again, design of a particular medium can influence where on the continuum it would be placed. For instance in Figure 7.7.2, different forms of teaching using video are represented in blue. Ted Talks, a televised lecture, and often xMOOCs are usually mainly talking heads. The Khan Academy uses dynamic graphics as well as voice over commentary, and MrExham's YouTube video on prokaryotic cells uses colour graphics and animation as well as a 'talking head' commentary. Educational television 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 because it depends on a single medium, audio, and even talking head video is richer symbolically than radio.

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.

7.7.3 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 (Vygotsky, 1934) 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.

7.7.4 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 with annoying mannerisms talking about the chain of reasoning.

In general, it is tempting 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, because rich media may enable learning goals to be achieved that would be difficult with a simple medium.

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.

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Activity 7.7 How rich is your medium?

1. What media are you using at the moment for teaching? Where would you place these on the 'richness' continuum? What benefits might there be to your teaching in changing your media to either increase or decrease the richness of media you are using?
2. Do you agree that: '*it is a useful guideline always to look for the simplest medium first*'.
3. How important do you think the richness of medium is when making decisions about the use of media and technology?
4. Do you agree with the placement of different media on this continuum in Figure 7.7.2. If not, why not?

I provide no feedback for this activity.

7.8 Understanding the foundations of educational media

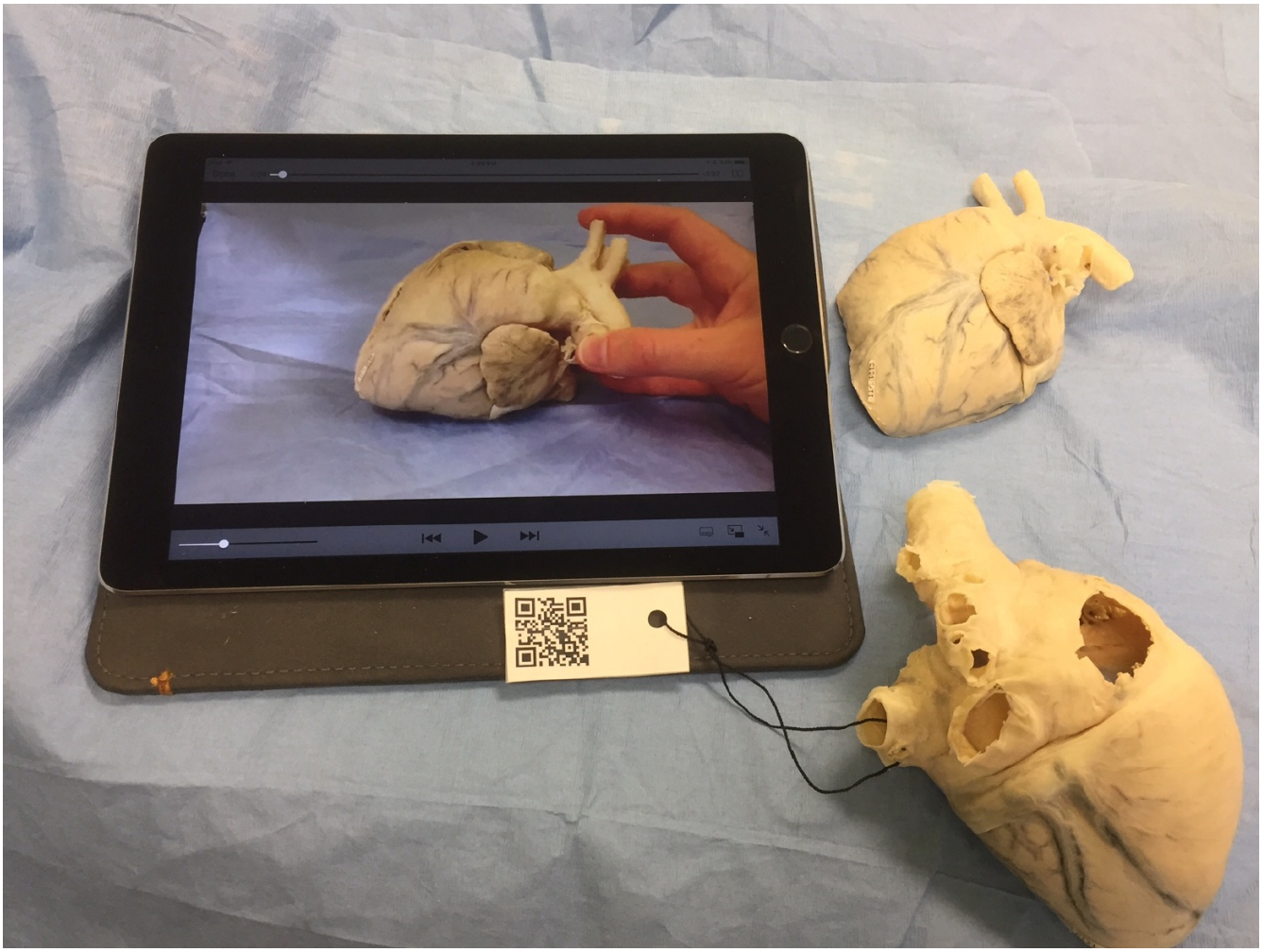

Figure 7.8 Video explanation of a (plastinated) dog's heart: note the QR code which enables students to access the video from their own phones or tablets. Image: Dr. Sue Dawson, University of Prince Edward Island

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 the main points that I have been emphasising throughout this chapter.

Key Takeaways

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. Recognising that in education media are usually used in combination, the six key building blocks of media are:
    1. face-to-face teaching
    2. text
    3. (still) graphics
    4. audio (including speech)
    5. video
    6. computing (including animation, simulations and virtual reality)
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.
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.
6. There are probably other characteristics or dimensions of educational media that might also be identified, but I believe these three key characteristics or dimensions to be the most important:
    1. broadcast vs communicative
    2. synchronous (live) vs asynchronous (recorded)
    3. 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, media have tended to become more communicative, asynchronous, and 'rich', thus offering teachers and learners more powerful tools for teaching and learning.
10. 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.

Activity 7.8 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, 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 three 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.

Chapter 8: Pedagogical differences between media

Purpose of the chapter

1. To identify the main pedagogical characteristics of the following media:
    - text;
    - audio;
    - video;
    - computing;
    - social media
    - emerging technologies (virtual/augmented reality; serious games; artificial intelligence).
2. To provide a framework of analysis for determining appropriate pedagogical roles for different media.
3. To enable you to apply that analysis to any particular module of teaching

What is covered in this chapter

Also in this chapter you will find the following activities:

- Activity 8.2 Identifying the unique pedagogical characteristics of text
- Activity 8.3 Identifying the unique pedagogical characteristics of audio
- Activity 8.4 Identifying the unique pedagogical characteristics of video
- Activity 8.5 Identifying the unique pedagogical characteristics of computing
- Activity 8.6 Identifying the unique pedagogical characteristics of social media
- Activity 8.7a Using and designing serious games
- Activity 8.7b Using and designing VR and AR
- Activity 8.7c Assessing artificial intelligence
- Activity 8.7d Assessing and developing applications of emerging technologies
- Activity 8.8 Choosing media for a teaching module

Key Takeaways

There is a very wide range of media available for teaching and learning. In particular:

- text, audio, video, computing and social media all have unique characteristics that make them useful for teaching and learning;
- the choice or combination of media will need to be determined by:
    - the overall teaching philosophy behind the teaching;
    - the presentational and structural requirements of the subject matter or content;
    - the skills that need to be developed in learners;
    - and not least by the imagination of the teacher or instructor (and increasingly learners themselves) in identifying possible roles for different media;
- learners now have powerful tools through social media for creating their own learning materials or for demonstrating their knowledge;
- courses can be structured around individual students' interests, allowing them to seek appropriate content and resources to support the development of negotiated competencies or learning outcomes;.
- content is now increasingly open and freely available over the Internet; as a result learners can seek, use and apply information beyond the bounds of what a professor or teacher may dictate;
- students can create their own online personal learning environments;
- many students will still need a structured approach that guides their learning;
- teacher presence and guidance is likely to be necessary to ensure high quality learning via social media;
- teachers need to find the middle ground between complete learner freedom and over-direction to enable learners to develop the key skills needed in a digital age.

8.1 Thinking about the pedagogical differences of media

Figure 8.1.1 Is slow motion a unique characteristic of video?
Image: Pouring mercury into liquid nitrogen: University of Nottingham
Click on image to see video

8.1.1 Identifying the pedagogical differences between media

In the last chapter, I identified three core dimensions of media and technology along which any technology can be placed. In the next two chapters, I will discuss a method for deciding which media to use when teaching. In this chapter I will focus primarily on the pedagogical differences between media. In the following chapter I will provide a model or set of criteria to use when making decisions about media and technology for teaching.

8.1.2 First steps

Embedded within any decision about the use of technology in education and training will be assumptions

about the learning process. We have already seen earlier in this book how different epistemological positions and theories of learning affect the design of teaching, and these influences will also determine a teacher's or an instructor's choice of appropriate media. Thus, the first step is to decide what and how you want to teach.

This has been covered in depth through Chapters 2-5, but in summary, there are five critical questions that need to be asked about teaching and learning in order to select and use appropriate media/ technologies:

- what is my underlying epistemological position about knowledge and teaching?
- what are the desired learning outcomes from the teaching?
- what teaching methods will be employed to facilitate the learning outcomes?
- what are the unique educational characteristics of each medium/technology, and how well do these match the learning and teaching requirements?
- what resources are available?

This chapter focuses on the fourth of these questions, but they are best not asked sequentially, but in a cyclical or iterative manner, as media affordances may suggest alternative teaching methods or even the possibility of learning outcomes that had not been initially considered. When the unique pedagogical characteristics of different media are considered, this may lead to some changes in what content will be covered and what skills will be developed. Therefore, at this stage, decisions on content and learning outcomes should still be tentative.

8.1.3 Identifying the unique educational characteristics of a medium

Different media have different potential or 'affordances' for different types of learning. One of the arts of teaching is often finding the best match between media and desired learning outcomes. Before exploring this relationship, first, a summary of the substantial amount of excellent past research on this topic (see, for instance, Trenaman, 1967; Olson and Bruner, 1974; Schramm, 1977; Salomon, 1979, 1981; Clark, 1983; Bates, 1984; Koumi, 2006; Berk, 2009; Mayer, 2009).

This research has indicated that there are three core elements that need to be considered when deciding what media to use:

- content;
- content structure;
- skills.

Olson and Bruner (1974) claim that learning involves two distinct aspects: acquiring knowledge of facts, principles, ideas, concepts, events, relationships, rules and laws; and using or working on that knowledge to develop skills. Again, this is not necessarily a sequential process. Identifying skills then working back to identify the concepts and principles needed to underpin the skills may be another valid way of working. In reality, learning content and skills development will often be integrated in any learning process. Nevertheless, when deciding on media use, it is useful to make a distinction between *content* and *skills*.

8.1.3.1. The representation of content

Media differ in the extent to which they can *represent* different kinds of content, because they vary in the symbol systems (text, sound, still pictures, moving images, etc.) that they use to encode information (Salomon, 1979). We saw in the previous chapter that different media are capable of combining different symbol systems. Differences between media in the way they combine symbol systems influence the way in which different media represent content. Thus there is a difference between a direct experience, a written description, a televised recording, and a computer simulation of the same scientific experiment. Different symbol systems are being used, conveying different kinds of information about the same experiment. For instance, our concept of heat can be derived from touch, mathematical symbols (800 celsius), words (random movement of particles), animation, or observance of experiments. Our 'knowledge' of heat is as a result not static, but developmental. A large part of learning requires the mental integration of content acquired through different media and symbol systems. For this reason, deeper understanding of a concept or an idea is often the result of the integration of content derived from a variety of media sources (Mayer, 2009).

Media also differ in their ability to handle *concrete* or *abstract* knowledge. Abstract knowledge is handled primarily through language. While all media can handle language, either in written or spoken form, media vary in their ability to represent concrete knowledge. For instance, television can show concrete examples of abstract concepts, the video showing the concrete 'event', and the sound track analyzing the event in abstract terms. Well-designed media can help learners move from the concrete to the abstract and back again, once more leading to deeper understanding.

8.1.3.2 Content structure

Media also differ in the way they *structure* content. Books, the telephone, radio, podcasts and face-to-face teaching all tend to present content linearly or sequentially. While these media can represent parallel activities (for example, in print, different chapters may deal with events that occur simultaneously but from different perspectives) such activities still have to be presented sequentially. Computers and television are more able to present or simulate the inter-relationship of multiple variables simultaneously occurring. Virtual reality is an exceptionally powerful example of this. Computers can also handle branching or alternative routes through information, but usually within closely defined limits.

Subject matter varies a great deal in the way in which information needs to be structured. Subject areas (for example, natural sciences, history) structure content in particular ways determined by the internal logic of the subject discipline. This structure may be very tight or logical, requiring particular sequences or relationships between different concepts, or very open or loose, requiring learners to deal with highly complex material in an open-ended or intuitive way.

If media then vary both in the way they present information symbolically and in the way they handle the structures required within different subject areas, media which best match the required mode of presentation and the dominant structure of the subject matter need to be selected. Consequently, different subject areas will require a different balance of media. This means that subject experts should be deeply involved in decisions about the choice and use of media, to ensure that the chosen media appropriately match the presentational and structural requirements of the subject matter.

8.1.3.3 The development of skills

Media also differ in the extent to which they can help develop different skills. Skills can range from intellectual to psychomotor to affective (emotions, feelings). Koumi (2015) has used Krathwohl's (2002)

revision of Bloom's Taxonomy of Learning Objectives (1956) to assign affordances of text and video to learning objectives using Krathwold's classification of learning objectives.

Comprehension is likely to be the minimal level of intellectual learning outcome for most education courses. Some researchers (for example, Marton and Säljö, 1976) make a distinction between surface and deep comprehension. At the highest level of skills comes the *application* of what one has comprehended to new situations. Here it becomes necessary to develop skills of analysis, evaluation, and problem solving.

Thus a first step is to identify learning objectives or outcomes, in terms of both content and skills, while being aware that the use of some media may result in new possibilities in terms of learning outcomes.

8.1.4 Pedagogical affordances – or unique media characteristics?

'Affordances' is a term originally developed by the psychologist James Gibson (1977) to describe the perceived possibilities of an object in relation to its environment (for example, a door knob suggests to a user that it should be turned or pulled, while a flat plate on a door suggests that it should be pushed.). The term has been appropriated by a number of fields, including instructional design and human-machine interaction.

Thus the pedagogical affordances of a medium relate to the possibilities of using that medium for specific teaching purposes. It should be noted that an affordance depends on the subjective interpretation of the user (in this case a teacher or instructor), and it is often possible to use a medium in ways that are not unique to that medium. For instance video can be used for recording and delivering a lecture. In that sense there is a similarity in at least one affordance for a lecture and a video. Also students may choose not to use a medium in the way intended by the instructor. For instance, Bates and Gallagher (1977) found that some social science students objected to documentary-style television programs requiring application of knowledge or analysis rather than presentation of concepts.

Others (such as myself) have used the term 'unique characteristics' of a medium rather than affordances, since 'unique characteristics' suggest that there are particular uses of a medium that are less easily replicated by other media, and hence act as a better discriminator in selecting and using media. For instance, using video to demonstrate in slow motion a mechanical process is much more difficult (but not impossible) to replicate in other media. In what follows, my focus is more on unique or particular rather than general affordances of each medium, although the subjective and flexible nature of media interpretation makes it difficult to come to any hard and fast conclusions.

I will now attempt in the next sections to identify some of the unique pedagogical characteristics of the following media:

- text;
- audio;
- video;
- computing;
- social media
- emerging technologies, in particular, virtual/augmented reality, serious games and artificial intelligence.

Technically, face-to-face teaching should also be considered a medium, but I will look specifically at the unique characteristics of face-to-face teaching in Chapter 10, where I discuss different modes of delivery.

8.1.5 Purpose of the exercise

Before starting on the analysis of different media, it is important to understand my goals in this chapter. I am NOT trying to provide a definitive list of the unique pedagogical characteristics of each medium. Because context is so important and because the science is not strong enough to identify unequivocally such characteristics, I am suggesting in the following sections *a way of thinking* about the pedagogical affordances of different media. To do this, I will identify what I think are the most important pedagogical characteristics of each medium.

However, individual readers may well come to different conclusions, depending particularly on the subject area in which they are working. The important point is for teachers and instructors to think about what each medium could contribute educationally within their subject area, and that requires a strong understanding of both the needs of their students and the nature of their subject area, as well as the key pedagogical features of each medium.

Listen to the podcast below for an illustration of the differences between media.

Podcast 8.1 Tony's shaggy dog story: click play on the above podcast (41 seconds).

An audio element has been excluded from this version of the text. You can listen to it online here: *https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=197*

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Activity 8.1: Thinking about the pedagogical differences between media

1. Examine one of your lessons or courses.
    - Can you think of content that would best be presented through video or audio rather than through talking or text? What content is still better offered through talking or a textbook? What are your reasons? Are they pedagogical or for other reasons?
    - can you think of a skill that you are teaching that could be better done through the use of media that you are not currently using?
    - can you think of new learning outcomes that you could achieve through the use of media?

There is no feedback from me on this activity, but the rest of this and the following chapter may help.

8.2 Text

Figure 8.2.1 There's nothing like a good book – or is there?.

8.2.1 The unique pedagogical features of text

Ever since the invention of the Gutenberg press, print has been a dominant teaching technology, arguably at least as influential as the spoken word of the teacher. Even today, textbooks, mainly in printed format, but increasingly also in digital format, still play a major role in formal education, training and distance education. Many fully online courses still make extensive use of text-based learning management systems and online asynchronous discussion forums.

Why is this? What makes text such a powerful teaching medium, and will it remain so, given the latest developments in information technology?

8.2.1.2 Presentational features

Text can come in many formats, including printed textbooks, text messages, novels, magazines, newspapers, scribbled notes, journal articles, essays, novels, online asynchronous discussions and so on.

The key symbol systems in text are written language (including mathematical symbols) and still graphics, which would include diagrams, tables, and copies of images such as photographs or paintings. Colour is an important attribute for some subject areas, such as chemistry, geography and geology, and art history.

Some of the unique presentational characteristics of text are as follows:

- text is particularly good at handling abstraction and generalisation, mainly through written language;
- text enables the linear sequencing of information in a structured format;
- text can present and separate empirical evidence or data from the abstractions, conclusions or generalisations derived from the empirical evidence;
- text's linear structure enables the development of coherent, sequential argument or discussion;
- at the same time text can relate evidence to argument and vice versa;
- text's recorded and permanent nature enables independent analysis and critique of its content;
- still graphics such as graphs or diagrams enable knowledge to be presented differently from written language, either providing concrete examples of abstractions or offering a different way of representing the same knowledge.

There is some overlap of each of these features with other media, but no other medium combines all these characteristics, or is as powerful as text with respect to these characteristics.

Earlier (Chapter 2, Section 2.7.3) I argued that 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. Academic knowledge is a second-order form of knowledge that seeks abstractions and generalizations based on reasoning and evidence.

Fundamental components of or criteria for academic knowledge are:

- codification: knowledge can be consistently represented in some form (words, symbols, video);
- transparency: the source of the knowledge can be traced and verified;
- reproduction: knowledge can be reproduced or have multiple copies;
- communicability: knowledge must be in a form such that it can be communicated and challenged by others.

Text meets all four criteria above, so it is an essential medium for academic learning.

7.2.1.2 Skills development

Because of text's ability to handle abstractions, and evidence-based argument, and its suitability for independent analysis and critique, text is particularly useful for developing the higher learning outcomes required at an academic level, such as analysis, critical thinking, and evaluation.

It is less useful for showing processes or developing manual skills, for instance.

8.2.2 The book and knowledge

Figure 8.2.2 What is a book? From scrolls to paperbacks to e-books, this one minute video portrays the history and future of books. Click to see the video from the UK Open University (© Open University, 2014)

Although text can come in many formats, I want to focus particularly on the role of the book, because of its centrality in academic learning. The book has proved to be a remarkably powerful medium for the development and transmission of academic knowledge, since it meets all four of the components

required for presenting academic knowledge, but to what extent can new media such as blogs, wikis, multimedia, and social media replace the book in academic knowledge?

New media can in fact handle just as well some of these criteria, and provide indeed added value, such as speed of reproduction and ubiquity, but the book still has some unique qualities. A key advantage of a book is that it allows for the development of a sustained, coherent, and comprehensive argument with evidence to support the argument. Blogs can do this only to a limited extent (otherwise they cease to be blogs and become articles or a digital book).

Quantity is important sometimes and books allow for the collection of a great deal of evidence and supporting argument, and allow for a wider exploration of an issue or theme, within a relatively condensed and portable format. A consistent and well supported argument, with evidence, alternative explanations or even counter positions, requires the extra 'space' of a book. Above all, books can provide coherence or a sustained, particular position or approach to a problem or issue, a necessary balance to the chaos and confusion of the many new forms of digital media that constantly compete for our attention, but in much smaller 'chunks' that are overall more difficult to integrate and digest.

Another important academic feature of text is that it can be carefully scrutinised, analysed and constantly checked, partly because it is largely linear, and also permanent once published, enabling more rigorous challenge or testing in terms of evidence, rationality, and consistency. Multimedia in recorded format can come close to meeting these criteria, but text can also provide more convenience and in media terms, more simplicity. For instance I repeatedly find analysing video, which incorporates many variables and symbol systems, more complex than analysing a linear text, even if both contain equally rigorous (or equally sloppy) arguments.

8.2.2.1 The form and function of a book

Does the form or technological representation of a book matter any more? Is a book still a book if downloaded and read on an iPad or Kindle, rather than as printed text?

For the purposes of knowledge acquisition, it probably isn't any different. Indeed, for study purposes, a digital version is probably more convenient because carrying an iPad around with maybe hundreds of books downloaded on it is certainly preferable to carrying around the printed versions of the same books. There are still complaints by students about the difficulties of annotating e-books, but this will almost certainly become a standard feature available in the future.

If the whole book is downloaded, then the function of a book doesn't change much just because it is available digitally. However, there are some subtle changes. Some would argue that scanning is still easier with a printed version. Have you ever had the difficulty of finding a particular quotation in a digital book compared with the printed version? Sure, you can use the search facility, but that means knowing exactly the correct words or the name of the person being quoted. With a printed book, I can often find a quotation just by flicking the pages, because I am using context and rapid eye scanning to locate the source, even when I don't know exactly what I am looking for. On the other hand, searching when you do know what you are looking for (e.g. a reference by a particular author) is much easier digitally.

When books are digitally available, users can download only the selected chapters that are of interest to them. This is valuable if you know just what you want, but there are also dangers. For instance in my book on the strategic management of technology (Bates and Sangrà, 2011), the last chapter summarizes the rest of the book. If the book had been digital, the temptation then would be to just download the final chapter. You'd have all the important messages in the book, right? Well, no. What you would be missing is the evidence for the conclusions. Now the book on strategic management is based on case studies, so it would be really important to check back with how the case studies were interpreted to get

to the conclusions, as this will affect the confidence you would have as a reader in the conclusions that were drawn. If just the digital version of only the last chapter is downloaded, you also lose the context of the whole book. Having the whole book gives readers more freedom to interpret and add their own conclusions than just having a summary chapter.

In conclusion, then, there are advantages and disadvantages of digitizing a book, but the essence of a book is not greatly changed when it becomes digital rather than printed. I have also written about the advantages of publishing an online academic textbook, based on my own experience of writing the first edition of this book, which is now available in 10 languages and has been downloaded over 500,000 times since 2015. For another perspective on this, see Clive Shepherd's blog: Weighing up the benefits of traditional book publishing.

8.2.2.2 A new niche for books in academia

We have seen historically that new media often do not entirely replace an older medium, but the old medium finds a new 'niche'. Thus television did not lead to the complete demise of radio. Similarly, I suspect that there will be a continued role for the book in academic knowledge, enabling the book (whether digital or printed) to thrive alongside new media and formats in academia.

However, books that retain their value academically will likely need to be much more specific in their format and their purpose than has been the case to date. For instance, I see no future for books consisting mainly of a collection of loosely connected but semi-independent chapters from different authors, unless there is a strong cohesion and edited presence that provides an integrated argument or consistent set of data across all the chapters. Most of all, books may need to change some of their features, to allow for more interaction and input from readers, and more links to the outside world. It is much more unlikely though that books will survive in a printed format, because digital publication allows for many more features to be added, reduces the environmental footprint, and makes text much more portable and transferable.

Lastly, this is not an argument for ignoring the academic benefits of new media. The value of graphics, video and animation for representing knowledge, the ability to interact asynchronously with other learners, and the value of social networks, are all under-exploited in academia. But text and books are still important.

8.2.3 Text and other forms of knowledge

I have focused particularly on text and academic knowledge, because of the traditional importance of text and printed knowledge in academia. The unique pedagogical characteristics of text though may be less for other forms of knowledge. Indeed, multimedia may have many more advantages in vocational and technical education.

In the k-12 or school sector, text and print are likely to remain important, because reading and writing are likely to remain essential in a digital age, so the study of text (digital and printed) will remain important if only for developing literacy skills.

Indeed, one of the limitations of text is that it requires a high level of prior literacy skills for it to be used effectively for teaching and learning, and indeed much of teaching and learning is focused on the development of skills that enable rigorous analysis of textual materials. Indeed reading ability is one of the core skills identified for the 21st century. Reading and writing literacy is somewhat under attack with the use of truncated language in text messages, automated spelling correction, and emotive symbols in

social media. However, we should be giving as much attention to developing literacy skills in using and interpreting multimedia in a digital age.

8.2.4 Assessment

If text is critical for the presentation of knowledge and development of skills in your subject area, what are the implications for assessment? If students are expected to develop the skills that text appears to develop, then presumably text will be an important medium for assessment. Students will need to demonstrate their own ability to use text to present abstractions, argument and evidence-based reasoning.

In such contexts, composed textual responses, such as essays or written reports, are likely to be necessary, rather than multiple-choice questions or multimedia reports.

8.2.5 More evidence, please

Although there has been extensive research on the pedagogical features of other media such as audio, video and computing, text has generally been treated as the default mode, the base against which other media are compared. As a result print in particular is largely taken for granted in academia. We are now though at the stage where we need to pay much more attention to the unique characteristics of text in its various formats, in relation to other media. Until though we have more empirical studies on the unique characteristics of text and print, text will remain central to at least academic teaching and learning.

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Although there are many publications on text, in terms of typography, structure, and its historical influence on education and culture, I could find no publications where text is compared with other modern media such as audio or video in terms of its pedagogical characteristics, although Koumi (2015) has written about text in combination with audio, and Albert Manguel's book is also fascinating reading from an historical perspective.

However, I am sure that my lack of references is due to my lack of scholarship in the area. If you have suggestions for readings, please send me an email. Also, a study of the unique pedagogical characteristics of text in a digital age might make for a very interesting and valuable Ph.D. thesis.

Activity 8.2 Identifying the unique pedagogical characteristics of text

1. Take one of the courses you are teaching. What key presentational aspects of text are important for this

course? Is text the best medium for representing knowledge in your subject area; if not, what concepts or topics would be best represented through other media?

2. Look at the skills listed in Section 1.2 of this book. Which of these skills would best be developed through the use of text rather than other media? How would you do this using text-based teaching?

3. What do you think about books for learning? Do you think the book is dead or about to become obsolete? If you think books are still valuable for learning, what changes, if any, do you think should be made to academic books? What would be lost if books were entirely replaced by new media? What would be gained?

4. Under what conditions would it be more appropriate for students to be assessed through written essays and under what conditions would multimedia portfolios be more appropriate for assessment?

5. Can you think of any other unique pedagogical characteristics of text?

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https://pressbooks.bccampus.ca/teachinginadigitalagev2/?p=201

8.3 Audio

Figure 8.3.1 Image: © InnerFidelity, 2012

> *Sounds, such as the noise of certain machinery, or the background hum of daily life, have an associative as well as a pure meaning, which can be used to evoke images or ideas relevant to the main substance of what is being taught. There are, in other words, instances where audio is essential for efficiently mediating certain kinds of information.*

Durbridge, 1984

8.3.1 Audio: the unappreciated medium

We have seen that oral communication has a long history, and continues today in classroom teaching and in general radio programming. In this section though I am focusing primarily on recorded audio, which I will argue is a very powerful educational medium when used well.

There has been a good deal of research on the unique pedagogical characteristics of audio. At the UK Open University course teams had to bid for media resources to supplement specially designed printed materials. Because media resources were developed initially by the BBC, and hence were limited and expensive to produce, course teams (in conjunction with their allocated BBC producer) had to specify how radio or television would be used to support learning. In particular, the course teams were asked to

identify what teaching functions television and radio would uniquely contribute to the teaching. After allocation and development of a course, samples of the programs were evaluated in terms of how well they met these functions, as well as how the students responded to the programming. In later years, the same approach was used when production moved to audio and video cassettes.

This process of identifying unique roles then evaluating the programs allowed the OU, over a period of several years, to identify which roles or functions were particularly appropriate to different media (Bates, 1984). Koumi (2006), himself a former BBC/OU producer, followed up on this research and identified several more key functions for audio and video. Over a somewhat similar period, Richard Mayer, at the University of California at Santa Barbara, was conducting his own research into the use of multimedia in education (Mayer, 2009).

Although there have been continuous developments of audio technology, from audio-cassettes to Sony Walkman's to podcasts, the pedagogical characteristics of audio have remained remarkably constant over a fairly long period.

8.3.2 Presentational features

Although audio can be used on its own, it is often used in combination with other media, particularly text. On its own, it can present:

- spoken language (including foreign languages) for analysis or practice;
- music, either as a performance or for analysis;
- students with a condensed argument that may:
    - reinforce points made elsewhere in the course;
    - introduce new points not made elsewhere in the course;
    - provide an alternative viewpoint to the perspectives in the rest of the course;
    - analyse or critique materials elsewhere in the course;
    - summarize or condense the main ideas or major points covered in the course;
    - provide new evidence in support of or against the arguments or perspectives covered elsewhere in the course;
- interviews with leading researchers or experts;
- discussion between two or more people to provide various views on a topic;
- primary audio sources, such as bird song, children talking, eye witness accounts, or recorded performances (drama, concerts);
- analysis of primary audio sources, by playing the source followed by analysis;
- 'breaking news' that emphasizes the relevance or application of concepts within the course;
- the instructor's personal spin on a topic related to the course.

Audio however has been found to be particularly 'potent' when combined with text, because it enables students to use both eyes and ears in conjunction. Audio has been found to be especially useful for:

- explaining or 'talking through' materials presented through text, such as mathematical

equations, reproductions of paintings, graphs, statistical tables, and even physical rock samples.

This technique was later further developed by Salman Khan, but using video to combine voice-over (audio) explanation with visual presentation of mathematical symbols, formulae, and solutions.

8.3.3 Skills development

Because of the ability of the learner to stop and start recorded audio, it has been found to be particularly useful for:

- enabling students through repetition and practice to master certain auditory skills or techniques (e.g. language pronunciation, analysis of musical structure, mathematical computation);
- getting students to analyse primary audio sources, such as children's use of language, or attitudes to immigration from recordings of interviewed people;
- changing student attitudes by:
    - presenting material in a novel or unfamiliar perspective;
    - by presenting material in a dramatized form, enabling students to identify with someone with a different perspective.

8.3.4 Strengths and weaknesses of audio as a teaching medium

First, some advantages:

- it is much easier to make an audio clip or podcast than a video clip or a simulation;
- audio requires far less bandwidth than video or simulations, hence downloads quicker and can be used over relatively low bandwidths;
- it is easily combined with other media such as text, mathematical symbols, and graphics, allowing more than one sense to be used and allowing for 'integration';
- some students prefer to learn by listening compared with reading;
- audio combined with text can help develop literacy skills or support students with low levels of literacy;
- audio provides variety and another perspective from text, a 'break' in learning that refreshes the learner and maintains interest;
- Nicola Durbridge, in her research at the Open University, found that audio increased distance students' feelings of personal 'closeness' with the instructor compared with video or text, i.e. it is a more intimate medium.

In particular, added flexibility and learner control means that students will often learn better from pre-prepared audio recordings combined with accompanying textual material (such as a web site with slides) than they will from a live classroom lecture.

There are also of course disadvantages of audio:

- audio-based learning is difficult for people with a hearing disability;
- creating audio is extra work for an instructor;
- audio is often best used in conjunction with other media such as text or graphics thus adding complexity to the design of teaching;
- recording audio requires at least a minimal level of technical proficiency;
- spoken language tends to be less precise than text.

Increasingly video is now being used to combine audio over images, such as in the Khan Academy, but there are many instances, such as where students are studying from prescribed texts, where recorded audio works better than a video recording.

So let's hear it for audio!

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Activity 8.3 Identifying the unique pedagogical characteristics of audio

1. Take one of the courses you are teaching. What key presentational aspects of audio could be important for this course?

2. Look at the skills listed in Section 1.2 of this book. Which of these skills would best be developed through the use of audio rather than other media? How would you do this using audio-based teaching?

3. Under what conditions would it be more appropriate for students to be assessed by asking them to make an audio recording? How could this be done under assessment conditions?

4. To what extent do you think redundancy or duplication between different media is a good thing? What are the disadvantages of covering the same topic through different media?

5. Can you think of any other unique pedagogical characteristics of audio?

Click on the podcast below for feedback on this activity:

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