Chapter 3
The Social Processes of Web 2.0 Collaboration: Towards a New Model for Virtual Learning

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Abstract This chapter examines how curriculum design needs to be influenced by the development of educationally effective virtual collaborative learning (VCL) environments. VCL environments can afford learners new opportunities to engage in rewarding, productive learning experiences. Put simply, successful VCL environments attract membership, engage those members, and encourage ownership of the networks of learning which they create. They must be useable in the ways that members prefer or can easily adapt to. Exactly how these outcomes can be achieved is the goal of this chapter, which argues the need for new thinking on the purpose and design of collaborative online learning solutions where the focus is not just on what to learn, but also the methods and tools that enhance the student's learning capacity. Considered as a whole, the preceding factors point to the need to not only rethink the design and purpose of the curriculum models that inform the design and function of VCL environments, but also to devise more adaptive, educationally focussed teaching and learning strategies which reflect the current realities of social Internet use, rather than the traditions encoded into learning management systems.

Keywords Virtual learning networks • Web 2.0 technologies • Networked communication • Collaborative networks • Knowledge communities • Networked learning

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3.1 Introduction

Although online learning is now accepted as a convenient option for accessing educational materials and associated instruction, most web-based learning environments rely on relatively traditional methods of instructional design, delivered through proprietary learning management systems (LMS). Despite the eloquent rhetoric of vendors and institutions alike, LMS do not, of themselves, promote pedagogical diversity and innovation. Indeed, in many cases, the combination of institutional structures, along with the traditional assumptions designed into LMS, and the general conservatism of university educators means that online learning is often an impediment to the changes and improvements needed for higher education to produce creative, independent thinkers.

University students are rarely offered the tools to organise their online activities to accommodate their individual needs and circumstances; online collaborative problem-solving activities and group projects seldom provide satisfactory learning experiences; and seamless integration with online communities of practice is often not permitted or, at least, made difficult by the closed nature of many interdependent systems and the assumptions about how they should be used.

When thinking more generally about the Internet, as opposed to LMS, people have a much wider array of social sharing and learning opportunities, with a strong emphasis on user-generated content and ongoing networked conversation. While in recent years LMS have adjusted to include some of the new ways that the Internet promotes information and communication, for example including within these systems such popular platforms as wikis, blogs, and the like, they remain 'closed' to the outside world and therefore do not properly emulate the online environment. Furthermore, many other opportunities exist online for creative knowledge work and collaboration which are not present in LMS at all, ranging from simple web applications for data visualisation, presentation, mind-mapping, web publishing, and so on through to complex environments like Second Life. The Internet continually offers new tools to support such activities, but most contemporary learning management platforms do not fully encompass them and, even when included, such services are usually far more difficult to use than those found in the 'real' Internet. Finally, and most importantly, key online services like Twitter and Facebook are now very widely used and have become the main way for people to share information and forge and maintain social networks. The way people use the Internet through these services is completely different to the traditional approach taken in LMS. A mismatch is evident between what people are doing on the Internet and the online provisions of universities (Liber, 2004, pp. 137–138; Allen & Long, 2009).

This chapter examines, in contrast, how the learning experience can be enhanced through the provision of virtual collaborative learning (VCL) environments that utilise so-called Web 2.0 technologies to produce learning networks. Such learning networks are innovative and more effective because the open and participatory nature of the technologies that sustain them relocate the practices and power of

learning within and across the network itself rather than to a central source from which learning is transacted. VCL environments disperse learning into the connections that form the network as opposed to serving to transfer knowledge from one point to another. They also more closely emulate the everyday behaviour of most Internet users and enable a greater development of informal learning *through* the networks thus formed. While in theory LMS might promote such activity, in fact they do not, because of the combination of institutional strictures and traditional assumptions noted above. The more that the Internet generally changes character away from its origins, which also give birth to the LMS in the 1990s, so the disparity between the everyday networked experience and the study-bound LMS experience grows and inhibits students from learning effectively when limited to the latter. While in its early days, e-learning moved away from traditions of instruction and transfer of knowledge, as it has become systematised within institutions, these traditions have largely re-asserted themselves and become culturally encoded into LMS use.

The educational arguments in favour of learning in such environments are straightforward and reflect several years of observing the relative successes and failures of current approaches to e-learning. First, whenever learning involves collaborative discourse, concepts, notions, or ideas are refined and transformed during collective exchange where participants contribute their ideas to an online community network and 'build on' the contributions of others. Second, conceptual change is an intentional and reflective cognitive process leading to higher order learning that arises through the efforts of individuals and collaborative groups (Campos, 2004, p. 10) and such groups form online as much as in physical spaces. Indeed new knowledge and ideas emerge whenever an individual or a group of individuals engages in discourse and interaction with other individuals and groups.

When correctly managed, networked online collaborations can proceed more efficiently than through past practices in knowledge exchange transactions. This efficiency stems from the fact that the raw material through which the networking process occurs—information displayed on a screen—can be rapidly transmitted, altered, developed, and refined, often in direct collaboration via that screen. The informatic and communicative aspects of the collaborative process converge, collapsing the time between initiation and completion of a learning activity, and thus enhance the interactions among the human participants. Further, as they are in digital form, these informational transactions can be stored, reused, analysed, and redeveloped with significantly less cost when compared to other mediums.

The purpose of this chapter is not, however, to argue the need for VCL—the literature abounds with positive endorsement for such environments. Instead, the focus is on understanding the curriculum design factors and strategies that inform the educationally effective deployment of VCL environments. We begin by examining how technology can support successful learning outcomes in the online environment.

3.2 Online Collaboration: Coordinating Technology and People

It is emphasised from the outset that the Internet is not a learning technology in the traditional sense. It is a socially widespread technology for knowledge work—through which knowledge networking has become far more prevalent (Allen & Long, 2009). The Internet is used by people in many ways to produce 'learning' regardless of whether they actively think of themselves as learners or students. In this nonphysical world of social interaction and virtual collaboration people are afforded the freedom to

- Communicate and interact with other people in ways that reduce the consequences of spatial separation and varying time-zones.
- Search for and acquire information that meets their immediate and longer-terms needs in developing knowledge to solve problems, make decisions, and become better informed about the world.
- Organise information via virtual libraries, bibliographies, tagging, or otherwise cataloguing their material and ideas.
- Organise collaborative online activities such as decision-making, shared information spaces, and website maintenance.
- Transact business processes in ways that save time and money by exchanging data and information in digital form without the need for more costly physical interactions.
- Publish and share content for other interested users through web-publishing services such as blogs, wikis, and discussion forums.
- Create textual and audio-visual resources and content, both distributing them online and forming interactive communities around them.

These activities occur separately throughout the Internet without the benefit of a single, task-specific, purpose-built digital environment in which all activities are fully harmonised. As a result, it is often the case that specific tasks are segregated according to the Internet function that generated them. For example, all emails are stored as emails, rather than as part of an overall task or project; website favourites are organised and stored as individual resources and not for group access. Although the emerging forms of Web 2.0 technologies are built upon collaboration and the coordinated activity of 'networked individuals', there is evidence that the majority of Internet users are still largely engaged in individual pursuits or interact with the spaces of collaboration (such as Wikipedia) only as observers, audiences, and readers.

The fact that technologies for collaboration exist and have so for several years suggest that there is more to online collaboration than *just* the technology. Fragmented private internet use no longer seems to be the preferred norm of technologies such as blogging, tagging, social media, and the like (Bruns, 2008; Howard, 2008), yet the uses are quite low or very narrow. Perhaps it is difficult to collaborate and simultaneously share a commitment to the ongoing maintenance of collaborative online endeavour.

Successful collaborative online behaviour is not inherently formed from the technologies, but is fundamentally social in its orientation, depending on the people involved as well as their computers and code. Three factors are crucial (Bruns & Bahnisch, 2009; Jones & Issroff, 2005):

1. Members of the network must be motivated to become involved and participate fully: such motivation is both intrinsic (in that the process of networking is engaging and enjoyable) and extrinsic (networking produces a realisable benefit for themselves and their community); further the activities of the network must themselves produce ongoing motivation and not serve or create demotivating concerns (for example, too much time required; lack of apparent success).
2. The rights and responsibilities of participants must be actively facilitated, not only in the early stages of the network's formation, but also in ways that enable the network to grow and adapt over time; in this respect a network is not a community—communities have more tightly defined boundaries, whereas networks extend and intertwine themselves far more through the active acquisition of additional nodes.
3. Participants are most successfully engaged and facilitated because they are the primary 'authors' and 'developers' of the network and, while members of the network can play several roles, they are all encouraged and capable of producing, not just receiving the information and communication flows within the network.

Put simply, successful collaborative networks attract membership, engage those members, and encourage ownership of the network. Moreover, network systems that enable human interaction must be useable in ways preferred by members. This requirement does not mean that the technologies must always be of a particular type or provide a specific function, but rather that the needs and imagination of the users should align with the capabilities of the applied technologies. Therefore, virtual collaborative networks are only successful when the needs and expectations of the participants align with the capabilities and affordances of the available technologies (that is, the chosen technologies must be adaptable to human needs (Oblinger & Oblinger, 2005, pp. 14–15)).

Users of virtual networks can be encouraged and supported to learn, refine, and filter content through communal opinion (whether or not a consensus is reached), discussion, and research to identify and interpret the meaningful relationships that exist between objects, phenomena, and human minds. It is the combination of information and computer technologies (ICT) along with advances in exploiting communal intelligence and conceptual understandings to build self-organising, adaptive online spaces that ultimately support innovation, creativity, and the generation of new ideas.

In effect, such spaces represent a framework for integrating various online technologies, offline spaces, human and technology-based support systems, and the thinking processes, methods, and strategies that give rise to learning. The construction of this framework requires design principles tailored to manage the complexities that occur as a result of the convergence of 'real-world' interactions between people and information, and the more abstract development of concepts, ideas, creativity, and learning.

The key to designing educationally effective online collaborations is to extend the individual's knowledge construction skills to embrace multi-levelled, interconnected, social learning systems that expose learners to a diverse array of perspectives, practices, interests, and the idiosyncrasies of the targeted knowledge domain. Collaboration among individuals and networks of individuals (groups) are fundamental to the sustained generation of new ideas, the refinement of accepted ideas derived through the efficient dissemination of information, and to the subsequent creation and application of knowledge. In this model, the learner is encouraged to negotiate pathways (either preset or self-determined) through divergent contexts while simultaneously being 'monitored' by community members who analyse and provide feedback on the strategies employed during the learning process. In this way, learning capability is enhanced for both the individual and the community.

However, any new model of learning for constructing educationally effective VCL environments that incorporate technology as an aid to the learning process must strive to connect people to people—not people to machines. With this goal in mind, a number of questions arise in determining how learning can be facilitated in the online environment. The questions that guide the present discussion are:

- How does learning emerge in a network environment?
- What are the strategies for producing collaborative learning in such environments?
- How to identify and provide automated support for the learning needs of a networked community of learners?

3.3 Learning in a Network Environment

In the physical world, social networks operate on the relatively simple principle that whenever people, groups, systems, nodes, organisations, resources, and other entities are connected, a 'greater than the whole' effect emerges as a result. Changes that occur within any of the components that make up the network produce an effect throughout the entire system. When such a network environment is used for education, learning occurs most effectively via the creation and strategic use of connections and relationships between nodes in this network. Nodes include information, ideas, individuals, and communities of interest. The likelihood that a new or unknown concept will become evident to the learner is dependent on how well it is linked to supporting nodes of information and to other supporting resources. As learners are exposed to more opportunities to identify and recognise the available nodes, the resultant increase in their depth of understanding eventually leads to cross-pollination of ideas and concepts communicated within the immediate learning community.

In effect, a social learning network is a structure within which a coordinated set of resources and activities are offered to provide opportunities for learning that are designed to empower the learner to create and evolve a range of experiences among people, places, and information. The learner is actively engaged in shaping the

learning environment to support his or her individual learning. Such networks contain *both* information and identity nodes—things to learn and learners—and the network sustains motivation to learn, learning activities, and the reflections by which learning is known to have occurred.

Networking as described above can inform online learning design and accordingly enable the transition from a centralised, institution-based education system that requires conformity to an inflexible, standards-based top-down structure, to a decentralised, bottom-up system of knowledge creation and sharing that is formed around informal structures and standards. The design and structure of a networked learning environment should not be limited to technological application and interface design, nor should it be confined to the provision of curricula and learning materials. Instead, learning networks can be thought of as environments that encompass the social and environmental aspects of human experience.

Human learning networks are analogous in their nature to ecological systems. That is, they are 'alive', in that they display properties characteristic of dynamic, vibrant, interactive, and evolving environments. They are also grounded in interdependence: no element of the ecology can flourish without others. From a learning perspective, the design elements of a collaborative educational environment should provide:

- A means of organising individual input and experience.
- A mechanism for putting that experience into context.
- A means of creating knowledge and becoming part of other individual's or group experiences.

The capacity to prompt learners to structure, integrate, and interconnect new ideas with their existing knowledge and prior experiences facilitated by tools that enable them to rearrange, synthesise, and restructure information in their efforts to expand their personal knowledge base, means in effect that ICT provides a useful aid for teaching the complex tasks of thinking, problem solving, and learning (Candy, 2004, p. 230). The focus of learning becomes the learner's active identification and creation of relationships among data and information, married to or assisted by the formation of relations between people within the network.

For many years, the Internet has provided a familiar example of how relationships can lead to the creation of meaning and knowledge, as well as a working environment for such learning networks. It is also a medium that can provide a pedagogically sound foundation, conducive to active learning, knowledge construction, and discursive interactivity (Geer, 2000, p. 1). Connections made via Internet networking enable the emergence of unusual 'nodes' of information or activity and support and thereby intensify existing group activities. The amplification of learning, knowledge, and understanding through the conscious extension of a personal network is, ideally, an epitome of connectivism in that it provides valuable insights into the learning skills and activities that empower learners to create new knowledge (Siemens, 2004, p. 4). The networked connections are constantly changing, dynamic, responding to interest, experience, and new understandings and thus are continually adapted and expanded as more is learned and the volume of accumulated knowledge

increases. In essence, a connectivist approach to learning environment design presents a model that acknowledges the act of learning is much more than an individualistic and hence, internalised process.

In recent years, the Internet has become far more capable of sustaining effective knowledge networks that enable learning. This change is both technological and social. Not only are many new kinds of online tools readily available for participation in knowledge networking (normally termed 'Web 2.0', but also understood as social media or the read/write web), but the cultures of use of the Internet have changed to make more and more people already part of social networks whose substance is formed by knowledgeable interactions. Thus, it is reasonable to conclude that while the Internet has always held potential for forms of learning based in social networks, it is only in the past 3 years that this potential has become operational. At this time, therefore, universities that have built structures and systems better suited to earlier ties are now facing many challenges to adapt to the epistemological shifts of Web 2.0 (Allen & Long, 2009).

3.4 Strategies for Collaborative Learning

It is natural to assume that knowledge resides in the minds of individuals, but when tacit knowledge is considered, especially as related to actual practice, it becomes apparent that there is much more to learn than what is already known and understood. However, complications arise when considering the broader epistemological topology as a whole in that both tacit and explicit knowledge apply not just to the individual, but also to the social network that is often referred to as a 'community of practice' (Fitzgerald & Steele, 2008; Greenhow & Robelia, 2009; Waters & Gasson, 2007). Furthermore, much of what is described as 'knowing' is made more authentic through active participation in the world and through interactions with other people where the focus is directed toward solving practical problems. More specifically, a great deal of an individual's 'knowing' or 'know-how' derives from active participation within a social network of learners. We might label this state 'constructivism' but it is more than that: the network of relations within which people 'know' is itself involved. A learning network is not just a space within which knowledge is constructed by individuals, but a fundamental collaborator in its own right: the network has agency and identity as much as its individual nodes.

Knowledge, therefore, is not derived from the individual alone, or from individuals in concert: it derives from the architecture and affordances of the network that those individuals form, along with their knowledge. The network particularly enables clarifications from and between individuals so that acquired understandings can be consolidated from deep expertise (Candy, 2004, p. 231). Such cognitive activities are increasingly being performed in 'virtual' networked contexts where the co-creation of knowledge is achieved through networked technologies. The key concept underpinning such online activity is that through active collaboration in the

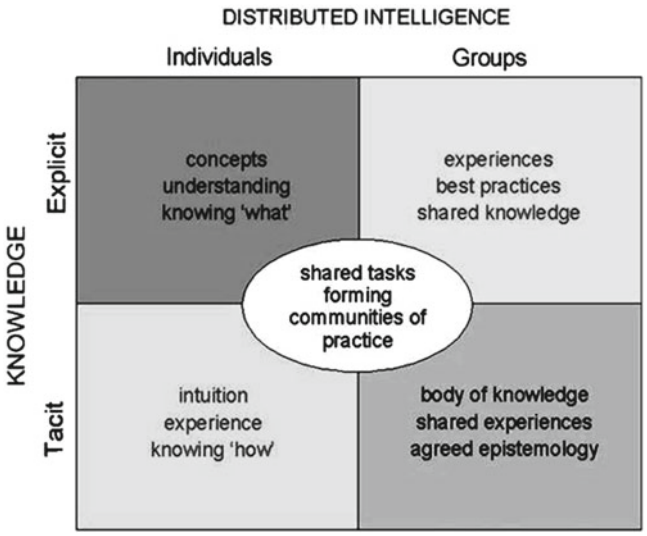

Fig. 3.1 Distribution of intelligence across a community of practice

production, creation, improvement, and innovation of knowledge, a community can accomplish much more than the contributions of individual. Campos (2004, p. 3) adds further weight to these views:

"Knowledge communities that develop within a networked cognitive communication process follow a path in which formal individual structures blend with collectively shared content. Knowledge building represents a collaborative process in which conceptual change and innovation are apparent. Therefore, both conceptual change and innovation are indicators of collaborative learning".

New knowledge emerges whenever an individual or a group of individuals engages in some form of discourse and interaction with one or more additional participants within an identifiable community of practice (or interest). When individuals collaborate, concepts, notions, or ideas are refined or transformed in a collective exchange as may occur in synchronous 'real-time' discussions or as a result of asynchronous activities such as the exchange of ideas through a bulletin board. If the shared aim of a community of learners is to enable knowledge building, then a detailed understanding of how intelligence is distributed across a broader matrix of learning (see Fig. 3.1) is critical (Brown, 2002, p. 7).

It is during collaborative, networked discourse that participants 'build on' the contributions of others. The outcome of this exchange is that participants reassess and reflect on new knowledge, and in the process, reconstruct previously held concepts, notions, or ideas. Collaborative learning is achieved when conceptual change is explicitly affirmed and redirected during the sequence of discussions with a view to transforming the shared thinking into new concepts and idea. However, any change

in concepts, notions, and ideas derived through networked argumentation that become more or less established (stable) during discourse (thus, collaborative learning) is not automatically valid evidence of knowledge building (Campos, 2004, p. 10). Whereas the resulting outcome may be in the form of knowledge that arises from any change in concepts, notions, and ideas that have stabilised through group consensus (thus, collaborative learning), knowledge that is clearly unique and could not be achieved by the individual alone is in effect the collective result of many interconnected minds. Therefore, networked learning presents opportunities for learners to access pedagogically rich environments that exhibit several fundamental elements of effective learning: the active construction of knowledge; positive interpersonal relationships; and discursive interactivity.

In terms of learning effectiveness, there are sound educational reasons for engaging students in collaborative activities. As students learn from each other and benefit from the need to articulate their knowledge and understanding to their peers, group work becomes conducive to cultivating cognitive development. Where most students are concerned, the authenticity of the collaborative activity or task is crucial to determining their willingness to participate. Tasks perceived to be trivial or superficial run the risk of students being unwilling to commit. However, students respect those tasks that they perceive to be 'real' and suggest a strong connection to the practical application of their knowledge and skills to creative endeavours. They also demonstrate a keen desire to test their abilities in a group environment and to take the opportunity to compare their work with their peers. In addition, well-designed collaborative learning environments may encourage the enhancement of highly valued generic skills that are considered necessary for successful engagement in an information-dominated future (James, Mcinnis, & Devlin, 2002, p. 48):

- Teamwork skills as related to understanding team dynamics and fostering leadership skills.
- Analytical and cognitive skills involving task analysis, effective questioning, critical interpretation of materials, and peer evaluation.
- Collaborative skills in as applied to conflict management and resolution; and acceptance of intellectual criticism, negotiation, and a capacity to compromise.
- Organisational and time-management skills.

3.5 Supporting the Learning Needs of Communities of Learners

Regardless of the desired outcomes, research studies that focus on the application of ICT to online learning design should demonstrate learning advantages for all affiliates including the learner, the lecturer/tutor, and the learning institution. The benefits to the learner should include: an increased capacity to acquire and generate knowledge; identifiable social benefits in terms of collaborative and team

participation skills; enhanced personal motivation and lifelong learning skills; and advanced learning and problem-solving strategies.

For the teacher, administrative workloads must be noticeably reduced, thus freeing up valuable time to focus on their primary role, that of facilitating the learning process. The main outcomes should include: the capacity to access high-quality resources for reuse in other learning contexts; provision of automated assessment tools; and the assistance of software systems that respond directly to learners' immediate needs and deliver customised assemblies of teaching resources tailored to diverse learning styles and generational preferences. Finally, the benefits to the learning institution apply to: a measurable increase in learners' knowledge and their eventual suitability for employment; calculable cost advantages and procedural efficiencies; the levels of contribution to organisational goals; and the status derived through the delivery of innovative teaching solutions in relation to world best practice.

Therefore, where VCL is concerned, it is important to recognise that in the absence of systematic planning and design to determine a suitable structured environment it is unwise to assume collaborative activities will automatically result in quality learning outcomes. Campos (2004, pp. 9–10) raises three crucial questions in relation to the learning effectiveness of collaborative environments that assist in devising a viable learning model:

- How to assess collaborative conceptual change and learning?
- How to assess collaborative conceptual (or notional or idea) change and (higher order) learning in online discourse when these processes follow one another?
- How to assess knowledge building?

In answering the first question, Campos emphasises there is a marked difference between successfully performing an action and understanding what has been achieved. Whereas an individual may succeed in identifying a problem and then structure it through language or the written word, in order to really understand a problem requires the capacity to reflect on the problem at hand, formulate hypotheses, and reconstruct prior logical conclusions (logical reasoning). It is during the process of applying logic to solve problems that inferences are made, a tacit learning process where the learner moves from meaning to meaning to draw valid relationships and refine their individual meaning system (natural logic). Conceptual change is an intentional and reflective cognitive process leading to higher order learning as opposed to lower order learning which is mainly automatic (such as learning instinctively or making unconscious decisions). Conceptual change can occur individually or in collaboration with others (collectively). When it is collaborative, concepts, notions, or ideas are changed or transformed in a collective exchange, as in the case of web-enabled asynchronous activities.

The distinction made here between succeeding and understanding points to the difference between cognitive and metacognitive behaviour, where metacognition refers to the individual's awareness of their own cognitive processes, or the thinking steps required to transform a concept, a notion, or an idea. Thus, metacognition is thinking about thinking as well as knowing 'what is known' and 'what is not known'.

The basic metacognitive strategies to be observed when designing a collaborative learning model are (Blakley & Spence, 1990, pp. 11–14):

- Connecting new information to former knowledge.
- Selecting thinking strategies deliberately.
- Planning, monitoring, and evaluating thinking processes (Dirkes, 1985).

In considering the implications of the second question, Campos instructs the learner to identify concepts, notions, or ideas that are both at the centre and are a result of a hypothetical collaborative process of networked argumentation. In this process, community participants 'build on' the contributions of others using a 'if this, then that' strategy to apply explicit or implicit conditionals that correspondingly lead to hypotheses formulation and inferencing. The result of this exchange is that participants reassess and reflect on knowledge and rebuild previously held concepts, notions, or ideas. When collaborative conceptual change occurs, then collaborative learning is also likely to take place. However, it should be noted that collaborative learning can only be achieved if there is evidence in the sequence of exchanges that conceptual change was clearly incorporated in the renewed discourse, either by affirming it or by re-transforming it to create renewed concepts, notions, or ideas.

Where question three is concerned, Campos advises that any change in knowledge must be profound. That is, the resulting knowledge must be unique and a truly collective result of the many asynchronously interconnected minds, something that could not be achieved by the individual alone.

3.6 Designing a Virtual Collaborative Learning Environment

VCL design does not mean 'building a website' or writing code, or even using a learning management system (LMS). Designing a VCL refers to the curriculum design strategies by which teachers can create, using web technologies, *experiences* for collaboration that involve networking. Such design must, in the first instance, be informed by the principles that underpin the attainment of metacognition: the design of a VCL needs to ensure that students have metacognitive awareness of their interactions and practices within it (Blakley & Spence, 1990, pp. 11–14). As Tay and Allen (2011) argue, curriculum design for technology-based learning must also identify and create effective social affordances, and not just rely on the technological affordances.

Students begin a learning activity through a conscious process of identifying 'what is known' and 'what is not known'. As they engage in a learning activity, students are required to verify, clarify, and expand or replace their prior knowledge and understandings with more accurate information. In essence, a metacognitive learning environment should be designed to encourage students to be aware of their own thinking. Therefore teachers need to monitor and apply their personal knowledge, deliberately modelling their individual metacognitive behaviour to assist

students develop an understanding of how to structure their own thinking processes. In other words, the teacher is as active within the VCL network as the students. Problem-solving and research activities provide additional opportunities for developing metacognitive strategies. To be successful, teachers need to focus student attention on how tasks are accomplished. Process goals, in addition to content goals, must be established and evaluated with students so they discover that understanding and transferring thinking processes lead to improved learning.

The substantive point here is that the learning network does not require code to do this type of work: rather, for it to be a learning network, there has to be a designed process—carried out using any relevant technology (blogging, discussion, wikis, chat, or more)—through which metacognition is made *present* within the interactions of individuals. Essentially, through the teacher's intervention, metacognition becomes a node in itself.

There are a number of useful models for gauging the learning effectiveness of collaborative activity in which it is understood that the goal of computer-mediated communicative interaction is the production of new knowledge or the understanding of meanings (Campos, 2004, pp. 4–6). He describes several models of which two are selected as typical examples of how collaborative learning environments may be designed and structured. The first draws directly on grounded theory principles to propose a five phase evolution of negotiation leading to the co-construction of knowledge: sharing and comparing information; the discovery and exploration of dissonance or inconsistency among ideals, concepts, or statements; negotiation of meaning and construction of knowledge; testing and modification of proposed synthesis or co-construction; and agreement on the applications of newly constructed meanings. A second model employs three methods. The first defines discussions as being vertical (seeking answers on a given subject matter), or horizontal (interacting with other participants to co-construct) in order to classify them as the simple assimilation of information or knowledge construction. The second method advocates the need for critical thinking and participation. The third classifies discourse according to vertical questioning, horizontal questioning, statements, reflections, and scaffolding.

An innovative example of how an online learning network may be structured to support learners in their efforts to construct and assimilate new knowledge is provided by Slotta and Linn (2000, pp. 4–5) who devised a set of design principles they refer to as the Scaffolded Knowledge Integration Framework. Within this framework, students become engaged in sorting out unfamiliar ideas and determining a predictive set of models. Students are also encouraged to develop personal criteria for linking ideas and expectations about what it means to explain and what it means to understand. Ultimately, the goal is to structure autonomous learning in a way that promotes the ability to integrate diverse sources of information and to judiciously critique the credibility of their findings.

To achieve such outcomes, cognitive, social, and epistemological factors provide the basis for devising the four major principles that underpin this framework, which we will now outline.

1. New goals for learning are required in order to shift students (and teachers) away from their traditional focus on rote memorisation and performance measurements against standardised tests. What is needed is a curriculum that emphasises opportunities for students to evaluate new information in accordance with personal understanding, to articulate their own theories and explanations, and to actively participate in principled design. Students must also assume a high degree of independence when engaged in the process of solving complex problems. This approach encourages students to seek out and explore connections and to test the validity of the connections they have made. In turn, they are able to develop greater autonomy in evaluating connections and seeking out disconnected information. The importance of connecting ideas in the Scaffolded Knowledge Integration framework is supported by the notion of 'making thinking visible'. Most noteworthy is the way connections are made and how relationships are defined to form new conceptual understandings that in principle is similar to systems thinking.
2. It is important to assist students to utilise their own repertoire of learning models by providing the tools and opportunities to represent their own thinking. This strategy allows students to develop more sophisticated as well as more diverse models of thinking, particularly if structured within a framework of cognitive, procedural, and metacognitive supports. To have any real effect however, it is essential students receive constructive feedback on the relevance and efficacy of their current thinking models.
3. There is a need to emphasise autonomous student activities that connect to students' concerns and engage them in sustained reasoning. Design or critique projects that require students to form opinions or explanations about the available evidence or to make principled design decisions assist to encourage autonomous learning. To make such projects authentic, it is essential to draw on students' existing knowledge and to incorporate information that is directly relevant to their individual interests.
4. Social supports for learning can assist students to develop valuable collaborative skills, and in the process, gain new insights from their peers. For example, listening to ideas from peers, validating each other's ideas, and asking questions of peers all foster the formation of links and connections among ideas. However, opportunities for discourse succeed best when structured into the curriculum, so that students are actively encouraged to share opinions, offer feedback to others, and to reflect on the mix of ideas.

Thus, designing an effective social context for learning also involves guiding the process of social interaction. Well-designed learning environments not only promote collaborative activity, but also provide an efficient means of teaching students to learn how others connect ideas.

3.7 Curriculum Design as Applied to Virtual Collaborative Learning Practice

How might these four principles be put into practice to create an effective VCL? To answer this question we must first of all appreciate that there is no single software solution, no packaged learning system or similar options. While LMS such as Blackboard, Moodle, Sakai, Desire2Learn, and others are very prominent in online learning and could play a significant part of the production of VCLs, they are not, of themselves, the answer. Rather, the four principles just outlined provide us with the ability to create an interwoven mix of technologies, practices, and learning design which gives effect to the VCL through the digital ecology of the network: the interaction of people, ideas, and activities that can be experienced through many technological forms.

Here is one way to use existing online knowledge work technologies to give effect to these principles.

The first principle, put simply, requires students to be active in their learning: to *do* something, rather than simply receive and attempt to internalise information. While learning is not solely about the inherent generation of knowledge from nothing, learning will only be effective, for the majority of students, when it involves working *with* prior knowledge, transforming it, appropriating it, and representing it. The Internet provides a very powerful array of technologies to enable such an approach. Wikis, whether in their more traditional form (for example, maintained through services like http://wikispaces.com, http://wikidot.com or http://pbworks.com) or in more sophisticated ways (http://springnote.com), are one such technology.

A wiki is a space that depending on the way it might be designed and prepared by a teacher is a more or less open, collaborative writing/media production environment, which more than any other online technology embodies the principles of the read/write web. Knowledge is received, considered, and also produced all in the same place. Quite literally, the space of reading is also the space of writing. Although difficult to use in practice, wikis produce the kind of active engagement that is essential within a VCL. There are alternatives, as well. To pick one example, http://slinkset.com enables any Internet user to create a private or public shared space that mimics the rolling stream of links and comments found in services like digg.com and reddit.com. VCL development requires educators to find these ‘open’ writeable spaces and then encode them with the scaffolding necessary for students to use them as a place for conducting knowledge work online.

The second principle demands that students have tools to represent, reflect on, and improve their own thinking. The Internet, particularly in the guise of Web 2.0 applications and services, has provided significant opportunities for students in this respect. Mind-mapping software (for example http://mind42.com; but also http://www.wisemapping.com, http://www.glinkr.net and http://bubbl.us) is a very useful technology by which the thinking process can be externalised, often shared with other students and teachers, even used as the basis for a fully finished piece of knowledge work (rather than being a precursor to a traditional written form of

presentation). While not commonly thought of as a tool for thinking representation, a blog (powered for example, by http://wordpress.com, http://blogger.com, or http://posterous.com) is a tool that can track thinking over time, with the particular value of the social understanding of the blog as a narrative developed over a period of time, rather than an edited, re-edited, and then finalised single piece of work. Visualisation services such as http://wordle.net or http://chartle.net can enable students to translate words into images that investigate the meaning of those words and the logical relationships within them. Services like http://xtimeline.com or http://www.preceden.com allow students to create timelines, which serve as another way of externalising the logical relationships involved in narratives that emerge over time.

The third principle emphasises autonomous student activity by which they take external, conceptual knowledge and link it to their own world, their own understandings and make sense of that conceptual knowledge. VCLs will work when they create specific tasks that students must complete to enable this linking to occur. These tasks should, however, involve the production of an outcome, not just the reception of knowledge. Many new services are emerging that give students the creative tools to work independently in this way, for an audience. Where knowledge is best understood and represented through images, http://flickr.com allows students to present knowledge as images; a service such as http://slideshare.com promotes the public sharing of powerpoint-style presentations; and http://hubpages.com or http://scribd.com can allow the creation of autonomous publication of written material.

VCLs need also to engage with technologies that create new forms of presentation—http://prezi.com is a significantly different form of presentation software; http://quizlet.com enables students to create flashcards which, instead of being a personal study aid, become a public representation of their understanding of the knowledge being learned. http://delicious.com and http://diigo.com enable students to work on the production of annotated literature reviews in the form of tagged web resources. In all cases, however, what makes these services useful for a VCL is that they all enable and often demand collaboration, commentary, and public reception.

Social support for learning through the networked conversations of learners that can be more or less directed towards specific learning outcomes can now take place in many ways. Traditionally, it has been assumed that such conversations between learners took place in ‘designed’ places, within the learning environment (discussion boards, chat rooms and the like within Blackboard or a similar system). Now, increasingly, learners utilise their own forms of networked conversation through Facebook, Twitter, MSN, and the like regardless of what is arranged for them; indeed these forms, which are more personal and affectively connected to students, are likely to provide more effective social support than formalised discussion forums. A VCL therefore needs to both recognise and accept this entirely unscripted, unprompted, and uncontrolled social learning, while also building on these approaches to create interconnections between formal, teacher-managed conversations and those that students are experiencing on their own. Twitter can provide such a mechanism, but in this respect the software is less important than the recognition that there is a continuum between entirely informal, student-dominated

conversations and very structured, 'learning focused' conversations. Thus, an educationally effective VCL will promote the use of a variety of technologies that students already use or may need to discover and then use, to create overlapping networks of more or less formal communication between students and teachers.

The recent enthusiasm developing within higher education for massive open online courses (MOOC) presents now a further challenge for educators seeking to generate highly active student learning within knowledge environments. MOOCs, while valuable in many ways, emphasise again individual learning in response to didactic instruction—while this is not the only model by which a MOOC could work, it does seem to be the emerging norm.

Ultimately, a VCL will emerge in different ways, for different purposes, depending on the students and teachers involved and the subject matter to be learned. There is no single model which can be adopted reliably in all situations. However, as evidenced from the examples above, a VCL needs to deploy a range of technologies that have, in common, the linking together of people, with ideas, and through these technologies interactions between people and ideas are brought to the fore of the learning experience. This chapter demonstrates that there is still significant research to be conducted in this field, directly addressing the questions of how might such interactive environments be realised in higher education, given the overwhelming focus on the traditional LMS.

3.8 Conclusion

While many educational institutions throughout the world have introduced online learning as a delivery option, there is mixed evidence about the concurrent development of curriculum models that advance pedagogical diversity and learning effectiveness. Aside from some innovative exceptions and a general tendency towards technology-oriented experimentation, the design of most online learning experiences is structured around the conventional instructional model, which inherently does not afford the flexibility required to take full advantage of the socialising and information sharing potential of the Internet as it now exists, with nearly a decade of Web 2.0 and social media development.

In many universities, online learners are not equipped with the tools required to organise their work, group learning is not always readily available, team-focussed problem-based learning activities are not easily supported and managed, and productive engagement with the wider community is not always feasible. There is little systemic attention paid to the importance of the pre-existing social networks of students, mostly enabled by Facebook and Twitter, nor their own social media habits (encompassing such newer services as Tumblr and Pinterest). Moreover, the power of these networks, and the way educators might intersect with them is not widely understood as the key challenge for curriculum design.

The Internet continually offers new tools to support such activities, but there is an obvious disparity between what people experience on the Internet and what

university online delivery platforms provide. Bridging this gap is only part of the solution as there is also the unrealised potential of students' web 2.0 expertise to consider. There is something incongruous in the notion of applying web 2.0 technologies to learning and teaching without enlisting the support of the very audience that by and large have been the drivers of web 2.0 innovations.

For students to learn effectively in the increasingly complex online systems available, teachers will need to create from the raw material of web 2.0 technologies, as well as any formal learning systems, an environment for virtual collaboration. In such a VCL, students will learn much more than the 'know what' (explicit knowledge). They will also experience and understand the 'know how' (innate knowledge) that is gained through personal and active involvement in applying what they already know, through networking with other recipients of that knowledge, practitioners, and so on. At the interplay between innate and explicit knowledge lies deep expertise, where the learner is required not just to assimilate the explicit knowledge of a given subject area, but also apply that knowledge through active engagement and contribution to relevant communities of interest (Brown, 2002).

Considered as a whole, the factors and strategies raised in this chapter point to the need to not only rethink the purpose of the curriculum models that inform the design and function of virtual collaborative environments, but also to devise more adaptive, educationally focussed teaching and learning strategies. What is missing are the technologies that promote the generation of ideas and support the communal filtering processes that lead to innovative thinking and deep learning. For such technologies to be successful, an analysis of the innate social processes that characterise human collaboration is required. This chapter begins the exploration of how these processes can be supported by the 'version 2' web revolution, which appropriately should be further enhanced and sustained through the active mobilisation of a strong student voice in the design and application of web 2.0 technologies.

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