What does co-constructive learning in a Web2.0 context mean from the perspective of facilitator and learner?

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Abstract

This case study describes how an online learning environment can be used to support co-constructive learning in a secondary school distance-learning via video-conferencing scenario. The experiences and actions of both learners and teacher were examined. Learners enjoyed the experience of learning in an online environment and were competent in managing the demands made of them by this way of learning. This study found that the quality of relationships between all course participants was an important factor in enabling students to make contributions to the course. The facilitating role of the teacher was also acknowledged. To enable teachers to more fully understand the difference between teaching in a classroom and facilitating virtual courses, I developed a new metaphor, based on the theme of a kitchen.
Acknowledgements

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Thank you to the team of other efellows who provided support and encouragement throughout the year. The team at CORE Education, especially Vince Ham and Michael Winter have also provided timely and welcome expert assistance, laughs and conviviality. My supervisor, Ann Trewern deserves warm thanks for marshalling my thoughts in a consistent direction and asking the 'hard questions'.

Jan Hoyle, the Principal of Te Aroha College, originally suggested that I apply for a fellowship award and this work would not have been possible without her support and encouragement over the last few years.

The BOT of Waimate High School, the Principal, Janette Packman, the staff and pupils have all in their own ways made this study possible and I am grateful for their help, friendship and support.

Lastly, Julie, Reuben and Phoebe have tolerated a year of frequent trips away, being here but busy, mess (I lost the paper war) and stress and yet have provided me with unwavering support and encouragement. Without you none of this work would have been possible. A big thanks to you all.

Trevor Storr
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Context of the Research Project

My story

It seems like a lifetime away, but really is only about six years ago that I was teaching ICT at Frome College, Somerset (http://www.fromecollege.somerset.sch.uk/) in the UK. The college had been part of a trial for an online repository and web editing suite called Digital Brain (http://www.digitalbrain.com/digitalbrain/web/subjects/2.%20secondary/ks4bus/), a type of what would now be called a Virtual Learning Environment (VLE) that enabled teachers and students to upload resources or assignments into an area that could be accessed over the internet from home. Digital Brain acted as a very crude and clunky way of accessing school digital materials when not at school. What was interesting for me was the observation that many students were quite willing to bridge the barriers between home and school using ICTs and were very comfortable in trying out new technologies.

At the start of 2004, my family and I flew half way around the world to start our new lives in New Zealand as I had accepted a position as Head of Computing and Network Manager at Waimate High School, Waimate, South Canterbury. Waimate High School was at the beginning of a three year ICTPD contract and I was one of two 'Lead Teachers' charged with implementing the project at my school. I enjoyed this role immensely as it allowed me to investigate the effects of new technologies on teaching and learning, but also gave me opportunities to enable other teachers to share my passion for all things computing. As part of the ICTPD contract, Lead Teachers from the cluster schools attended Ulearn '04 in Christchurch. I was fortunate enough to attend a workshop presented by Richard Wyles and John Clayton (from The Open Polytechnic and The Waikato Institute of Technology respectively) where they spoke enthusiastically about the work they had been doing with Moodle as part of the NZOSVLE project. They also offered a free six month trial of Moodle hosted by Catalyst IT in Wellington (http://catalyst.net.nz/). I eagerly accepted the free trial offer as I could see that Moodle was a far more sophisticated VLE than Digital Brain, the system I had successfully used back in Frome. The free trial gave me ample opportunity to evaluate Moodle and its use in school.

Towards the end of the 2004 academic year, my Principal approached me with a rather challenging timetabling request that Moodle could help resolve. Waimate High School is a small (roll about 370) Y7 -13 school that has a relatively small senior school, which in turn causes difficulty in timetabling a wide curriculum due to resource pressures. My Principal asked me if, for the next academic year, I would be prepared to run all my Senior Computing classes as multi-level classes, where for example, any Senior class could have in it a mixture of Level 1, 2 or 3 students. I immediately saw the potential for Moodle to free me of the task of trying to simultaneously deliver 3 sets of course content and give me more time with students to actually help them understand it. I agreed to the request from my Principal and busily set about constructing courses for my Level 1, 2 and 3 classes.
The classes that I ran during the 2005 and 2006 academic years were by any measure successful. Students enjoyed being able to access resources at will and boys in particular appreciated a paperless course (I guess because it's quite difficult to lose a computer!). At first my courses were almost entirely resource based. Typically a course would have lots of notes, diagrams and hyperlinks and perhaps a quiz so that students could self-assess their mastery of the content. In many ways, Moodle was acting as a simple repository of content that students could readily access whenever and where ever they wanted. As I designed and taught more courses using Moodle, I recognised that these courses did not use many of the features in Moodle that enabled students to interact, for example forums, wikis and chat.

My ongoing involvement in the ICTPD project had also raised my awareness of how different pedagogies could be used in online environments to increase student engagement, motivation and ultimately learning. In particular I was interested in how online environments could alter the nature of learning compared to 'ordinary teaching'. My experience of 'ordinary teaching' is one where the teacher has a great deal of control over how students access resources and how students communicate with each other. I saw that online environments had the potential to alter the balance of control of learning away from the teacher and towards the learners. As I began to revisit and review courses that were being used for a second year I started to try to incorporate the social tools (some would say Web2.0 tools) that Moodle has to offer.

Some of my initial trials using the social tools were successful, others less so. I tried using forums to allow students taking a course in different timetable lines to communicate with fellow participants, and also attempted to use forums with students in the same physical classroom location. When students were in the same class the forums were less successful, probably as students were more easily able to talk to each other than contribute to a forum. Students also successfully completed glossaries, both in the same and different classes. By this stage of my experience with Moodle, I was interested in how instructional design can assist with designing successful online courses that will engage students and allow them to learn in a way that moves the balance of control of learning away from the teacher and towards the learner. The bigger questions that I was beginning to frame could be paraphrased as, 'What are the roles of teacher and learner in the 21st Century?', and 'What is teaching and learning like in the 21st Century?' It was a desire to try to answer these questions that led me to apply for an efellowship award during the latter half of 2006.

Towards the end of the ICTPD contract, the four secondary schools involved decided to collaborate together to provide a few Senior courses by video-conferencing, using Moodle as a 'skeleton' from which the VC lessons would 'hang'. The Level 4 Computing course is a result of the decision to experiment with Senior VC courses during 2007. During late 2006 and through 2007, the number of schools collaborating in the video-conferencing project has grown to 11 and 'Aorakinet' (http://Aorakinet.school.nz) continues to evolve.
Research Questions

What does co-constructive learning in a Web2.0 context mean from the perspective of facilitator and learner?

Introduction

I have been a secondary school teacher for 16 years, originally I taught science but I now teach computing. Since 2004 I have been teaching at Waimate High School, a small, rural, Y7-13 school in South Canterbury. I am an enthusiast of open source technologies, Web2.0, virtual learning environments (VLEs) and social constructivism. In particular, I have used Moodle, an open source VLE to deliver blended learning computing courses to senior students at my school. Anecdotally I have noticed that students appear to enjoy this style of course delivery and the flexibility it is able to offer both to teacher and student. My research project looks at teacher and student experiences of online learning. I have tried to find out if the teacher's experience of constructing and delivering an online course is matched by the students who participate. While much research has been done on online course delivery for tertiary students, I have found little data is available on the experiences of senior high school students using VLEs and how this compares to their teacher's perception of their enjoyment and progress through the course.

The outcomes of this research are important because VLEs are, for a variety of reasons, becoming increasingly common within the compulsory education sector within New Zealand. Additionally it is often asserted that Web2.0 activities are an ideal medium through which to learn by co-construction, yet their use and appeal to senior students has yet to be formally evaluated.

The research project methodology is that of a case-study. In 2007 I taught a Level Four Computing course to a group of Y13 students. The group consisted of students from both Waimate and other schools nationwide. The course was delivered 25% by videoconferencing and the remainder online using Moodle, an open source VLE that claims to support the implementation of social constructivist learning styles. I gathered data on the experiences and reflections of students as they progressed through the course and compared them with my own thoughts on the process of designing and implementing the course. I have analysed the data gathered in order to provide an insight into senior student attitudes towards co-construction in a Web2.0 environment that can be compared with reflections of their teacher and course-designer. I have used questionnaires, interviews and data gathered from Aorakinet to describe the attitude and experiences of learners when participating in co-constructive learning. The results of this study will be used to inform VLE course design for senior school learners.

I kept a journal during the duration of the project and recorded my thoughts and reflections on both course design and learner activity. Learner responses were measured in a variety
of ways including analysis of online activity, questionnaires and interviews. The timing of gathering the learner data was arranged so that learner responses were recorded at critical times during the study. Summative interviews were also conducted to enable learners to reflect more thoroughly on the course.

**Time frame:**

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<th>Activity</th>
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<td>Term One 2007</td>
<td>Write research proposal, literature review, design questionnaires, design online activity rubric, design interview framework, teach class.</td>
</tr>
<tr>
<td>Term Two 2007</td>
<td>Collect data, teach class.</td>
</tr>
<tr>
<td>Term Three 2007</td>
<td>Analyse data, teach class.</td>
</tr>
<tr>
<td>Term Four 2007</td>
<td>Write-up, teach class.</td>
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**Research Questions:**

- Do Y13 enjoy co-constructing knowledge when delivered through Web2.0 activities?

- How can I facilitate co-construction in a Web2.0 context?

- Do my experiences as a teacher concur with those of a learner when delivering co-constructive activities?

- Do Y13 find co-construction an effective way to build on their prior knowledge?

- Do Y13 find co-construction an effective way to increase their knowledge building skills – apart from the explicit 'content'?

- What particular co-constructive activities are more/less successful in a Web2.0 context?¹
1 Success could be viewed from the perspective of facilitator or learner along the axis of success/enjoyable/motivating.
Literature Review

Introduction to the Review

In this review I hope to give a broad introduction to Web2.0, co-construction, constructivism and online learning. The intention is that the reader will have an understanding of the technologies, their educational use and the learning theories that underpin them, and have been used during this study.

Web2.0

Tim O'Reilly (2005) coined the term Web2.0 in 2004 to describe the revitalised 'web' that had emerged from the aftermath of the dot-com bubble burst of 2001. The term Web2.0 seems to imply the existence of a Web1.0, which is not really the case. The core technology of the web itself is unchanged, Web2.0 is a description of a set of attitudes, experiences and uses of the web that have emerged in the past few years. It is worth considering what makes Web2.0 distinctive and critiquing its very existence: is Web2.0 just media hype?

The conventional web, pre dot-com boom was, for the user, essentially an experience not dissimilar from using a rather haphazardly catgorised library. Web users of the time will recall that most sites were 'brochure style' whose purpose was to convey information from author to reader. If we consider what most websites are like now, we will see a proliferation of opportunities for the reader to interact with others so, for example, most news websites, that have the main purpose of conveying news from source to readership allow users to comment on stories. Web users now have endless opportunities to generate their own content without having to become experts in HTML coding. Moreover, they can easily generate content to solicit response from, or in response to, other web users. Other characteristics define Web2.0 apart from the capability of users to construct their own content. The meme map produced by O'Reilly (2005) lists among other things: 'An attitude not a technology', 'The perpetual beta', 'Play', 'Services not software', 'Emergent: User behaviour not predetermined', 'Harnessing collective intelligence'.

The ambiguity of some of these terms is a little symptomatic of Web2.0, but the two 'meta-characteristics' of Web2.0 are easy to identify. Web2.0 is rapidly evolving at such a rate that it is impossible to keep up-to-date with. This speedy evolution has placed high priority on the interoperability of user data between different Web2.0 applications, so that users are not locked in to a particular application from one vendor (O'Reilly, 2006). Indeed, the latest type of Web2.0 application is a 'mashup' where data from several separate applications is parsed through a user-created custom application, so for example a user could easily create an application that takes a news site's headlines and finds pictures on flickr (www.flickr.com) that are tagged with the words in the news headlines (yahoo pipes, 2007). The second meta-characteristic of Web2.0 is about creating user-generated content in a way that is easy to make, change, use and interact with. In practical terms the term 'web application' is given to a computer software application that is accessed over the
internet using a web browser. Currently there are many types of web application that allow Web2.0 type user interactions. In 'Coming of Age: an introduction to the new world wide web' Freedman (Ed, 2006) gives an overview of the types of Web2.0 applications and tools that are currently available and how some educators are using them, including: RSS, Blogs, Podcasts, Folksonomies, Portfolios, Content Management Systems, News Servers, Forum Discussions and Wikis. It is not my intention here to describe each individual type of Web2.0 application and give examples of how they may be used but I will discuss why Web2.0 is, in a general educational context, important.

I believe that Web2.0 offers significant opportunities for teachers and learners to revitalise the schooling process so that it is appropriate for the beginning of the 21st Century. The participatory nature of Web2.0 encourages and allows teachers to move away from a style of teaching that is based on 'transmitting knowledge', to one where knowledge is being used by learners. Web2.0 encourages a dialogue between participants and could turn learning into a more overtly social process. Web2.0 could also allow opportunities for learners to follow learning programmes that are more customised towards their needs while still allowing dialogue between participants. The physical location of participants would not be constrained to a particular place as long as access to an internet connection was available. These ideas have been expanded upon by Gilbert (2005) and will be discussed more thoroughly in the conclusion. Web2.0 could also be important as a tool for making schooling more relevant to learner’s lives. At a recent staff meeting at my school, during a discussion about the need to increase the number of computers available for student use, it was commented that 'writing is irrelevant; the only place people write is at school!' The elements of Web2.0 that require participants to enter into a written dialogue could be especially useful in motivating learners to value writing as the technology presents their writing in a context that is both familiar and relevant to their lives outside of school.

Virtual Learning Environments (VLEs) are one particular type of Web2.0 application that are of special interest to me. A VLE allows online courses to be created so that not only can learners access materials or resources created by their teacher, but learners can interact together to discuss learning, help each other, work together on a project, mark each other’s work and other types of cooperative and collaborative activities. In many ways, a VLE can be thought of as a collection of Web2.0 type applications and tools presented together in a uniform and coherent environment so that teachers and learners are able to construct and use interactive online courses easily. Moodle (http://moodle.org/) is the VLE that I am most familiar with, but other VLEs are available including, Blackboard (http://www.blackboard.com), Sakai (http://www.sakaiproject.org/) and Dokeos (http://www.dokeos.com/) amongst others. Moodle promotes itself (http://docs.moodle.org/en/Philosophy) as being based on 'sound pedagogical principles' with it’s philosophy being based on social constructionist pedagogy with the concepts behind this being grounded in constructivism, constructionism, social constructivism and connected and separate ways of knowing. The rest of this literature survey will concentrate on unpacking these concepts and assessing their relevance to Web2.0 and online learning.
Constructivism and Constructionism

In this part of the literature review I aim to discuss constructivism and constructionism, their relevance to elearning and how they have influenced online pedagogies. Three great characters associated with constructivism and constructionism are Jean Piaget, Lev Vygotsky and Seymour Papert. Piaget and Vygotsky formulated theories about learning while Papert took these theories and adapted them to the context of using new technologies in schools. At the most simple level, constructivism is a theory that explains how, at a cognitive level, people learn. Piaget asserted that knowledge has to be 'constructed' by individuals and that the process of construction is cognitive and often involves synthesis of new knowledge from 'old' knowledge. In simple terms the concepts and ideas that we currently hold, correct or incorrect, are the building blocks from which we construct new knowledge. As McMahon (1997) relates, ‘Rather than the transmission of knowledge, learning is an internal process of interpretation.’ (p.1)

The easiest way of expanding this is by example. During April 2007 I was fortunate to be able to spend 3 weeks in Brisbane, Queensland, house-sitting for a friend who was overseas. The house we were looking after was in Cleveland, a suburb about an hour on the train from the centre of the city. As we usually live in Waimate, a small town of 3000 people, the city had many attractions for us including the Gallery of Modern Art, Streets Beach and of course the shops and restaurants. Late most mornings, when the commuters had completed their cramped journey, we caught the train into the city centre. To amuse themselves during the hour long trip, Phoebe (8) and Reuben (10) played a game where they would stand facing each other about 5 metres apart, with the articulated joint of two carriages between them. The purpose of the game was to arrive at Brisbane Central Station without holding onto the handrails at any point through the frequent stop-starting of the train as it made its way to the city centre. It was an extraordinarily long game of balance! During one of these games Phoebe exclaimed to Reuben that she was very glad that she was in her carriage, as her carriage swayed from side-to-side much less than his. Of course Phoebe’s carriage rocked about just as much as Reuben’s but from her perspective (as she rocked with it) it appeared far more steady than his. Reuben and Phoebe entered into a long and (for me) interesting dialogue that finally resulted in Reuben and Phoebe swapping places and Phoebe agreeing that both carriages were equally 'rocky'. Phoebe constructed her knowledge, possibly along the following lines. Firstly, if something appears to sway from side-to-side then it must be moving (movement at this
point in Phoebe's understanding is an absolute quality). Secondly, (after having dialogue
with her brother), Phoebe has constructed an understanding that swaying (and maybe
movement too) is a relative concept with an observer and moving object being parameters
that must be considered and evaluated for movement. Lastly, Phoebe may have
developed the idea of movement having both absolute and relative components that must
be evaluated at 'the same time'. What was of particular interest for me, the observer, was
being privileged to observe not only construction, but the role of dialogue with others in
enabling construction, challenging the possible outcomes and verifying the results of the
cognitive processes involved in constructing knowledge.

Vygotsky (1962) claimed that learning is essentially a social activity and it was interesting
for me to see the social aspect taking place with my own children. In particular, the type of
interaction between Phoebe and Reuben is worth describing. Reuben directly challenged
Phoebe's assertions and Phoebe tried to defend her (incorrect) beliefs about 'swaying'. By
a process of negation, negotiation and confirmation Phoebe's world model changed. It is
also interesting to note that Phoebe looks up to her older brother as being more
knowledgeable about the world around us, as he is nearly two years older than her.
Constructing knowledge mediated through a social experience is called co-construction
and Reusser (2001) has provided a useful overview of how co-construction relates to both
educational theory and practise. He states that:

“No precise and widely accepted definition of the concept and process of co-construction
can be found in the psychological or educational literature.” (p. 2058).

Areas of differences in definition are found in the social type of discourse, the
psychopedagogical processes involved in co-constructive activity and the expected
outcomes of collaboration. As the concept of co-construction is central to this project I will
need to formulate my own working definition of co-construction that is robust and easily
transferred to the context within which I am working. After many discussions with people
far more familiar with co-construction than I, my understanding is that co-construction must
have some form of dialogue, and if we can adequately define 'dialogue' then defining co-
defines dialogue as:

'A dialogue is a reciprocal conversation between two or more entities.'

The key word in this definition is 'reciprocal', which I interpret as meaning as some type of
involvement by both entities that is ‘unique’ to the transaction in question. So for example,
if two people are having a conversation about how to solve a particular mathematical
problem, then there is a possibility, indeed a good chance that co-construction is taking
place. This is because using my definition the conversation is unique to each of the two
individuals. If however one of the individuals is trying to solve the problem using a
mathematics textbook, I do not consider this to be an example of co-construction between
the individual and the textbook author as the dialogue is not unique on the part of the
author. This definition is aligned with Reusser's (2001) recognition of the importance of
dialogue in the facilitation of co-construction and Hausmann's (2003) assertion that co-
construction is an interactive activity, with significant contributions from all participants.
The idea that construction of knowledge is a process that may effectively take place not as
an individual, but working with others is usually given the term social constructivism
(Dougiamas, 1998). It is important at this point to establish that constructivism and social constructivism are theories of learning that inform us about the process of learning. They are not theories of teaching or pedagogy even though they may be used to develop ideas about how best to teach.

The new technologies being introduced into classrooms around the world, including Web2.0 applications such as forums, wikis and interactive blogs have been claimed to encourage co-constructive learning, though the research evidence that may substantiate this claim is difficult to find. Holmes and Gardner (2006) suggest that traditional education is akin to a spoon-feeding process that facilitates learner passivity and that new technologies have a role to play in empowering learners to become active in a community where expertise and knowledge creation are shared and the individual's role in their own education is increased. This is compared to schooling as presently exists, where they suggest that the learner is a recipient of 'charity education' that is not only funded by benefactors, but also organised without consultation and delivered in a design predetermined by others. The concept of charity in this instance is one that invokes the idea of an imbalance of power and inability to control outcomes that a recipient of 'charity' may experience.

An interesting analysis of the concept of social constructivism, and how it is influenced by the recent advances in information technology, has resulted in an expanded definition of this term (Holmes et al., 2001). Communal constructivism is used to describe the constructing of knowledge not only by individuals for themselves, but by individuals for their learning community. The approach of the authors required that from the outset learners were required to see themselves as producers and not just consumers of information. The techniques used to enable this were among others: extensive use of group work and project-based learning; a portfolio assessment process; online 'content' followed by discussion; peer tutoring and mentoring; apprenticeship lecturer roles undertaken by older students. While the context of this work was a tertiary IT in Education paper, the ideas outlined apply to all learners irrespective of context.

The ideas presented so far in this review allow us define construction of knowledge not only through cognitive processes, but also in terms of if the process is conducted alone or with others mediated through dialogue and also if the knowledge is being constructed for an individual or for the benefit of a group of learners. These ideas are presented in Fig. 1.

While constructivism is a well-regarded theory of learning, constructionism is less well known among teachers, but equally valuable in enabling us to understand the theoretical basis of how learning in an OLE might work. Seymour Papert conceived the term 'constructionism' to describe the idea that learning happens particularly well when learners are engaged in a 'public entity' (Papert and Harel, 1991). Constructionism is far more complicated than this though, Papert argues that by constructing artefacts in the context of prolonged projects students have the time to think, modify their ideas, talk with others about their own work, see other's reaction to their work and build a relationship with the artefact. Papert uses a metaphor of a painter for the strategies of work that a learner may use when undertaking a project. The first ('bricolage') does not use a rigid pre-organised plan, but is guided by the work as it proceeds. The second takes the idea of 'closeness to objects' - some people think in ways that favour 'closeness to physical things' (as opposed to others that use formal abstract ways of thinking). The bricolage metaphor is particularly interesting for me as my experience of NCEA assessments is that a rigid pre-existing plan

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is required, followed by extensive and exhaustive evaluations and modifications which appears to simply be at odds with how many people tackle making an artefact. The process of frequent modifications on a minuscule scale (perhaps the process of negotiation that Papert and Harel ((1991)) identify) appears to be far more natural to learners than the style of assessment that NCEA assumes. During a video-conference to a group of Japanese teachers, Papert (1980), succinctly described the difference between constructionism and traditional, instructionist, education:

‘All my work is focussed on helping children learn, not on just teaching. Now I’ve coined a phrase for this: Constructionism and Instructionism are names for two approaches to educational innovation. Instructionism is the theory that says, “To get better education, we must improve instruction. And if we’re going to use computers, we’ll make the computers do the instruction.” And that leads into the whole idea of computer-aided instruction.

Well, teaching is important, but learning is much more important. And Constructionism means “Giving children good things to do so that they can learn by doing much better than they could before.” Now, I think that the new technologies are very, very rich in providing new things for children to do so that they can learn mathematics as part of something real.’ (Part 1: Teaching vs. Learning)

Papert was a student of Piaget in the late 1950's and early 1960's and the theory of constructionism is grounded in constructivism. Constructionism is more pragmatic and 'situated' than constructivism and questions the view that abstract thinking is always the highest form of intellectual development and the most powerful way of thinking. Ackermann (2001) has compared and contrasted Piaget's and Papert's ideas and has concluded that they have similar goals, but different means. Both are constructivists who have a developmental and incremental view of knowledge construction. They both appear to view intelligence as adaptive or accommodative. Piaget, however, was mainly interested in the construction and maintenance of internal structure and stability (that is detached or remote from the context of learning) while Papert encourages us to think of intelligence as being associated with a particular context or 'connection' that is shaped or formed through different media.

Not all commentators approve of constructivist pedagogies, on the basis that prior knowledge is required before constructivist, inquiry-based teaching can be effective. Kirschner, Sweller and Clark (2006) have argued that the cognitive architecture of the human brain favours instruction based pedagogies to enable facts to be retained in long-term memory. This area of research is controversial and debate is ongoing about the meaning of learning and if current assessment methods assess learning or knowledge retention.

The final concept that the pedagogical philosophy of Moodle is based upon is that of 'connected and separate ways of knowing'. This concept tries to describe the types of interaction learners may have with each other when learning using co-constructive methodologies. At one extreme, a learner may have a high degree of empathy with others and be able to share the perspective of another learner, even though they may not wholeheartedly agree with it. Clinchy (1989) calls this 'connected knowing' and connected knowers try to 'get inside' concepts and form an intimate attachment to the thing they are
examining. The opposite of connected knowers are 'separate knowers' (Belenky, 1986). These tend to take an adversarial stance when confronted with knowledge or viewpoints that they disagree with. The core of separate knowing is an impersonal detachment that allows the separate knower to keep distance from the object that is being analysed. The outcome of separate knowing is an unbiased judgement or evaluation that emphasises the objective conclusions of the analysis undertaken. Separate knowing is obviously an extremely important and useful way of thinking that allows us to criticise our own and others thinking. In the context of learner interaction in an OLE, it should be apparent that to co-construct knowledge, elements of both separate and connected knowing should be present. However, as separate knowing already has high regard in academe, emphasis may have to be placed on facilitating connected ways of knowing amongst OLE participants (Dawson et al., 1999). Connected knowing will allow OLE learners see problems from the perspective of others while separate knowing will allow critiques of ideas and theories to be made.

Having established the theoretical basis of constructivism and connected and separate ways of knowing, I will now give a brief review of what co-construction is actually like in a classroom, with particular reference to elearning. The practical difficulties of teaching in a way that facilitates constructive learning have been well documented by Windschitl (2002). He lists four dilemmas: conceptual dilemmas, pedagogical dilemmas, cultural dilemmas and political dilemmas. Conceptual dilemmas are the difficulties that teachers and other stakeholders may have in understanding cognitive and social constructivism and reconciling their own pedagogical beliefs with those of theorists. Pedagogical dilemmas exist in allowing authentic construction to take place while ensuring the subject content is mastered by students and also in the practical craft managing social constructivism in the classroom. Cultural dilemmas manifest themselves as the tensions within a classroom during the transformation to constructivist pedagogies and include, for example, managing routines and trusting students to accept responsibility for their own learning. Political dilemmas arise from the difficulties in negotiating accountability with the various stakeholders in the school and clarifying appropriate expectations from all when teaching and learning will be conducted in a radically different and unfamiliar way. The importance of teachers having a sound theoretical basis to defend new pedagogies against reactionary commentators arguing in favour of the status quo of teacher-centred education has also been noted (Windschitl, 1999).

Turning now to the practicalities of co-construction in OLEs, Gibbs and Gosper (2006) have forcefully argued the case that new technologies rather than educational principles and philosophies have shaped the development of e-learning and that if educators not technologists need to take an active roll in the development of OLEs if technology is to realise its transformative potential. It is too often the case that products designed for the education market have had little input from those who have experience of, or interest in, pedagogical philosophies. Moodle is clearly an exception to this statement as not only has the design been influenced by explicitly published philosophies, but the open source licensing means that suitably skilled educators can modify the software to suit their use, or alternatively they can pay someone else to code the modifications for them. This approach is explicitly encouraged by the GPL licensing that Moodle is released under. A brief visit to the main site of Moodle (http://www.moodle.org) will reveal that the community of teachers that actively code is surprisingly large and that many contributions to Moodle are released under an open source license that allows others to freely use, reuse and re-
manufacture the code. From a teacher's perspective, even if the software allows or even actively encourages co-constructive interactions, the time constraints of using new software and exploring new methodologies can be problematic. Pirani (2004) asserts that both instructors and students underestimate the time required to commit to e-learning and that they should expect them to be as time-consuming as a traditional class. In a study of the strategies used by students to construct knowledge in e-classrooms, Mackereth (2006) found that socio-cooperative strategies, including negotiating meaning, offering alternatives/solutions, giving feedback and seeking information/clarification were 'by far and away the most frequent' compared to cognitive and metacognitive strategies of knowledge construction. Interestingly, students tended to view all activities as cooperative regardless of whether the teacher had intended it to be an individual activity. Mackereth's work involved Y10 and Y11 students completing online tasks in a real classroom, and were not using an OLE. Clearly the implication is that co-construction seems to occur quite readily in ICT-rich environments but challenges may be present when trying to facilitate this in purely virtual environments.

The review so far has considered research from both tertiary and secondary age groups. I could find no previous work that specifically covered the particular area that I am interested in. It would appear that the experiences of secondary teachers (when facilitating) and students (when learning) in a Web2.0 context have not yet been considered as a research topic. This is not surprising because, as discussed in the first section of this Chapter, the term Web2.0 was first used in 2004 and the use of Web2.0 tools in Secondary education has yet to become widespread.

This literature review has outlined the nature of Web2.0 technologies and described how OLEs are akin to collections of Web2.0 tools assembled in a cohesive and relatively easy to use fashion that allow teachers and students to interact together in online courses. We have seen that the theoretical grounding of Moodle is based on social constructivist, constructionist and connected and separate ways of thinking philosophies. Each philosophy has been examined and outlined and the practicalities of enabling co-construction in online environments raised.
Fig. 1. Diagram showing the hierarchy of a selected subset of constructive epistemologies.
An Introduction to Moodle

Introduction

Moodle is a web-based application that allows teachers to easily create and students to participate in online courses. In particular, Moodle allows the creation of interactive courses that enable teachers and students to interact in both synchronous and asynchronous ways to create knowledge. This introduction will outline how Moodle has been used during this project.

History

Moodle was created by Martin Dougiamas, a WebCT administrator at Curtin University, Australia as a response to the inadequacies of commercially available software that fulfils similar aims. Dougiamas had the inspiration to release his original source code under the GNU Public License (http://www.gnu.org/copyleft/gpl.html) that allows others to modify the code freely as long as the modifications are also released under the same license. This has enabled other developers to improve and tinker with Moodle so that it is now a very popular and quickly evolving project that is used in over 190 countries on more than 30,000 sites by greater than 15 million users (http://moodle.org/stats/). Moodle originally stood for Modular Object-Oriented Dynamic Learning Environment, a reflection of the fact that the software design of Moodle allows for easy refactoring of code so that third-party extensions or modules are added very easily to increase the functionality of a site.

Aorakinet

Aorakinet (http://aorakinet.school.nz) is the Moodle instance or site of the Aorakinet virtual learning cluster of schools that comprise Geraldine High School, Timaru Boys’ High School, Timaru Girls’ High School, Waitaki Girls’ High School, Roncalli College, Craighead Diocesan School, Ashburton College, Mountainview High School, St Kevin’s College, Opihi College and Waimate High School. These schools collaborate to provide virtual courses for their students so that students can be provided with access to courses that would otherwise be impossible.
A Tour of Aorakinet

This section aims to give an indication of the layout, structure and appearance of the course used during this study. A simplified schema of the course structure is given in Fig. 2. The levels give an indication of the granularity and hierarchy of the controls available within Aorakinet. Level 1 is the site as it appears without clicking on any links. Levels 2 and 3 describe those parts of the site that are revealed once hyperlinks are followed.

Moodle allows the course designer (in this case, myself) to select available components such as a forum, wiki, assignment, link to a file etc. and easily add them to the course. As I was interested in fostering learner interactivity, I ensured that the course had many opportunities for students to engage in dialogue with each other by providing forums for students to post any questions or solutions to problems they had encountered. I also trialled wikis and a chat session, but these were far less successful in engaging students. Wikis appear to introduce difficulties for students when negotiating the responsibilities of multiple authorship and also students simply found them less purposeful as the wikis were not used for assessment and were a far more clumsy tool for clarifying understanding than a simple forum. The chat facility in Moodle was used occasionally during sessions when all course participants were online. It was useful to clarify points or send hyperlinks between users. However, the main problem with the chat facility is that it is synchronous and so was limited to those few occasions when all or most users were online. In summary then, forums were the main way in which students communicated with each other during the course.

The main course page is shown in Fig. 3. A key to the most relevant icons is shown in Fig. 2. The page is divided into three columns, the left column shows tasks that can be done, the centre column is the main area of course information, and the right column shows recent activity. The main, central column is divided into topics that start with an introduction and then proceed through topics one to ten. The Introduction in this particular screen shot has several pdf files, several forums, a link to a web page and an assignment. A view of further down the course page is shown in Fig. 4. Clicking on the Problems forum link takes the user to a page listing the current threads within that forum, shown in Fig. 5. Course participants can add new discussion topics to the forum. Any particular thread can be viewed by clicking on the name of the link (Fig. 6). This also allows participants to reply to the posting. A typical assignment is shown in Fig. 7. The instructions for this particular assignment are related to uploading the assessment and a sample pdf file has been uploaded. The instructions for any particular assignment can be included in the assignment area or on the main course page. Figure 8 shows a chat session.

I created the course content using the editing features of Moodle. These allow a teacher to create content easily in the form of text, insert images, hyperlinks, upload files and add activities such as forums, assignments and wikis without having any knowledge of HTML markup. Moodle was designed to be used by people who are primarily educators, not computing experts.
Main page of the course

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Introduction</th>
<th>Topic 1</th>
<th>Topic n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link to a particular forum</td>
<td>Link to a particular assignment</td>
<td>Link to a file</td>
<td>Link to a webpage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Page showing threads in the forum (can start a new discussion topic here)</td>
<td>Page with details of assign</td>
<td>File is downloaded</td>
<td>Page is viewed</td>
<td>Chat dialogue window is opened</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 3</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual threads (can reply here)</td>
<td>Page to upload assignment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2. Simplified schema of Aorakinet course structure with common icons shown.
Fig. 3. Aorakinet main course page.
Fig. 4. Aorakinet main course page, lower view.
Fig. 5. A view of the course forum page.
Fig. 6. An individual forum discussion thread.
Fig. 7. A course assignment uploading area.
Fig. 8. Course chat facility.
Research Methodology

Introduction

The research methodology was designed to find out what the students and I – the course participants – did during the course and what the experience was like. Ethical consent was obtained from both the students and their schools before the research data was collected.

Methods of Collecting Data

The following types of data were collected:

- Aorakinet (Moodle) server log files that recorded the actions of participants on Aorakinet.
- Forums on Aorakinet
- Questionnaire given to students on 31 May 2007.
- My own journal of thoughts and reflections.

Aorakinet Server Log Files

The actions of individuals during the course was relatively straight-forward to record. Moodle, like any website records the actions of site visitors in a log file. The log file (Fig. 9) contains the following details: courseid; timestamp; ipAddress; name; activity and info, the details of which are shown in Tables 1 and 2.

I decided that a careful analysis of the course log files would enable me to construct a detailed description of the actions that individual users completed when visiting the course. Since the log files were quite large and had approximately 20,000 rows of data, it would have been very slow, if not impossible to analyse them using spreadsheet type software, for example Microsoft Excel or OpenOffice Calc. I decided to use an industrial type database to analyse the server log files, the advantage of this being that it would be capable of searching through the log files quickly. Possible disadvantages of this approach were my own lack of expertise and associated cost in terms of time. I used an open source database, MYSQL, that is free to use and has plentiful support on internet forums. The database server was installed onto my laptop. To enable easy configuration of the database, phpMyAdmin (Fig. 10) was also installed. phpMyAdmin allows the user to
configure and use the database using a web-based interface. Without phpMyadmin, the use of MYSQL would have to be accomplished using a terminal interface, which would have been slower and more difficult to use. The server log files were down loaded from Aorakinet as a *.csv file and then uploaded into the database. Fig.10. Viewing a MYSQL database using phpMyAdmin. The log files were analysed using Structured Query Language (SQL) queries. The syntax of SQL is human-readable, but not obviously so. However, SQL is a powerful language that enabled detailed analysis of the server logfiles.

The following types of queries were constructed: the hourly breakdown of activity per user; the frequency of different types of activity, for example page views or forum activity, on Aorakinet per user and the total frequency of the different types of activity for all users. The server log files were analysed towards the end of the Level 4 course, during August 2007.

**Aorakinet Forums**

The actions of participants in providing content for the course forums were also easy to record, as actions were evident in the forum postings. The course forums were analysed for indications that co-constructive learning had taken place between participants. The indicators used were those developed in the introduction and are more fully explained there. It is important to re-acknowledge that these are mainly indicators of collaborative activity and that an assumption is being made that co-construction follows as a consequence of collaboration. The indicators are shown in Table 3.

Individual forums were analysed using these indicators and a tally chart kept of the frequency of their occurrence for each course participant. The analysis consisted of looking for evidence in the forum postings that suggested an indicator of co-construction was taking place.

**Group Interviews**

While server log files recorded participants activity on Aorakinet, I was also interested in participants reflections on their experiences during the course. The most obvious and easy way of gaining some insight into these experiences was by means of interview. Two interviews were carried out, the first on 31 May 2007 and the second on 10 September 2007. Both interviews were group interviews. The first interview consisted of all course participants being interviewed together in the same room while the second interview had some participants attending the interview via a video-conference link. The analysis of the interviews followed a grounded approach. The interview dialogue was transcribed and then analysed for content that was of interest to the project. Each point of interest was noted and collated into categories for later reference.
**Questionnaire**

A brief questionnaire was given to students before the interview on 31 May 2007.

**My Own Journal**

My own thoughts about my participation in the course were recorded on an ad-hoc basis in the form of a journal. These were analysed in a similar fashion to the analysis of the interviews. That is, categorisation of anything relevant to the research project followed a careful reading of my journal.

Table 4 gives an overview of the type of data collected, the purpose of the data and how it was analysed.

**Other Software Used**

As far as possible open source software was used in the research and publication of this report. The online learning environment, Moodle was used to provide the virtual Computing course. I thoroughly recommend it to anyone who wishes to host a virtual course. The charts were produced using Grace, a scientific chart plotter that allows fine-grained control over all aspects of chart production. Audio recordings were digitised and analysed using ReZound. The planning for the project was co-ordinated using BasKet Note Pads. This is a rather smart application that allows notes and other resources eg files, hyperlinks and images to be collated together into a single screen. This report was written using OpenOffice.org writer. Lastly, the operating system used for running the above applications was 'Feisty' Kubuntu Linux, 7.10.
<table>
<thead>
<tr>
<th>courseId</th>
<th>timestamp</th>
<th>ipAddress</th>
<th>name</th>
<th>activity</th>
<th>info</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;18738&quot;</td>
<td>2007/08/17 14:01:14</td>
<td>&quot;125.236.44.52&quot;</td>
<td>&quot;trevor storr&quot;</td>
<td>&quot;course view&quot;</td>
<td>&quot;75&quot;</td>
</tr>
</tbody>
</table>

In all cases the courseId should be 18738 as this is the id of the course.

The timestamp shows the date and time that the user initiated an action.

The public ip address of the machine making the request to Aorakinet.

This is the users Moodle username.

The type of activity taking place. A separate table of these, with explanations is given below.

A unique numerical id given to each instance of an activity.

Table 1. Explanation of Moodle log file headings.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>course view</td>
<td>View the main course page</td>
</tr>
<tr>
<td>resource view</td>
<td>View a resource such as a hyperlink (to a website or file)</td>
</tr>
<tr>
<td>forum view</td>
<td>View the list of course forums</td>
</tr>
<tr>
<td>forum view forum</td>
<td>View the list of postings in an individual forum</td>
</tr>
<tr>
<td>forum view discussion</td>
<td>View the postings (the discussion) content of a forum</td>
</tr>
<tr>
<td>forum delete post</td>
<td>Delete a forum postings</td>
</tr>
<tr>
<td>forum add post</td>
<td>Make a forum posting</td>
</tr>
<tr>
<td>assignment view</td>
<td>View the details of an assignment</td>
</tr>
<tr>
<td>assignment upload</td>
<td>Submit an assignment for marking</td>
</tr>
</tbody>
</table>

Table 2. Explanation of Activity recorded in a Moodle log file.
<table>
<thead>
<tr>
<th><strong>Indicators of co-construction</strong></th>
<th><strong>Notes and examples</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking and answering questions</td>
<td></td>
</tr>
<tr>
<td>Providing positive feedback, affirmation or encouragement</td>
<td>This could include statements such as: 'Thanks for doing this', 'Great!' or other statements likely to make the recipient feel that they have made, or are capable of making, a creditable effort.</td>
</tr>
<tr>
<td>Providing negative feedback</td>
<td></td>
</tr>
<tr>
<td>Developing a shared/mutual understanding of a topic or problem</td>
<td>This implies a dialogue is taking place between participants.</td>
</tr>
<tr>
<td>Asking about progress</td>
<td>This is an example of the social processes that accompany co-construction.</td>
</tr>
<tr>
<td>Making statement on own progress</td>
<td></td>
</tr>
<tr>
<td>Providing resources for others to use</td>
<td>Resources could include a simple hyperlink to a web page, the code that may provide a solution to a problem or a diagram showing how a solution may be attempted.</td>
</tr>
<tr>
<td>Receiving resources in response to a request</td>
<td>As above</td>
</tr>
<tr>
<td>Helping solve a problem by suggesting strategies</td>
<td>For example A say's 'Help, I can't get this to work!' B suggests: 'Have you tried this...'.</td>
</tr>
<tr>
<td>Receiving and trying strategies suggested by others</td>
<td>As above</td>
</tr>
<tr>
<td>Statements or other evidence that cognitive modelling has been influenced by dialogue with others</td>
<td>This evidence could come from interviews or forums comments. Examples may include statements that directly state the influence of others in constructing a coherent cognitive model.</td>
</tr>
</tbody>
</table>

Table 3. Indicators of co-construction used during this study.
<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Purpose of Data</th>
<th>How it was Analysed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorakinet Server Weblogs</td>
<td>Find out the activity of participants on Aorakinet</td>
<td>Statistical analysis using MYSQL</td>
</tr>
<tr>
<td>Forum Postings by course participants</td>
<td>To find out the means and extent of co-constructive learning between course participants</td>
<td>Frequency analysis of indicators of co-construction</td>
</tr>
<tr>
<td>Interviews with course participants</td>
<td>To find out the attitudes of participants towards co-constructive learning in a web2.0 context</td>
<td>Grounded approach</td>
</tr>
<tr>
<td>Questionnaire completed by course participants</td>
<td>To find out if the course coding day was successful and how it was different from interactions on Aorakinet.</td>
<td>Simple numerical analysis</td>
</tr>
<tr>
<td>My own written reflections</td>
<td>To record my own reflections on teaching a web-based course</td>
<td>Grounded approach</td>
</tr>
</tbody>
</table>

Table 4. Overview of data collected, purpose and analysis methods used in the study.
Fig. 9. Screenshot of a Moodle log file.
Fig. 10. Screenshot of phpMyAdmin being used to browse a database.
Participants

Introduction
This section describes the characteristics of the student participants as they are relevant to the course.

Details of Participants

The participants self-selected participation in the course. The course was offered as an open enrolment course on the Virtual learning Network (http://www.virtuallearning.school.nz) and schools could negotiate to enrol students on the course. The following students enrolled on the course.

School A  based in the North Island
Initially two students enrolled on the course followed by a third halfway through Term One. Of these three, none completed the course. One student actively participated in the course until the end of Term One when she realised that the time commitment to complete the course was too much and so decided to quit. The other two students logged into Aorakinet a few times over a period of about five weeks and participated in one VC session. I was later informed that they had left school.

School B  Roncalli College, Timaru
Initially two student enrolled on the course, but within two weeks they had decided that the course would be too difficult for them and so they were unenrolled. A week or so later another student enrolled and then a few week after this a further student enrolled. Both these students successfully completed the course.

School C  Waimate High School
Initially five students enrolled on the course. One student left school within a few weeks of the start of Term One and another left at the end of Term Three (to go into higher education) having almost completed the course. The remaining three students successfully completed the course.

It concerned me that adequate course counselling did not always seem to take place before students were enrolled by schools onto the course.
Research Findings

Introduction

The findings of my research are divided into two main areas:

● what were the actions of course participants during the course
● their considered reflections of their experience of doing the course.

My initial analysis attempted to discover from the Aorakinet web server log files simple descriptors, such as the time during the day when Aorakinet was accessed by users. I then compared the time profile of how students used Aorakinet with my own profile of use in order to help describe the experiences of teachers and students when using Aorakinet. More detailed analysis of Aorakinet was achieved by looking for indicators of co-construction in two forums and attempting to build participant profiles from the frequency of the indicators. As mentioned in the methodology, the web server log files record the actions of users on Aorakinet.

An example of what can be determined from the log files, is shown in Table 5, and discussed below.

This record from the server log file can simply be interpreted as a user logged in as 'trevor storr' visited the main page of the Level 4 Computing Course ('course view,' '75') from an IP address within the schoolzone IP address block ('125.236.44.52') at 2:01pm on August 17, 2007. This record gives us no indication at all of what the user did when they completed this action. Perhaps we can assume that they actually looked at the page, but beyond that further assumptions about what the user did in terms of cognition while completing the action become increasingly tenuous. As an example of how problematic this is when trying to describe user actions, consider the scenario in Table 6, discussed below.

Analysis of the server log file allows us to determine unequivocally a few simple things: the course was the Level 4 Computing course (18738), the user was logged on as H... B... (name of student) and Aorakinet was being accessed from an IP address external to the schoolzone IP block. However, it is more difficult to make conclusions about what the user was actually doing. HB was completing actions between 20:36:47 and 21:54:54 a period of 1 hour 18 minutes and 7 seconds. During this time he looked at the main course page (course view), looked at a forum discussion (forum view discussion), looked at an assignment (assignment view), submitted some work in response to the assignment (assignment upload) and viewed the list of postings in an individual forum (forum view forum). We have no way of finding out if HB worked exclusively on the level 4 course during his 1 hour 18 minutes on Aorakinet or if he was doing other things as well during this period of time. Some of the events in the above set of data occur in sequence quite quickly, for example those between 21:51 and 21:54 and in this case it would seem reasonable to assume that HB was occupied exclusively on Aorakinet. However, between 20:44 and 21:23, HB demonstrates only intermittent activity on Aorakinet. It could be that HB was reading the main course page very carefully and took 39 minutes to do it – but this is unlikely. From the server log files we have no way at all to determine what HB did other
than establish what 'mouse clicks' he made. The rest of my findings as they relate to the server log files are reliant on this understanding that 'mouse clicks' are being analysed, not the cognitive actions of course participants.

**Time-based Analysis of Server Log files**

A simple analysis of when actions were recorded on Aorakinet was conducted for each user. Additionally, the actions of students were compared to my actions (i.e. a student-teacher comparison was made).

The hourly breakdown of Aorakinet activity for student HB (Fig. 11) is typical of many of the students. Most of the activity is during the school hours of 09:00 to 15:00. The peak of activity between 13:00 and 14:00 is due to that time period being used for the weekly VC session where we often accessed Aorakinet. Not surprisingly HB accessed Aorakinet little before 09:00. HB's after-school Aorakinet activity was significant. He accessed Aorakinet frequently between 15:00 and 23:00, with less activity towards the end of this period. HB, like many students, tended to show an after-school peak immediately after school finished.

Student AL shows a similar hourly activity profile (Fig. 12) to HB but with proportionately more Aorakinet activity in the late evening. A close look at AL's profile also shows that this student probably had his evening meal between 17:00 and 18:00!

Not all students accessed Aorakinet in significant amounts outside the usual school hours. The hourly Aorakinet activity profile of student MH (Fig. 13) shows little access to Aorakinet in the evening, contrasting to the two students just discussed. A simple reason for this may have been that MH did not have internet access at home, but when asked why his access tended to be only from school MH provided an honest and unexpected explanation: his family had just had a new baby and working from home (presumably on all types of homework) was difficult.

A comparison of the total Aorakinet activity for all students compared to that of myself (TS) is shown in Fig. 14. My own access profile follows overall similar trends to that of the students with a few minor differences. Firstly, my own profile of activity did not show the peak between 13:00 and 14:00 that is observable for students. Secondly, my lowest activity was between 17:00 and 18:00 when I tended to be cooking tea for my family rather than working on Aorakinet, and lastly, evening activity on Aorakinet is proportionately more significant for me than for my students. This chart also shows the proportion of teacher activity on Aorakinet compared to student activity. Overall approximately 1/3 (20357/6936) of activity originated from myself. The extent to which all participants accessed Aorakinet outside usual school hours is quite significant. Between the hours of 09:00 and 15:00 Aorakinet was accessed 5637 times, out of a total of 20357 hits, this equates to about 28% of Aorakinet activity being in school hours. This figure relates to both myself and students. When the data for students only is considered the figure is remarkably similar at 31%. The implications of these figures for schools are simple: given the opportunity, students will readily access internet based learning resources in their own time. My own experience in providing teacher training on Moodle is that many teachers are sceptical that students will access the resources provided out of school hours and that the effort made in providing them will be wasted. Hopefully, these figures will help to convince teachers that providing online resources is a productive use of their time.
**User-based Analysis of Server Log files**

The different users showed very different amounts of total Aorakinet activity (Fig. 15). I had most individual activity at 6936 hits, followed by students HB (2809), AL (2287), MW (1854), MH (1185), SM (955) and JM (468). An admin user recorded a little activity (63). 'Other' includes activity from users who were not directly part of this study. These included a few accounts from students who withdrew from the course during the first few weeks of Term 1 and anonymous users who were able to view the site. Access to this particular course was open: any internet user who came across the course could enrol as long as they provided a valid email address against which to authenticate their account. A few accounts were created in this manner.

**Group Activity Analysis of Server Log Files**

The methodology chapter of this report gives details on the categorisation of user activity recorded by the server log. A comparison of the types of activity recorded on the Aorakinet log files is provided in Fig. 16 for both all users and myself (TS). A few words of explanation are required to fully understand this chart. The x-axis (labelled 'Type of Activity') shows the type of activity recorded in the server logs and the frequency of these activities for all users including myself is shown on the y-axis. In this chart, 'myself' is a subset of 'all users' so for example, the %view% bar has a total of 17407 hits which includes 5344 that can be attributed towards myself. The labels on the x-axis were taken from MYSQL searches used to analyse user activity on Aorakinet. Some of these MYSQL searches included a wildcard character, '%'. The interpretation of these labels needs to take this into account. As an example, '%view%' is the category of actions that includes 'view' anywhere in the server log file string for activity. These could include: course view, forum view, forum view forum, forum view discussion, resource view, wiki view or user view – essentially any activity that is looking at (i.e. viewing) a web page. Looking again at the x-axis labels, it can be seen that 'Forum view discussion', 'Course view' and 'Resource view' are subsets of '%view%'. The other two wildcard searches can be interpreted as follows: '%upload%' - this includes any activity concerned with uploading files in response to an assignment; '%delete%' - any activity concerned with deleting material submitted by the user, most likely to be deleting a forum posting; '%add%' - any activity where the user creates content such as a forum, forum posting, wiki or glossary.

Unsurprisingly, viewing was the most frequent type of user activity and viewing the main course page (Course view), the most common type of viewing. This was probably due to the nature of how Aorakinet interoperates with authentication credentials supplied by a student when first accessing Aorakinet. Typically, when a student accesses Aorakinet, the first page they access requires them to supply a username and password. When the user has been successfully authenticated against the database of accounts, the user is directed to a page where the courses associated with the login are listed as hyperlinks. The student chooses the correct course, 18738, and is redirected to the main course page where course content is arranged in topics and forums and other activities can be accessed. It is viewing this main page that is counted in 'Course view'. Unless a user had made specific web browser bookmarks to, for example, a particular course forum they would have to go through the procedure described above. This is shown in Fig. 17.
The next most frequent viewing activity analysed was viewing forum discussions. This activity involved reading the contributions of others. The motivation for doing this could possibly be one or more of the following: seeing if a response had been made to a posting the reader had posted; seeing if a response had been made to a posting that another reader had posted; re-reading a previously read posting to retrieve information. Viewing resources was the next most frequent type of activity.

In the context of Aorakinet server log files, 'Resource view' covers the following types of activity: Following a hyperlink to an external web site or following a hyperlink that leads to a download of a file, usually a PDF type file. Most resources were placed on Aorakinet by myself; the only way that students could place a resource on Aorakinet was in a forum – they could include a hyperlink in the body of the text and also include an attachment with their posting. Almost all forum submissions during the analysis period were attachment free and most did not include hyperlinks. I assume that most of the resource viewing was the viewing of resources placed there by myself. It seems that if a teacher provides resources for students to use in a OLE then students readily view them. For me, the interesting point that this raises is: if we want students to interact together in an OLE, to what extent should the teacher provide resources that may help with developing a solution to a problem.

Other types of Aorakinet activity were relatively low compared to that of viewing. Activity related with assignments was the next most frequent. Typically, an assignment would contain instructions about something: a piece of work that a student had to submit for assessment (though the assessment could be formative in the context of NCEA rather than summative). Students certainly visited assignments relatively frequently even though they were less enthusiastic about completing formative assessments. Adding forum posts was an infrequent activity on Aorakinet. That the outwardly most visible activity is also one of the least frequent leads to the obvious question regarding the relative importance of posting to forums. I will try to expand on this in the more general discussion of results towards the end of this chapter. Participants were generally confident in composing well drafted forum postings. Aorakinet allows participants 30 minutes during which to edit a forum posting before it becomes 'live' and visible to other users. Amending a forum posting occurred in about 15% of cases, demonstrating confidence in the accuracy of meaning of the original posting.

The actions of myself and the actions of students on Aorakinet did show some disparity. Table 7 shows the proportion of total actions attributable to both teacher and students. The percentage comparisons in this table require some explanation. The course had six active students for most of the duration of the study and one teacher. However, Table 7 includes the data for 'other' users as outlined in the discussion of Fig. 15. As an estimate, just for the purposes of this discussion, if we assume a student:teacher ratio of somewhere between 6:1 and 8:1 then we will be quite close to the real ratio of students to teachers. Using this figure, if I contributed to Aorakinet in proportion to my presence on the course then my contributions would be between 12% and 16% of the total. The table clearly shows that in almost all areas I contributed relatively more than students and in a few cases absolutely more so. In particular, my forum presence, at 43%, was relatively high compared to students. This is hardly surprising as both my own and students' expectations of teacher behaviour is to monitor students dialogue. The careful reader will have noticed that I did not define the above expectation as including answering students' questions. In the spirit of the co-constructive nature of the project, I did, try at times, and
also directed students to answer each other's questions. My efforts at cajoling students to interact with each other were mostly successful!

A full analysis of the content of forum postings for both teacher and students is covered in the next section. I also had a proportionately high 'Course view' figure (41%). The reason for this was that I often visited the main course page, perhaps several times a day, to check if any new activity was reported in the 'Recent Activity' block on this page. This block automatically updates a new headline ticker type area to include any new course specific activity on Aorakinet since the viewing users' last login. 'Recent Activity' is a very useful and time efficient way of keeping up to date with participant activity on Aorakinet. I only infrequently looked at resources (9%). This was because I was the person adding the resources, hyperlinks, files, for students to use. I usually checked once or twice after adding a resource that it linked correctly, but no more. Students, however, as discussed above, tended to use resources when provided. 'Adding' at 50% was also proportionately a teacher dominated activity. This encompassed many of the activities in setting up and modifying resources, forums, assignments and other aspects of course administration, so is not surprising.

**Individual Activity Analysis of Server Log Files**

Mindful of the possibility that individual students may have very different profiles of Aorakinet activity, I further analysed the server log files at an individual level. Tables 8 and 9 show this data. The data shows that individual users do indeed have very different activity profiles on Aorakinet. The raw frequency data is shown in Table 8, for example, HB has a frequency of 2621 for %view% and JM a value of 426. The relative percentage frequency for each participant is shown in Table 9. This latter figure allows us to compare the relative frequency of different actions on Aorakinet between users. For example Table 9 shows us that HB had 20.09% of his actions logged as 'forum view forum' while JM had a figure of 25.82% for this action. This latter approach is useful in comparing the relative proportion of activity between participants, but only if the absolute frequency data is used with these figures to build a complete picture of both real frequency and relative proportion of Aorakinet activity for the participants.

A mean value for all students has also been calculated. Using these mean figures, it can be seen that a typical student has values of approximately 20%-25% each for the actions course view, forum view forum, and forum view forum discussion (25.93%, 23.76% and 22.61% respectively). In other words, 20%-25% each of student actions on Aorakinet are viewing the course homepage, viewing the page that lists individual forums and lastly, viewing individual forum postings. These figures contrast with the percentage frequency for forum add post (1.67%), viewing assignments (1.95%), viewing resources (10.76%) and user view (7.09%). Of particular note is that the percentage frequency of viewing forum discussions (22.61%) is 13 times greater than that of adding a post (1.67%). This is 'hidden' activity that is not visible to other participants without looking at the server log files. I believe this data describes a situation that teachers worldwide observe everyday: a class discussion taking place where just a few learners contribute and most listen to others ideas. The virtual equivalent of this, a forum, also has roles for contributors and listeners and in the case described, for the average student, 'listening' was about 13 times more frequent than contributing.
Not all students in this study had an Aorakinet profile that could be described as 'average', indeed some students had profiles that varied quite distinctly from each other and the 'average'. I will consider these next and try to develop some ideas about the reasons for the differences.

Student HB is particularly interesting. His data for viewing the course homepage and for viewing the page listing the forums is broadly in line with an average student, but his relative percentage frequency of viewing forum discussions is approximately half (9.96% compared to 22.61%) that of the mean for students. However, the percentage figures for viewing resources are approximately twice (23.05% compared to 10.76%) that of the mean. HB's relative frequency of posting to a forum is also the lowest of the users studied. All of HB's other data is within a few percentage points of the student mean. HB, compared to the mean for other students, reads forum discussions much less, posts relatively the least, and accesses resources such as hyperlinks and files more frequently. Moreover, HB's absolute frequency of activity on Aorakinet is the highest of all the students.

Student AL is in direct contrast to student HB. AL has a high relative percentage frequency for viewing forum discussions (29.63%) compared to the mean student (22.61%). AL adds forum post at nearly twice (3.06%) the relative percentage frequency compared to a mean student (1.67%) and accesses resources about half as much (4.67% compared to 10.76%).

The other four students in this detailed study, JM, SM, MW and MH show greater convergence of their data around the student mean with JM trending towards an HB profile and MW trending towards an AL profile.

The comparison of my own relative frequency percentages (TS) to those of the mean for students is interesting. For reasons already explained I viewed the course homepage far more frequently, both in absolute and relative terms, than our fictitious 'typical' student. My own viewing of forum discussion was proportionately low, and at 17.59%, was second lowest (HB scored 9.96% in this respect). A possible explanation for this may have been that I was using the home page to find out if forums had been updated. However, it is more likely that the percentage figure is skewed to a low value by the frequency of other actions being so high. In absolute terms I viewed forum discussions far more (807) than any other participants. In absolute terms AL had the next highest count for viewing forum discussions at 590. This last point is a good example of knowing the difference between absolute values and how they affect the relative percentage frequency. My relative percentage frequency of adding forum posts was of similar order to other students at 3.09% though in absolute terms it was over twice as high (142 compared to AL's 61) as the next highest value.

**Summary of Server Log File Data**

Analysis of the server log files provided interesting data about the activities of participants on Aorakinet. Most, though not all, students accessed Aorakinet out of school hours on a significant number of occasions. I, their teacher, accessed Aorakinet proportionately more than the students. In terms of actual activity when on Aorakinet, viewing was the most frequent. Making forum posts was quite a minor activity, though reading forum posts was
much more frequent. Different users had different activity profiles. Even within a group of six students, with both low forum posting / low forum viewing and high forum posting / high forum viewing profiles seen as well as profiles between these two extremes. The use of resources posted on Aorakinet also varied with different users. My own profile was different to that of students, having higher viewing and forum posting indicators.

The server log file data and the trends described can be used to inform good practice when designing online courses. Clearly the students in this study used Aorakinet in different ways. When teachers are designing online courses they should take into account that students are likely to use the course in different ways with some students more likely, for various reasons, to use social tools than others. The use of resources provided as part of the course is also likely to be variable depending on the student.

Forum Analysis   What Does Co-construction Look Like?

Two forums, 'Problems' and 'Solutions' were analysed for indicators of co-construction using the indicators shown in Table 10. These indicators were arrived at by searching the relevant literature for previous, similar studies and then considering these in light of the present study. The survey of literature at the start of this report includes my working definition of co-construction and the indicators were assessed for suitability against this definition. The intention was to define a set of indicators broad enough to signal when any student behaviour that might include co-construction was occurring.

The 'Problems' and the 'Solutions' forums were selected for analysis as they had the greatest amount of forum activity. Co-construction is essentially a social and cognitive activity and therefore it is difficult to measure or determine with certainty if it has taken place. The indicators in Table 10 attempt to define situations where social and cognitive events in the forums have taken place. The indicators are often indirect measures of the occurrence of co-construction. For example, 'Providing resources for others to use' describes an activity such as posting as code snippet or URL for others to visit and use. The assumption here is that the resource is used by other course members and that in some way the resource helps other users to deepen their understanding of the topic or situation that the resource poster intends. The results of the forum analysis are given in Table 11. A graphical representation of these results is also given in Fig. 18.

The data shows that both the frequency and type of indicators observed vary greatly for the different Aorakinet participants. The highest frequency was shown by myself (75), followed by AL (64), MW (22), SM (6), JM (3), MH (1) and HB (0). The overall frequency of the individual indicators of co-construction from greatest to least is: Providing resources for others to use (42); Asking and answering questions (39); Making statement on own progress (21); Providing positive feedback, affirmation or encouragement (20); Developing a shared/mutual understanding of a topic or problem (18); Helping solve a problem by suggesting strategies (10); Asking about progress (9); Receiving and trying strategies suggested by others (5); Statements or other evidence that cognitive modelling has been influenced by dialogue with others (4); Receiving resources in response to a
request (2) and Providing negative feedback.

As with the server log file analysis, the different participants exhibited quite different ‘profiles’ of behaviour. Of the student participants, two, AL and MH had the highest frequency of indicators. Proportionately of those participants with a high enough frequency of indicators of co-construction to be considered reliable (TS, AL, MW) AL had the highest relative proportion (18%) and absolute frequency for ‘Asking and answering questions’. In real terms, by looking at the content of the forums, AL tended to ask questions, and lots of them. AL also provided relatively a lot of feedback about his own progress (15.6%) and also was the only participant to receive or try strategies suggested by others, receive resources in response to a request, provide negative feedback (say that a strategy did not work) and show evidence that cognitive modelling has been influenced by dialogue with others. MW had a very different profile from AL. MW had a very high relative proportion of providing resources for others to use (31%) and a much lower figure for asking and answering questions (13.6%).

Analysis of the forum content showed that MW was answering questions and providing resources for others to use rather than asking questions himself. MW also had a high proportion of ’Developing a shared/mutual understanding of a topic or problem' compared both relatively and absolutely to other participants. As mentioned earlier, the other participants (MH, SM, HB and JM) had so small frequencies of indicators of co-construction that it is impossible to draw meaningful conclusions from about them, apart from the obvious one of relative lack of co-constructive behaviour. In this respect, HB stands out as he has zero indicators of co-construction.

My own profile of co-constructive behaviour was quite different from the profiles shown by students. In absolute terms I provided the most positive feedback, affirmation or encouragement (9), showed the most activity in ’Developing a shared/mutual understanding of a topic or problem’ (8), provided more resources for others to use (18), suggested more strategies for solving problems (7) and was the only participant to ask others about their progress (9).

Summary of Forum Analysis

Analysing the forum content for indicators of co-construction provided useful data about what type of forum activity was taking place between participants. There were large differences between both myself and student participants, and within the student participants. Examples of a student who was asked lots of questions and a student who answered lots of questions were observed. The largest group of students had low frequencies of indicators of co-construction. The most common co-constructive behaviour was sharing resources, followed by asking and answering questions. I, the teacher, had the highest absolute frequency of indicators of co-construction and was the only participant who asked others about progress with their work.
Server Log File and Forum Analysis - Combined Conclusions

The previous analysis of server log files and forum content each provide different and complementary insights into the behaviour of participants on Aorakinet during this study. When the analyses are considered together a more powerful insight into the nature of participation of students and teacher during the course is gained. The most appropriate method of conducting the combined analysis is to consider the data at an individual participant level and attempt to build a description or profile of Aorakinet usage for each person in terms of what they actually did on Aorakinet and how they contributed to the forums. This approach also has the benefit of using the data from a perspective that every teacher will be familiar with: that of a learner.

AL's Story
AL used Aorakinet a lot. He asked a lot of questions in the forums and tended to use this aspect of Aorakinet in preference to other resources such as hyperlinks or files. AL made relatively frequent statements about his own progress and often provided code snippets for others to use – but these snippets of code were for others to help him solve his own problems. AL was quite focussed on getting the course completed and appeared to want help from others in doing so. AL was possibly quite self-centred as much of his contributions were concerned with his own learning rather than with helping others. He received resources in response to requests – this did not happen to other students. While it would be exaggerating to say that AL was dominant in the forums, his presence was very significant.

MW's Story
MW used Aorakinet frequently. He often visited the forums to see if he could help people out. He did this by answering questions, posting code snippets for others, suggesting strategies to use and providing positive feedback or encouragement to those needing it. MW was outward-looking and rarely made statements on his own progress (which was very good). He looked at resources regularly and appeared to be confident in his ability to complete the course without requiring help from others.

HB's Story
HB used Aorakinet a great deal, the most frequently of all the students. However, he did not, interact much with other students and not a single indicator of co-construction was attributable to him. When on Aorakinet, HB spent a little time looking at forum postings and much more time looking at resources such as hyperlinks or uploaded files. Clearly HB was quite an independent learner who did not feel the need to interact with others or respond to others requests for help.

MH's Story
MH used Aorakinet mainly during school hours. He did view forum discussions relatively
frequently but only rarely posted to them. He had one instance of an indicator of co-construction being attributable to him. MH looked at resources quite often. MH did need some help with the content of the course but did not appear to be very forthcoming in requesting it from others.

SM's Story
SM did not use Aorakinet a great deal, but was quite willing to look at the course forums and make posts when he was on the site. He did demonstrate co-constructive behaviour with others in the forums: he answered questions, provided positive feedback, resources and strategies for others to use. SM's knowledge of the topic was great, and he had much to offer others, but he did not contribute towards the learning of others as much as he was capable.

JM's Story
JM started the course after the other participants so a low presence on Aorakinet would be expected, but even allowing for this, he did not use Aorakinet much. JM readily viewed forum discussions, but did not contribute to them much at all. He had typical resource usage.

My Story
I showed high usage of Aorakinet in almost every aspect apart from viewing resources. In absolute terms, I viewed the forum discussions the most and made the most forum postings. I had the greatest frequency of indicators of co-construction and was the only participant to ask others about their progress. In many ways my behaviour on Aorakinet was trying to model what I hoped the students would do.

Though the 'stories' above have been simplified somewhat, it is quite obvious that even with a small group of seven users widely differing profiles of usage are apparent. So far, almost by omission, it has been implied that the interactions on Aorakinet and the resulting profiles of usage are independent of the sum effect of interactions. For example, MW has developed as an answerer of questions, while AL has largely asked questions and the other students have participated in the forums to a lesser extent. I am unable to make any meaningful comment on what the profiles of individual users would be like if MW and AL had not developed the roles that they did. Taking this into account, it is worthwhile considering the general types of role that participants may take or evolve into when learning in an OLE such as Aorakinet.

The role of the teacher needs to take into account the expectations of the students, their ability and willingness to work together and their self-sufficiency to enable independent learning. Much of what the teacher does is essentially that of modelling the appropriate actions such that learners can understand what is expected of them. For example, I tried to answer questions promptly and encourage a sense that a teacher was present on the course who cared actively about their progress. The level of help that I gave in my replies was often a judgement call on how to help the student discover the best way to find a solution to their problem. Often I would describe how I would go about solving a similar problem rather than the specific problem that was being asked about. This enabled
genuine authenticity in terms of NCEA examination criteria, but also allowed students to develop a greater understanding of the problem area rather than just 'fix the problem'. For example, AL had difficulty getting his implementation of php.mail working and requested help. I replied by showing him how I got my own implementation working, which allowed him to understand the mechanism by which php.mail operates. The teacher also needs to ensure that all students feel an amount of responsibility towards the teacher – I did this by asking about their own progress, both in online forums and as a regular round up of 'where we are at', in the VC sessions.

To what extent the teacher takes on the role of being the 'hub' in an online course will depend on both the students and the learners. It would be interesting to analyse the participants in co-constructive behaviour and determine if the teacher were indeed at the centre of most interactions. From a frequency perspective, it would appear to be the case, as I had more indicators of co-construction attributable to me than the other participants. No matter how much we want co-construction to take place between students the reality is that students will probably look to the teacher for direction and help with their learning. The critical role of the teacher could possibly be in fostering or directing co-constructive behaviour between students.

The role of the student learners probably depends on a combination of individual personality traits, the other 'personalities' on the course and the effectiveness of the teacher in enabling co-construction. In general terms I was able to find the following student roles in this study: Independent; Regular Observers – Frequent Contributors and Regular Observers – Infrequent Contributors. Independent learners are those that use the OLE for the directed resources that it may provide – e.g. files and hyperlinks and tend not to interact with other course members. Their use of the OLE is likely to be largely 'hidden' from other users, though server log files may reveal that their actual usage of the OLE was quite large. In this study, HB was, of course, an independent learner.

I have used the term 'Regular Observers – Frequent Contributors' to describe those students that actively co-construct with others (teachers or students). They appear to have a prominent 'visibility' in the forums and may be asking questions, responding to questions, or both. A less verbose description may be 'social learners'. Regular Observers – Infrequent Contributors is how I have categorised those learners that appear to use Aorakinet a lot but score low in their frequency of indicators of co-construction. This group of learners look at the forum contributions of others and occasionally submit postings of their own. A diagrammatical representation of how these groups align with each other on axes of contributions and observations is shown in Fig. 19.

Analysis of Interviews

Group interviews with students were conducted twice, the first at the end of the course day on 31 May 2007, and the second towards the end of the course on 10 September 2007. The analysis has tried to draw out significant themes that appeared during the interview.

Analysis of First Interview 31 May 2007

This interview was conducted partway through the course.
Students are strongly aware that it is more difficult to socially interact in an OLE compared to a normal classroom.

TS: ... What's the difference between using Aorakinet and say an ordinary lesson?

JM: There's people.

TS: There's people.

JM: Yep.

silence / laughter

The sense of other participants being 'abstract' is very real for some students.

MH: I suppose also you're disconnected... you're over in one end and I'm over in the other and I'm not, we're not, really interacting, we're just... reading each others words... That's about it, not actually speaking or getting a sense that you should get things done.

TS: It's interesting what you say about this feeling of being disconnected.

MH: Well you're not really there... you don't see them as a people, you see them as a computer

JM: It's robotic... (more)

MW: It's got a lot of disadvantages.

MH: It does have disadvantages... it also doesn't help that if you sit there in a room by yourself... not even really in a classroom, just by yourself just doing it.

The process of asking and answering questions posed difficulties for some of the students. The difficulties expressed were based around the difficulty in expressing and understanding questions in text and the slow response time, compared to a classroom situation, of using forums.

MH: Probably a lot easier too... you always have trouble reading explanations from things... I always find it easier to hear from someone... when you talk to them.

JM: If you have trouble interpreting it you can't just say... “sorry, what do you mean?” It's like you send one message and then later you get a reply and then later...
TS: ... I wanted to... get your thoughts about the difference between asking questions online and the difference between asking them in the class.

JM: You get an answer straight away in class

AL: Whereas in a forum it takes maybe a day, two days...

Students realised that asking questions using text is very different from asking them verbally and that this requires more careful phrasing than in a classroom. Sometimes the process of formulating a question can help the process of answering it.

MW: I think a lot of it's the questions because when you are in a classroom you are used to just asking a question like 'I need help' and they say 'what's wrong', you say 'I don't know look at this' and you know, you're giving lots of information, but with online you have to give all the information you can to help with to get a reply.

JM: And you may have missed something out.

MW: And people aren't really used to doing that.

MH: It's also how to put things into words I guess.

MW: Yeah, you've got to... think about the question more.

TS: Is that a good thing or a bad thing?

MW: Well it's a good thing I think, it's just that you have to get used to it, because I've done stuff before, posting questions on a forum, like coding and stuff and I didn't know what to do and I wrote it out and the question was completely crap and I rewrote it all. Then I read through and I knew how to do it, so I could figure it out myself, just from asking the question.

The process of co-construction in an online environment and how that differs from the usual routines in senior classes also provided a topic for comment. The individual nature of the projects the students were completing made formal, teacher-led lessons inappropriate.

SM: It's just different... [instead of] in class normally... you all learn sort of one thing at a time, like everyone at the same time. But we're all at different stages, so [it's] there's no sort of set lesson each time of something you learn. You have to work at your own pace.

JM: It's not hard.

Learning itself was acknowledged to be 'useful', but with the caveat that useful learning
had taken place.

**TS:** ... When you are doing stuff like this – what's most useful – getting the solution straight away or eventually getting to a solution and learning lots of other things?

**SM:** Having got to a solution.

**MW:** Actually both.

**AL:** Sort of both.

Students acknowledged that 'figuring it out for themselves' would be 'best' but would also be time-consuming.

**SM:** ... It's not a bad thing, it's just different...

**TS:** One of the things that interests me... is, we're at the point... where half of the class want to put information into their database using forms, and how useful would it be if one of you were to... half start this and... then let, somebody finish it off. I could probably put a solution up there for you, but would it be better for me to... put a solution up or for you to try and develop it amongst yourselves...

**MH:** It depends on time... this really has to be done by the end of the term so... if you had like previous ??? us trying to figure it out amongst ourselves it would be the best way...

**JM:** If you tell us how to do it then they'll be completing the task better. If we hadn't had to do it ourselves then that would be a... mechanical task. Having said that, answering ourselves would take a lot more time.

**MH:** But still when you post an example up, it doesn't always work, so we still have to... pull it apart, and... reassemble it, so [it] can work for your own individual things, but you're still learning, but probably handed onto places don't quite get the gist.

**MW:** Yeah you're being taught, but here you have to teach yourself and actively do it, but with normal classes... you said, you're gonna learn how to do this like... They don't just say we have a test coming up, here's what you have to learn, go and do it, they say right we're going to learn about... algebra today so we're going to learn A, A and A.

**SM:** Then we can... make our own goals of what we want to learn...

...**MH:** But the thing is... you learn the actual stuff [that] you need to get the thing done is actually learned... from the teacher on the board. So you get all the stuff ready for the task, as opposed to Aorakinet you... just learning as
you do, it makes it a bit messy.

All of the students were very familiar with technologies such as email, cell phones, texting etc. and were quite happy to use these for personal use. However, as far as the students were concerned a digital-divide between school life and life outside school exists.

MH: ... People would be prepared happily to use forums... instant messenger if they were talking about just garbage but since it's schoolwork it's something different it's... not really interested[ing] because... it's work as opposed to... talking about... crap.

TS: That's interesting, some people... think that your generation... fit in with [this kind of communication] forums, texting, really well and should use that for education, but...

JM: I like it... but.

MH: I suppose it's useful that... you can do it if you're tired at your own [leisure]...

Not all comments about online learning were negative, students valued the freedom that the course allowed.

AL: You can work from home on Aorakinet so you've got more time to do stuff, more leisure time, more leisurely time rather than you've got this hour to get this much done. So you've got as much time as you want, you can go away and do something else.

MW: Yeah, cos you would say usually people wouldn't bother doing it, that's a good thing too though, learning on your own... . When most people would... just ask cos that's easiest thing to do, they don't bother learning much by themselves.

Analysis of Second Interview  10 September 2007

Students valued being able to compare their own progress with the progress of other students on the course. When asked about doing other VC courses that did not use Moodle or a similar OLE:

TS: It must be more difficult to see how other people are doing or to share resources?

MW: Yeah that's true. We don't really know how everyone else is doing and stuff. We don't really help each other or anything, it's more you're just doing it on your own.

MH: We could see each others work because we could put it up online.
MW: You could see how you are doing compared to everyone else.

TS: Did you do that much, did you look at each others websites?

HB, MW, MH: yeah.

AL: Yeah I looked at them a bit.

JM: I looked at a few.

TS: It's interesting – you seem to think it's quite important to see what other people are doing.

MW: It is.

MH: It's [a] mental thing – to keep up with everybody.

MW: If you get behind it's more like you have got to catch up rather than 'I don't care'.

Students didn't appear to reflect on the obvious differences in forum participation rates between the different students on the course. They appeared not to 'self analyse', but did acknowledge that they did have different 'profiles'.

TS: So what's the motivation for helping people out?

AL: If you help them, you might have a problem and they'll help you in future.

TS: That's interesting, because I've looked at the logs for Aorakinet and you can break people down into certain types of behaviour and some people hardly help other people at all, some help people a lot and others ask questions and help and so on. I'm not going to name names, but would you have been aware that different people have had different inputs, but together I think it's worked. Do you think it's worked?

All: Yep

TS: Were you aware when you were doing things that hey ' I'm asking a lot of questions' or 'I'm answering a lot of questions'?

MH: No I didn't care.

MW: I just went ahead and did it.

MH: If I didn't know the answer I just didn't bother answering.
AL: I noticed I asked a lot of questions about coding and stuff but I didn’t care that I was... I just asked and someone would help and I say this is what I did, is it right? If not someone would suggest something.

TS: If I look at what people have done apart from asking forum questions, you can see that... H[name of student]... hardly posted any questions or replied to any questions, but you were looking at what other people were doing. So were you aware that you were doing that?

HB: Yep

TS: But were you A[name of student], you asked a lot of questions, were you aware that perhaps other people would be interested in the answers to those questions?

AL: Yeah I sort of was. But then I thought maybe I should have posted back up on there things that I had worked out.

There was a very strong feeling that participation was a result of knowing the other course members and that as the level of familiarity with other members increased so did the confidence in interacting with them. The course coding day when students met face-to-face helped to cement friendships started online.

JM: I think if you had a class without the actual VC where people were less connected and just had an online class then people would make less contributions to the forum and a way of helping each other and sharing experiences because they don’t really care about the rest of the group.

MH: That’s true.

MW: If you didn’t know each other as well you might just...

MH: I suppose seeing people it’s like weird, so you see them as actual people as opposed to something out there on the internet, into the void. And also that day they came down, so you knew they were people... real people, you can mentally see who they are, as opposed to just on the net.

TS: Do you think as the course went on that process, that feeling changed so that you did get to know people more?

MW: Yeah we did. We asked and answered each others questions further along because we knew each other and stuff.

AL: It’s a confidence thing, at the start... if I post that up people will think I’m stupid, it might be really easy or something and I just don’t know how to do it. People might think I’m stupid. Everyone’s more confident.
MW: It wouldn't happen so much if we didn't know each other.

TS: Do you think if you did another online course now it would be easier to start asking all those questions?

ALL: Yeah.

MH: Cos we... know what goes on. At the start of the year we were really unsure of what was really going on with the whole thing.

When asked if they had advice for others who were going to do an online course like they had just completed, students were quick to pick up on the permanency of online transactions and how unwilling they were to ask questions compared to a normal classroom.

AL: Keep on track with what you are doing, cos otherwise you'll get lost.

MW: Don't be afraid to ask questions and stuff.

MH: Probably the don't be afraid bit... most of the questions that I generally asked was in the classroom with M[W] and H[B], S[M]. If you're online just go and type instead of worrying about if people think you're... I mean we're willing to ask dumb questions in class, but we're not willing to do it online.... I find that odd.

AL: With face-to-face and with voice, there's no written record of it. Basically people are going to forget you said something really stupid.

Working within a constructionist framework, where they have to build an artefact – the web site was recognised as both more challenging, engaging and useful than projects that were not actively involved in building something.

TS: We set a problem at the beginning, how did you find that part, you have a problem, we've got to get to an end point, but we're not sure how we are going to get in between that OK?

MW: I thought that was OK.

TS: Was that OK, or was that quite difficult to think, well, doesn't the teacher know how we are going to get there? Cos I guess you are used to in classes, teachers saying this is how we get from A to B and we do it in little steps.

MW: I liked it more.

MH: I suppose we actually learned it more.... the class teacher just feeds you that information, puts it into your ear and just rot away and that.
Whereas with this you really have to focus on it. I learned it better but it probably takes more time.

MW: You do learn it better when you have to figure it out.

MW: Yeah, but you don't just get given it. It takes more effort.

TS: What about you Roncalli? [This was asked to gain the opinions of the students at Roncalli College who were on the other end of the VC connection.]

JM: It's a bit strange at first, but you kind of learn two things at once. One, how to come to a solution but also how to deal with that so you can come to a solution.

TS: How do you mean, what's the difference between the two?

JM: Well, one, you've got to come to the solution – that's the physical problem of 'I've got to make a web site' and how to do the PHP but also there's the second part of that, how to deal with the problem of how to go about getting resources, how do I go about putting it together?

MH: The organisation.

JM: The organisation type of stuff.

MH: I suppose...

MW: Organise yourself.

MH: It makes you... more responsible. Also when you have a teacher nagging you, when you do the thing you don't do it just because, by yourself, just to get the teacher to stop nagging at you. You have to do it more yourself.

Students agreed that personality played a part in determining the extent and type of online interactions, but did not concur with the idea that their learning behaviours were fixed. AL stated that the extent to which he asked questions depended on the class he was in.

TS: How much do you think your personality... has influenced your behaviour online?

MH: Probably a lot.

MW AL JM HB: Yeah.

TS: Give me an example then.
MH: Well maybe A[L] is a more open person so he asks more questions than lets say me who's sort of...

TS: Well would you ask a lot of questions in class A[L]?

AL: It depends what class it is. Some classes like Stats, I always ask heaps of questions of the teacher and all the other people, but in other classes like Geography I just do what the teacher tells us. It depends on the class how many questions I ask.

MH: My personality is laziness.

AL: That's a good description of it!

MW: I usually answer quite a lot of questions and stuff.

TS: How about you H[B], do you ask lots of questions?

HB: No because...

MW: I do the work.

HB: Yeah.

MW: Yeah, I usually help people and stuff.

Analysis of My Own Journal

I am not a great writer of diary type journals, once I kept a diary for two whole weeks it was a Christmas present given to me as a young boy so the journal entries I wrote were brief and infrequent: I wrote whenever I felt the need to record an important event that I might otherwise forget and did not record the mundane realities of running an online course.

Term One Summary

My main concern is the constructionist nature of the course and how others will view a teacher who does not have 'all the answers'!

This course has been difficult to set up. By the end of the course I want students to have used PHP scripting to build interactive websites. Their learning should have been achieved using social constructivist methodologies facilitated by Moodle / Web2.0. From the conception of the course I was aware of what Gilbert (ref) refers to as 'systems level' knowledge and how this would fit into the course. My own background is that of being (reasonably) competent in Java / Web / Linux. I would consider
myself to have good (enough for level 4) systems level knowledge in the area of interactive web design, but at the start of the term had no experience of PHP at all. This is quite an important point, I want to put myself in position similar to the students, where I am able to guide and direct but not instruct or convey the detail of implementation of solutions to their projects. This feels quite strange to me. All my professional career I have acted on the compulsion to be 'ahead' of my students. Students expect their teachers to know a 'correct' answer, and indeed students often want to be told the 'correct' answer. How will students, parents (and indeed other teachers) respond when it becomes apparent that I don't 'know' or can't recall what is correct? These thoughts are similar to those outlined in the paper that Ann gave us. It is quite exciting though, knowing that I'm going to learn something new, attempting to expect the unexpected, spending time thinking about the meta-problems that the students will have rather than the detail of the implementation. While I have tried as little as possible to not learn the detail of implementation of what the students will do, I have had to ensure that what they are attempting with their websites is both possible and feasible within the time available for the course.

I was also concerned about how the students were finding cooperating with their peers to be difficult (at least at the start of the course).

The initial response from the students towards co-constructive activities has been a little disappointing – but I have to keep positioning my responses to an analogous classroom situation. How many teachers could claim they have a co-constructive classroom? How many students volunteer to take part in classroom discussions? I will ensure that the next phase of the course involves group/teamwork so that co-construction becomes integral to student learning.

The next journal entry is from 11 May 2007 the Roncalli students did not attend the VC lesson, leaving the Waimate students and myself to use the time coding, and relates my excitement of seeing the course students participate in co-construction take place in a face-to-face environment.

Any doubts I had about some of the students in this course being able to co-construct knowledge with their peers have been thoroughly dismissed. The fact that it was not using web2.0 in some sense is minor. The task now is to transfer the co-construction to a web2.0 environment.

Students were learning how to connect to a MYSQL database using php and then display the results of a query. I had provided a template of the type of php code required to achieve this, but before students could use this to connect to a database, they had to first construct the database and then heavily modify the template code to fit their own circumstance & database. In terms of difficulty, I graded this quite difficult – minor mistakes with syntax can throw up seemingly intractable errors that are very difficult to trace.
MW had completed a php login process on a remote site (not the course server) and was in the process of transferring it over to the course server when MH was having difficulties in authenticating against the course database. MW started to help MH – describing the process of what should be happening in the code, checking it was, meanwhile MH was interrupting, correcting MW’s mistakes in a sort of to and fro process between them. As an observer, the process was electrifying. Seeing first hand, quite naturally, without being asked to work in groups, co-construction happening between students during a ‘technical’ project reinforced my belief that this project is worthwhile. I wish I had been able to record this! Why, why, why is co-construction so difficult to initiate with this group?

Some thoughts about this: firstly, co-construction 'real-time' is spontaneous, quick, 'just in time'. When done via web2.0 (e.g. a forum) it is ponderous, considered and the dialogue of co-construction has an indefinite response time frame. Is the positive feedback from trying to co-construct too weak to make it worthwhile?

Again, on 16 May 2007, I was concerned about my role as a teacher when I needed them to help me with a coding problem – would it live up to student expectations?

Ten minutes ago I posted my request and link to code on Aorakinet. It will be interesting to see what the students make of this. I'm hoping that it will be seen in the spirit that it is intended, a challenge, a co-operative venture. How do I feel about this? I am a little excited that I'm demanding something from the students - walking the walk as well as talking the talk. I wonder how much of this online web2.0 stuff is about modelling the type of behaviour the teacher wants!! I don't feel vulnerable that the students will not see me as a font of knowledge, but then I'm operating in a subject area where systems level knowledge is the key to accessing detailed implementation level knowledge and I'm assured I have the former.

On 23 May 2007, I was concerned about communication with students, how the asynchronous nature of most of the online work can cause problems.

One of the problems that I think is emerging here is synchronicity. Students are used to learning in a synchronous environment (classroom) yet web2.0 is asynchronous. Perhaps the particular difficulties of this environment are the cause of the lack of community? Are students less comfortable with the ponderous, reflective nature of Web2.0 interactions (generally that is – chat interactions tend to be quite furious) than f2f? Perhaps in an ordinary classroom the 'chatter' is not so much about work, but about socialisation – in a forum based web2 environment, this becomes more difficult.

This was the last journal entry that is worth commenting on here.
Analysis of Course Coding Day Questionnaire

A course coding day was held on 31 May 2007 where all course participants spent a day at Waimate High School and collectively coded our projects. A questionnaire was given to participants at the end of the day to find out their experience of the day. The questions and results are reproduced in full in Appendix 1 and an analysis follows.

Students appeared to enjoy the coding day more than the usual VC sessions. It cannot be determined from this questionnaire if this was due to it being a different type of activity or if was because it actually was 'more enjoyable', but comments made by students included: 'more personal than using VC ' and 'made friends ', indicating that the success of the day was at least due to the ease with which social interactions take place when in a face-to-face context. Compared to using Moodle, students also found it much easier to get help from others. All students received help from others and four of the six students gave help to others. Comments made by students on this aspect of the day included:

- 'If I had a problem I could ask someone and get an answer straight away'
- 'People don't post their solutions so cannot always learn from example'
- 'The teacher is here and easy to ask questions'
- 'People right there to help'
- 'It was easier'

Students found the day useful and it appeared to make them reflect on their Aorakinet work and relationships with other students.

Overall, I thought that the coding day was very successful. Two aspects were particularly evident. Firstly, the relationships between all course participants, including myself, were expanded and cemented. The benefits of this were apparent from this day onwards in terms of greater trust and co-operation on Aorakinet. Secondly, minor technical coding problems were able to be quickly sorted and this appeared to increase the confidence of students. The students obviously valued the day and commented that: 'We should have another one'. The differences in ways of working when face-to-face and when 'online' were apparent to some of the students with one commenting: 'People including me should post more of our work on Aorakinet', indicating a realisation that a successful online environment requires commitment by participants to share ideas.

Discussion of Findings

In this discussion I will relate the present findings to previous work and then suggest how they are relevant to the context of New Zealand education at present. The findings of this project are interesting with regard to both what participants actually do when taking a course in an OLE and what the experience of completing the course is like for them. Even amongst a group of six students it is evident that different types of participant profiles are exhibited. This is not really surprising, as any teacher will be able to relate how students behave and appear to learn in different ways. However, what this study has shown, is that by recording participant's actions and interactions, the extent of differences between students in this small cohort is obvious. These differences may well exist in a classroom.
scenario but may be less noticeable or, because interactions in an OLE are more novel, amplified in some way.

The present study found that students could be grouped in the following ways:

- they were regular observers-frequent contributors,
- regular observers-infrequent contributors and
- independent learners.

Other researchers have also tried to categorise the communication between participants in online networks. Welser (2007) used visualisation methods to reveal the social signatures of participation in the online world. An ‘Answer Person’ was defined as someone whose primary mode of interaction is the provision of helpful, informative responses to other group members questions. In the present study, MW exhibited the profile of an 'Answer Person'. He answered lots of other peoples questions and freely gave his time and resources to helping others. 'Answer people' have an important role in online communities and act to provide helpful and informative responses, often without thanks or compensation. The motivation for being an 'Answer Person' is not clear. What makes a person freely give away their own knowledge and skills to others for no apparent material gain? In an ICT context, a close similarity exists between 'Answer People' and those who contribute to open source software projects. These projects are contributed to by programmers and licensed in such a way that others can use the program at no cost (for licensing) indeed, other people can even sell the software, even though they have no 'ownership' of it. Stahl (2005) has suggested that the motivation for giving away 'intellectual property' in this context may be a combination of altruistic and egotistic factors. The altruistic element would be those motivations that support contributing for the greater good of things (a program, society, an online course perhaps), while the egotistic elements are those that in some way increase the human capital or personal market value of the contributor. In the context of the current project, the motivation to become an answer person could derive equally from both altruistic and egotistic factors depending on the person in question.

The data gathered from the second interview suggested that students thought that their own personality would affect the type and extent of their own online actions and interactions. Without transgressing into what 'personality' is and how it may affect interactions with others, this idea seems reasonable. Indeed, Daughenbaugh, Ensminger, Frederick and Surry (2002) found that personality effected students satisfaction with online courses, but in ways that were unexpected. Traditional wisdom has it that introverted personalities prefer online interactions, presumably due to finding face-to-face interactions stressful in some way. Daughenbaugh et al (2002) found that statistically significant extrovert personalities had a greater preference for online courses and recommended that online courses should be designed in ways that allow for a variety of ways for students to interact with each other, including face-to-face interactions where possible. In another study, but not in an online context, Nussbaum (2002) found that extroverts tend to argue more and introverts participate more in co-constructive discourse. Waller (2007) looked not at personality, but learning styles and students experiences of using e-learning applications and concluded that any teaching mechanism should be examined critically to ensure that all learning style modalities are addressed, advice that would be difficult to dispute.
A major theme that is apparent in both interviews and the questionnaire is the extent to which students felt uncomfortable with a purely online environment and that some element of face-to-face contact was required (the face-to-face contact does not necessarily have to be real, and could be by VC) to build relationships among the learners. This finding has major implications for the use of OLEs in schools. Online courses could be used to help fulfil aspects of the recent personalised learning agenda by providing students with courses that are more suited to their needs than traditional schooling can supply. However, unless care is taken to ensure that the courses enable relationships to be built, nurtured and explored, rather than seen merely as a vehicle for delivering content, then they will probably isolate participating students and teachers.

Garrison (2004) asserted that an educational community of inquiry requires participants to variously adjust in terms of social presence, cognitive presence and teaching presence. Social presence is the ability of participants to engage in ways that support the common purpose, cognitive presence is the construction of knowledge and teaching presence must manipulate the social and cognitive factors in ways that support the purpose of the community.

In the present study, the social adaptation required to make the course work took place during the first part of the course, and was cemented by holding a course coding day. The feedback from this day indicated that the socialisation that occurred in a face-to-face context was critical in making the relationships with other course participants secure.

The implications of social presence adjustment for online course designers mean that courses need to be designed to remove social barriers and speed up social presence adjustment. This can be done in several ways, face-to-face meetings are very important, to what extent they can be replaced by VC meetings is as yet unknown. The mixture of entirely virtual, VC and 'real' face-to-face learning is, of course, a form of blended learning. The real face-to-face meeting added a degree of what Mayadas and Piccanio (2007) would call 'localness'. This is a dimension that measures the connections to local communities or radii of influence. Localness in the present study has enabled students to build a degree of trust and has contributed towards the extent and quality of social presence. It would be interesting to determine the different effects of VC and real face-to-face on the degree of localness that is experienced by course participants.

Online courses are highly textual and this can act as a barrier to effective learning. Questions and answers have to be asked using text and this can pose problems for students. The participants in the present study acknowledged that sometimes asking questions on the forums was difficult due to the level of articulation that was required to express a particularly complex point. Some participants also expressed concern about posting questions because of the possibility that other participants may perceive them to be performing poorly or (in student language) 'dumb'. Kitsantas and Chow (2007) found that university undergraduate students were more likely to seek help in online classes than in traditional classes. The interview data from this study leads me to believe that this conclusion is less certain in younger students.

The constructionist nature of the course was seen to be successful by both students and myself. Having to build the interactive web sites was a technically difficult challenge, but one that the students found motivating. It did take students a while to adjust to the
expectations placed on them by the constructionist approach, but once this had taken place they appreciated that the depth of learning, the meta-learning skills, were, equally or even perhaps more important than the content of the course.

Turning now to my original research question,

*What does co-constructive learning in a Web2.0 context mean from the perspective of facilitator and learner?*

we can begin to put together a picture of what co-constructive learning in Web2.0 implies for teachers and students. Compared to traditional classrooms, students have more responsibility for their own learning, access to support that is available any time and anywhere, and possibly greater personalisation of their learning. Students will also probably have to make greater efforts to socialise with their fellow participants. As a teacher, the experience was both liberating and exhilarating in terms of being free from delivering content but also at times terrifying because I felt responsible for not only ensuring the students learned the appropriate content, but in some way responsible for learning for them, much as Windschitl (2002) has described.

My experience of facilitating learning during the course was one were for much of the time I had to resist the urge to give students answers to the questions they were asking and instead guide them to discover the answer for themselves. This was achieved using a variety of means. At times I simply pointed students to an online resource that may have been useful, while on other occasions I replied to forum questions with pointers or suggestions to solve a problem. I also made requests on the forum, asking for other students to help solve the problem. This last tactic was quite interesting and students seemed to enjoy helping their teacher.

The co-constructive approach was acknowledged by students to be a more engaging and challenging way to learn than traditional instruction and in the context of an online course may well lead to students experiencing better satisfaction and ultimately success. This could be due to co-constructive teaching methods resulting in greater social presence which in turn may lead to reduced feelings of isolation and hence improved levels of overall satisfaction and enjoyment. Pelz (2004) states that interactivity is the difference between an effective online course and a high-tech correspondence course and the present study supports this view.

The learning skills that students must use if they are to succeed in the type of course described in the present study are not ones that are frequently found in a traditional classroom. In particular students had to plan their projects and find and reuse knowledge in their own individualised context without continual checking from their teacher. The students responded enthusiastically to the challenges provided by the course and acknowledged that they were acquiring experience in a type of learning that was difficult yet engaging. While these skills were not explicitly taught during the course, students did appear to use knowledge building skills effectively, prompting me to consider where and how they acquired these skills. I am unable to comment on these particular aspects of the study, but it is interesting that the students did use these skills without any explicit assistance from me.

I consider the success of the course to be a result of three critical factors: designing the course assessment tasks so that students completed projects based on a constructionist
philosophy; providing the means for and expectation that students will co-construct knowledge together in order to complete the assessment task; the teacher resisting the urge to be a 'font of all knowledge' and so allowing the students to take part in co-construction. When these three factors are present a purposeful, flexible yet guided environment exists for students to learn together with the confidence that their teacher will ensure they will be successful in completing the course.

A New Metaphor for Co-Constructive Learning Using Web2.0

During the course of this research I became aware that explaining to other teachers about teaching and learning using co-constructive methodologies in an OLE was quite difficult. The problems centered around the language used, terms such as social constructivism and co-construction just don't seem to appeal to many teachers! I realised that I needed a metaphor to describe the experience that would be suitable for both teachers and learners.

Metaphors are useful in that they allow us to understand the similarities between two or more situations but there is a danger that using a metaphor to describe a complicated situation may over-simplify the concepts too much and result in a loss of richness or depth to the concept in question. The famous physicist Albert Einstein once said 'Everything should be made as simple as possible, but no simpler.' (http://en.wikiquote.org/wiki/Albert_Einstein), the not so famous Richard Schwier (2002), in a paper concerning metaphors and OLEs said 'Even good metaphors... add little to our understanding'. So it was with some trepidation that I set out trying to find a metaphor for co-constructive learning using Web2.0. To clarify my thoughts, I set about constructing a set of descriptors for the metaphor, the idea being that a good metaphor would be able to match most or all of them. These are produced in Table 12.

I then considered some of the common metaphors for online learning and tried to fit them into the above framework. The metaphors that were tested in this way were location based as a location often has various roles that may be associated with it. The locations that I tried as part of the development of my metaphor were: a village, a garden, a café, a pub, a classroom, a surgery and a kitchen.

The village metaphor uses a sense of community to describe the roles and situations that may be encountered in an OLE and there are some interpretations of a community metaphor that do indeed fit very well to the schema described above. A community implies communication which is consistent with the co-constructive ideals that I am trying describe. As Schwier (2002) relates,

'All of this sounds so pleasant. Communities are idealized in our minds, but often quite different in gritty experience. We think of communities as warm, inviting and supportive; the truth is often less favourable.' (p.2)

The reality is that though we might wish to view participating in an OLE as being similar to being in an idealised community as a metaphor it is weak, inaccurate and does little to describe the roles and responsibilities of participants.
The metaphor of an OLE being like a garden is appealing in many ways. The act of gardening implies a sense of nurturing that what is required to grow, much as a teacher tries to nurture the intellectual growth of learners. The weakness of the garden metaphor is that the role of plants (learners) is ambiguous and has a subtext of being passive to control by the teacher. In my view, participants in an OLE must have some amount of self-determination, and this is missing from the garden metaphor.

The café and pub metaphors are similar and will be treated together. Both of these places are associated with socialisation, dialogue and making, cementing and nourishing friendships, so fit well with the requirements of a metaphor to describe the friendly nature of co-constructive relationships. These metaphors are weak though in that they are not rigorous enough to describe the different types of relationship that are present in a functioning OLE course: the differences in the roles between teacher and learners, the responsibilities of learners to themselves and each other, and the nature of producing something together. Like a community, the pub/café metaphor can mean many things to different people, after all, people visit a pub or café for many reasons, sometimes to meet and co-construct with others, sometimes not.

Using the image of a classroom as a metaphor for learning using an OLE has many advantages. A classroom is a familiar concept to all who learn. Both teachers and learners will have unambiguous expectations of the types of relationships and activities that are associated with being in a classroom and herein lies the problem or weakness with this metaphor. For me, and I expect for many others, the metaphor of a classroom will place emphasis on teacher led instruction, direction and control, and conversely will place less importance on co-construction, constructionism and the building of relationships between learners. A classroom metaphor will tend to bring to mind associations with a 'traditional classroom' rather than a learning experience where knowledge is constructed as a social activity with course participants and relationships between all participants, including the teacher, based around exchanging, validating and improving ideas.

None of the above metaphors are entirely satisfactory, each is deficient in some way, leading to either an over-simplification of the concept, or is just plain inaccurate or misleading. I thought carefully about the relationships, actions and responsibilities of OLE participants and tried to fit them into the metaphor of a kitchen. While this was partially successful, a greater 'fit' with the descriptors was achieved by adjusting the metaphor to be a kitchen in a rather large hotel. The details of this are given in the Table 13.

There are several parts of this metaphor that I consider to be particularly satisfying. The most important function of a kitchen is to produce timely, quality food using the resources available. Clearly, if all OLE courses enabled quality knowledge to be constructed, then the acceptance and use of appropriate online pedagogies would be more widespread than it currently is. The cooks in a kitchen have a very active role that requires communication, interaction and empathy with others, while having belief in their 'own ways of doing things'. In short a good cook will require elements of both separate and connected ways of knowing. The Head Chef in a kitchen plays an inspirational role, acting to co-ordinate, reward, praise and admonish, and acts to ensure that quality food is prepared. Note that it would probably be quite rare for a head chef to prepare a whole meal without significant help from Junior Cooks. The Head Chef should try to develop the responsibilities of cooks.
so that they are able to make meals with minimal supervision. This metaphor is strong because it accurately describes the roles and actions of OLE participants in a way that all should be able to understand and most importantly puts the act of co-constructing knowledge at the centre of the concept.
Try and fit the images below to OLE participation using the kitchen metaphor!
Table 5. An example from the web server log file.

<table>
<thead>
<tr>
<th>courseId</th>
<th>timestamp</th>
<th>ipAddress</th>
<th>name</th>
<th>activity</th>
<th>info</th>
</tr>
</thead>
<tbody>
<tr>
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Table 6. Web server log file showing extended activity on Aorakinet.
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<th>Total</th>
<th>%</th>
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<td>73</td>
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<td>59</td>
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<td>91</td>
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Table 7. All Users - Teacher Percentage Comparison of Activity Type on Aorakinet.

Comparison of Teacher and Student Types of Activity on Aorakinet.
Table 8. Types of Activity on Aorakinet classified by participant – raw frequency

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<th>SM</th>
<th>MW</th>
<th>MH</th>
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<td>211</td>
<td>332</td>
<td>200</td>
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<td>774</td>
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<td>1991</td>
<td>4589</td>
<td>744</td>
<td>1452</td>
<td>1013</td>
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Table 9. Types of Activity on Aorakinet classified by participant – percentage normalised per participant

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<th>AL</th>
<th>SM</th>
<th>MW</th>
<th>MH</th>
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<th>mean for students</th>
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<td>28.78</td>
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<td>20.83</td>
<td>16.87</td>
<td>23.76</td>
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<td>1.76</td>
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<td>1991</td>
<td>744</td>
<td>1991</td>
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<td>4589</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asking and answering questions</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Providing positive feedback, affirmation or encouragement</td>
<td>This could include statements such as: 'Thanks for doing this', 'Great!' or other statements likely to make the recipient feel that they have made, or are capable of making, a creditable effort.</td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>Developing a shared/mutual understanding of a topic or problem</td>
<td>This implies a dialogue is taking place between participants.</td>
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<td>This is an example of the social processes that accompany co-construction.</td>
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<tr>
<td>Making statement on own progress</td>
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<tr>
<td>Providing resources for others to use</td>
<td>Resources could include a simple hyperlink to a web page, the code that may provide a solution to a problem or a diagram showing how a solution may be attempted.</td>
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<tr>
<td>Helping solve a problem by suggesting strategies</td>
<td>For example A says 'Help, I can't get this to work!' B suggests: 'Have you tried this...'.</td>
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</tr>
<tr>
<td>Receiving and trying strategies suggested by others</td>
<td>As above</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Statements or other evidence that cognitive modelling has been influenced by dialogue with others</td>
<td>This evidence could come from interviews or forums comments. Examples may include statements that directly state the influence of others in constructing a coherent cognitive model.</td>
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Table 10. Indicators of Co-Construction used in this study.
Table 11. Frequency of Indicators of Co-Construction in Problems and Solutions Forums.

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<th>MH</th>
<th>SM</th>
<th>HB</th>
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<td>asking about progress</td>
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<td>answering questions</td>
<td>completing assignments</td>
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<td>cooperating</td>
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<td>independent learning</td>
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<td>asking questions</td>
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Table 12. Descriptors used for the metaphor of OLE.
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<th>Notes</th>
<th>Real</th>
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</thead>
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<td>Kitchen</td>
<td>A kitchen is a room used for food preparation and sometimes entertainment.</td>
<td>OLE</td>
</tr>
<tr>
<td>Executive (Head) Chef</td>
<td>The Head Chef has responsibility for the kitchen, praises, rewards, reprimands cooks and is in charge of quality control. Beware of the Gordon Ramsay effect!</td>
<td>Teacher</td>
</tr>
<tr>
<td>Cooks</td>
<td>Cooks co-operate in making a meal. They have individual skills and specialities that can be used for the good of the kitchen.</td>
<td>Other learners</td>
</tr>
<tr>
<td>Ingredients</td>
<td>Ingredients may be sourced from different locations. A quality cook may have their own preferred supplier of ingredients, but will always be on the look out for superior and novel sources.</td>
<td>Raw untransformed knowledge</td>
</tr>
<tr>
<td>Meal</td>
<td>A meal results from the actions of many participants. Each participant has left a tangible imprint or trace on the final product.</td>
<td>Transformed, co-constructed knowledge</td>
</tr>
<tr>
<td>Cooking</td>
<td>This is the act of making a meal and requires cooks, ingredients, cooking implements and a Head Chef to direct the occasion.</td>
<td>Co-construction</td>
</tr>
<tr>
<td>Cooking implements</td>
<td>Without cooking implements, the food would be unable to be processed into a meal.</td>
<td>Forums, online tools</td>
</tr>
</tbody>
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Table 13. Explanation of the kitchen metaphor for teaching and learning in an OLE.
Fig 11. Hourly breakdown of total Aorakinet Activity for Student HB.
Fig 12. Hourly breakdown of total Aorakinet Activity for Student AL.
Fig 13. Hourly breakdown of total Aorakinet Activity for Student MH.
Fig 14. Hourly breakdown of total Aorakinet Activity student – teacher comparison.
Fig. 15. Total Aorakinet activity per user.
Fig. 16. All Users - Teacher Comparison of Activity Type on Aorakinet.
Fig. 17. Typical Aorakinet login procedure.

1. Aorakinet login page

2. Correct login credentials supplied by user

3. User homepage on Aorakinet with hyperlinks to users' courses

4. Hyperlink clicked by user

5. Course 18738 homepage
Fig. 18. Frequency of Indicators of Co-Construction in Problems and Solutions Forums.
Fig. 19. Diagram showing groups of learners and their relation to contributions and Observations.
References


O'Reilly, T. (2006). Web 2.0: Stuck on a Name or Hooked on Value? *Dr. Dobb's Journal*, 31, 7, 10


Appendix 1

Course Coding Day Questionnaire Results

**Question 1**
Please rate how much you enjoyed today (Scale 1 to 10, 10 = most)

n=6  mean=8

**Question 2**
Did you enjoy today more or less than the usual VC sessions?

n=6

more x5, it was good X1

comments: got work done; not buggy laptops; more personal than using VC; I have learnt the necessary stuff I need to use to make my website; gave me more time to work on project, less restrictive that way; more hands on approach, made friends, used specific programmes I do not have.

**Question 3**
Did you enjoy today more or less than using Aorakinnet? (Scale 1 to 10, 10 = most)

n=6  mean=8

comments: The teacher is here and easy to ask questions; It was easier. Talking to people; Easier to ask questions; If I had a problem I could ask someone and get an answer straight away; Applied work.

**Question 4**
Did you help anyone today?

n=6  yes=4  no=2

comments: help JM and AL; Showing how to use forms & MYSQL; JM explained PHP that I had just learned.

**Question 5**
Did you receive any help today?

n=6  yes=6  no=0

comments: SM & MW; SM; MH helped me with PHP; Matthew showed me how insert data into MSQL database using PHP; Explanations from AL, MW#2 & Trevor.

**Question 6**

Compared to Aorakinet, how easy was it to obtain help today? (Scale 1 to 10, 10 = most)

n=6  mean=8.3

comments: Mr Storr was there and things were explained between; The same; Just ask; People don't post their solutions so cannot always learn from example. Also sometimes I you don't always get an answer to a question to a problem; People right there to help.

**Question 7**

How useful did you find today? (Scale 1 to 10, 10 = most)

n=6  mean=7.8

**Question 8**

If you have any other comments about the day or the course please write them down here:

Comments: It was good to get some work done. Met the people from Roncalli; Not really any comments; We should have another one. Would help with learning and getting stuff done; People including me should post more of our work on Aorakinet.
## Appendix 2

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