Engaging Adult Literacy Learners: Investigating Problem Based Learning Object (PBLO) Use as a Possibility for Implementing Problem Based Learning (PBL) Online

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ABSTRACT

Anecdotal evidence revealed that learners in an adult literacy program at a large school board in Ontario were disengaged – unable to identify opportunities to act in response to traditional pedagogy used to prepare them for science Prior Learning Assessment & Recognition (PLAR) assessments. Given the evidence that Problem Based Learning Objects (PBLOs), embedded in collaborative online learning environments, engage adult learners in science, a similar approach was adopted. A social, constructivist online learning environment and a PBLO were designed and introduced to four learners with the intent of fostering engagement in the form of "social practice." Csikszentmihalyi's (1990, 1997) "Flow" framework was used to measure learner emotion, the means through which activity during PBLO use was investigated. In response to the online experience, learners were able to identify opportunities to engage; however, a more longitudinal study is warranted to further understand the activities and interactions in terms of "social practice."

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CHAPTER 1- INTRODUCTION

A traditional approach in education, one in which teaching and content are the focus, prevails (Dewey, 1938; Moore, 2009). As a result, learners – including adult learners – struggle to access abstract concepts that are associated with "schooling" (Brown, Collins & Duguid, 1989). They are unable to identify opportunities to engage, to learn (Lave & Wenger, 1991). The situation is not only evident in face-to-face classrooms but online learning environments, as evident by the acknowledgement of "teachers" as having the role of "knowledge experts" and providing learners with information they should know (Anderson, 2008).

Although anecdotal evidence – resulting from an internal study conducted across three adult and continuing education (A&CE) schools within a large school board in South Central Ontario – identified that Literacy & Basic Skills (LBS) and Prior Learning Assessment and Recognition (PLAR) programs positively impacted learner engagement (i.e. attendance), one key group of stakeholders was not included - adult learners preparing for PLAR assessments, via LBS programming. The school board in question provides PLAR preparation via the LBS Program, a common service delivery model across Ontario. However, peer reviewed, published research regarding this group of learners is scant. Literacy, in this context refers to "the ability to read, write, calculate, speak, and [comprehend], as well as sign (for the Deaf) and communicate in other forms of language, according to need...[it] is a continuum of these skills necessary for everyday life in the home, at work, in education, and in the community (MTCU, 2012, p. 7)." "Basic Skills" refers to the "additional skills a learner needs to use their literacy skills, such as, digital technology, interpersonal skills, problem solving and critical thinking (p.7)." PLAR is a formalized process in Ontario through which learners over 18 can achieve grade 9 and 10 mandatory secondary school credits by completing standardized assessments.

A motivator for this study included further anecdotal evidence gathered by the LBS Program Instructor, Coordinator/PLAR Assessor, also the researcher. Curiously, despite the result of the school board's study highlighting the merits of both LBS and PLAR programming as a re-engagement strategy, a suspected lack of engagement

became evident within the program itself. Specifically, learners were unable to act in response to pedagogical strategies used while preparing them for PLAR assessments, in this case, science assessments. Despite passing the assessments, and receiving secondary credit, learners were unable to apply information to different contexts, such as a post-assessment discussion. The researcher suspected the focus on teaching and curriculum content – a behaviourist, traditional pedagogical strategy – as a potential problem (Dewey, 1938; Jonassen, 1995, 1996; Moore, 2009; vanOostveen, Desjardins, and Bullock, 2010).

To address the research problem, an action research project, in the form of this case study was initiated. Specifically, the researcher sought to shift her perspective to a more learner-centered, process-focused approach - a constructivist perspective – as constructivist learning environments have been documented to engage adult learners, including "school science" (Bencze, 2001; Hodson, 2009; Huang, 2002; Jonassen, 1996; Ruey, 2010; Savin-Baden, 2007; vanOostveen, Desjardins, and Bullock, 2010). To do this, an online learning environment (OLE) – one that took on the form of a cognitive partner, prompting learners to experiment and problem solve (Jonassen, 1996) – was designed. A problem based learning (PBL) online context offered possibility. Savin-Baden (2007) describes PBL as "an approach to learning where curricula are designed with problem scenarios central to student learning in each curricular component (modules/units)" (p. 3). Further, she emphasizes that problem scenarios should be the focus of a PBL initiative, whether educators seek to design one module or an entire program using the approach. Finally, the online learning environment (OLE) design required a social component allowing learners to interact, to make conjectures and refutations, as a means to afford social negotiation of meaning (Popper, 1963; Jonassen, 1996).

By situating pre-service teachers within a real-life context, via the use of problem based learning objects (PBLOs) – reusable digital tools using video case scenarios to anchor instruction - embedded within a collaborative online learning environment (COLE), Desjardins and vanOostveen (2008) adopt a PBL online approach, ultimately engaging adult learners in science. The intent of their design is to prompt discourse – hence possibility for conjectures and refutations – among learners, ultimately fostering

social negotiation and construction of new meaning (i.e. learning of something new) (Popper, 1963; Piaget, 1952; Jonassen, 1996).

Further, since cognitive processes are situated within the context of everyday life (Brown, Collins, and Duguid, 1989), and since identification of opportunities to engage – hence learn or construct new meaning – require situated learning in the form of "social practice" or "legitimate peripheral participation" (LPP) within a "community of practice" (CoP), this researcher sought to create the conditions necessary for a situated learning experience, engagement in "social practice" (Lave & Wenger, 1991). To do this, and to address the perceived lack of engagement (i.e. the inability to act with regards to "school science") observed in her class, the researcher designed a social, constructivist OLE and PBLO as a means to adopt a PBL online approach. Finally, as "social practice" is difficult to measure, the researcher made use of Csikszentmihalyi's (1990, 1997) "Flow" framework as a means to measure learner emotions and associated actions (or engagement) in response to such states. In doing so, the researcher attempted to address the following broad research question: Since PBLOs – introduced to learners in conjunction with a social and constructivist online learning environment (OLE) - have been documented to engage adult learners, particularly those studying within the domain of "school science," will they engage adult literacy learners studying science as they prepare for PLAR? In other words, can PBLOs foster "social practice" for this group of learners?

The following chapters outline a Conceptual Framework providing literature support regarding the adoption of this form of PBL online (Chapter 2); a Theoretical Framework outlining the operational design of the PBLO and OLE, as well as a methodology (Chapter 3); Key Findings (Chapter 4); Interpretations (Chapter 5); and a concluding chapter (Chapter 6) outlining key conclusions, limits to the study, as well as recommendations for future research. Although the scope of this case is limited, it is a first step in understanding the merits and complexities of a PBL online approach for adult literacy learners preparing for PLAR via LBS programming. The hope of the researcher is that questions that unfold, from her attempt to adopt this PBL online approach, will inform future research with a longer-term goal of engaging LBS and PLAR practitioners across Ontario in discourse regarding the approach.

CHAPTER 2 – A CONCEPTUAL FRAMEWORK

Prior to describing the design of the Online Learning Environment (OLE) and Problem Based Learning Object (PBLO) used in this study, a foundational rationale is warranted. As depicted in the Conceptual Framework presented below (see Figure 2.1), learning environments that are constructivist, online, and social afford the possibility for situated cognition, hence situated learning, in the form of social practice (Brown, Collins & Duguid, 1989; Desjardins & vanOostveen, 2008; Jonassen, 1995, 1996; Lave & Wenger, 1991). Problem based learning (PBL) is an inquiry based approach that can be introduced to learners online, involves social interaction, and as such, provides a learning context through which the above mentioned learning environment design parameters are possible (Savin-Baden, 2007). PBLOs are a means through which some researchers have provided a PBL context online (vanOostveen, Desjardins & Bullock, 2010). When introduced to learners in conjunction with a constructivist, social online learning environment (OLE), PBLOs foster opportunity for situated learning (i.e. social practice) (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). Social practice requires legitimate peripheral participation (LPP) within a community of practice (CoP) (Lave & Wenger, 1991). It requires action – engagement – on the part of the learner; however, LPP within a CoP is difficult to measure. To achieve a "Flow" state also requires action on the part of the learner (Csikszentmihalyi, 1990, 1997). The "Flow" model can allow researchers to directly observe individual action – engagement – within a group. In other words, through observing elements of the "Flow" framework, this researcher can determine whether the use of a PBLO introduced in conjunction with a constructivist, social, and online learning environment (OLE) prompts action – engages – adult literacy learners. This Chapter outlines how the presented Learning Environment Design Parameters and PBLO structure work together to afford social practice (i.e. situated learning). Lave & Wenger's (1991) theory of situated learning as well as Csikszentmihalyi's "Flow" model is also discussed as a segue into Chapter 3 - Methodology. This Chapter serves as foundational information necessary to begin to address the following research question: Since PBLOs – introduced to learners in conjunction with a social and constructivist online learning environment - have been

documented to engage adult learners, particularly those studying within the domain of school science, will they engage adult literacy learners studying science as they prepare for PLAR?

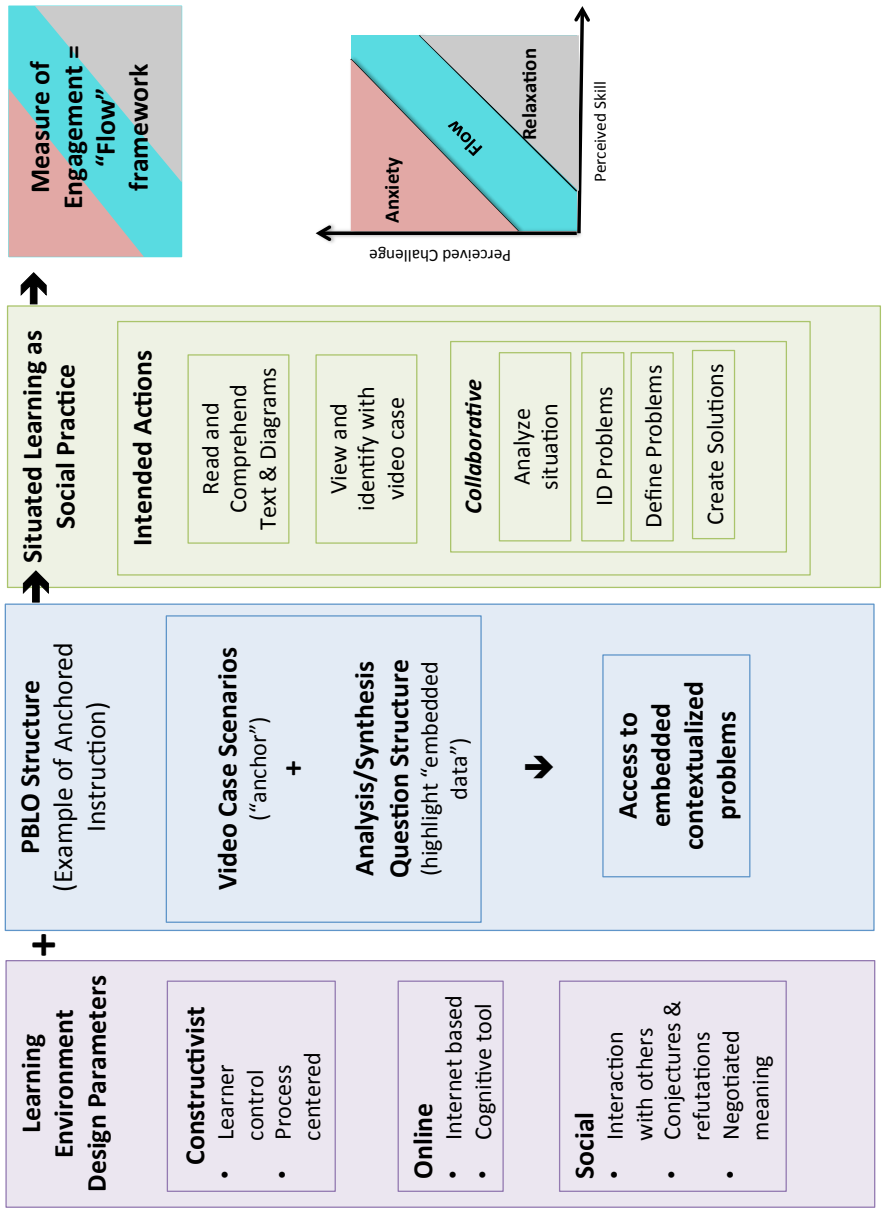


Figure 2.1: Learning Environment and PBLO Design, Social Practice, and Measuring Learner

LEARNING ENVIRONMENT DESIGN PARAMETERS

As learning environment design differs depending on educator philosophies of teaching and learning, it is imperative to provide insight regarding the history of learning environment design, specifically the founding philosophies that have shaped current perspectives, prior to discussing learning environment design parameters used in this study. It is through this discussion that this researcher can distinguish for the reader what the OLE used in this study *is* and *is not*. In *Experience and Education*, Dewey (1938) discusses his philosophy of education as one that connects experience and education (Moore, 2009). He provides an analysis of the views of education at the time – traditional and progressive perspectives. In Dewey's time, traditional education was authoritative and focused on the educator and curriculum. Moore (2009) describes Dewey's account of traditional education as

> "…a system that consists of bodies of information, skills, developed standards, and rules of conduct that worked historically, and that encourages a student's attitude of docility, receptivity, and obedience. The task of educators in traditional education is to communicate knowledge and skills, and to enforce rules of conduct onto the new generation…It provides minimal active participation by students in the development of subject matter."

Alternatively, "progressive education" focuses on the learner's interest and impulse, unconstrained by the educator" (Dewey, 1938, p. 9). It offers learners "growth and expression of individuality; free activity; learning through experience; the acquisition of skills as a means of attaining ends which are vital and appealing to students; and, becoming acquainted with a changing world" (Moore, 2009).

At the time, Dewey (1938) argued that neither the traditional nor progressive views of education were sufficient for a "new education," and proposed a new philosophy of education focusing on the connection between experience and education. The essence of the philosophy is as follows:

- Experience results from interaction between individuals, objects, and other people.
- The experience becomes what it is because of the interaction between the individual and what constitutes his or

> her environment.
> - The environment consists of whatever conditions (objects or people) interact with an individual's internal personal needs, desires, capacities, and purposes that create the resulting experience.
>
> (Dewey, 1938, pp.43-44)

Further, Dewey's philosophy states that experience involves conditions external (i.e. what the educator does and how) and internal to a student (i.e. what goes on within the individual having the experience) (Moore, 2009). However, an experience is truly an experience – promotes growth and creativity in future experiences or is educative – when external conditions are secondary to internal ones. Essentially, by considering what is happening inside the learner first, and by evaluating where the experience is headed, determining attitudes necessary for growth, and using the physical and social environment in a way that promotes growth, educators can foster educative experiences (Moore, 2009).

Traditional education as described by Dewey prevails today and associated learning environment design results from this behaviourist perspective. According to Skinner (1985), behaviourism is concerned with "antecedent events in the environment and the environmental histories of both the species and the individual" (p. 291). This implies that events in the environment – and past history with similar events and environments – determines a learner's behaviour. Further, the behaviour is reinforced by positive or negative consequences; it is shaped not by what the learner is thinking but by biology (Skinner, 1985). In essence, a behaviourist perspective dictates that the learner has no control over learning.

The presence of "drill and practice" activities in a learning environment, a form of direct instruction, is founded in behaviourism and offers rewards that "[enhance] the likelihood that learners would make a particular response when presented with a specific stimulus" (Jonassen, 1996). According to Kirschner, Sweller, and Clark (2006), "direct instructional guidance is defined as providing information that fully explains the concepts and procedures that students are required to learn as well as learning strategy support that is compatible with human cognitive architecture" (p. 75). Essentially, and staying true to the tradition, behaviourist perspective of education, this instructional strategy is teacher

or teaching-centric and curriculum-driven with a purpose of ensuring that students learn what is *required* (emphasis added by author).

Integration of technology into classrooms (i.e. computer-assisted instruction) throughout the 1970s and 80s was founded in behaviourist principles (Jonassen, 1996). Initially, it was deemed innovative to use computers in classrooms, and early forms involved what Jonassen (1995, 1996) describes as "learning *from* computing" and "learning *about* computing" (p. 4, 9). "Learning *from* computing" includes "drill-and-practice" programs, tutoring systems, and later intelligent tutoring systems (ITS). The common theme across all programs/systems is that the learner is intended to acquire knowledge from what is presented by the software. Learners have little to no control, are not permitted to construct their own meaning, and are not encouraged to "reflect on and diagnose their own performance" (Jonassen, 1996, p. 7). "Learning *about* computing" refers to learning about parts of a computer and different software (ibid). Alternatively, Jonassen (1995, 1996) proposes that "learning *about* technology" should be "situated in the act of using the computer to do something that is useful, meaningful, and intellectually engaging" (p. 9). He introduces the concept of "Mindtools" which are "computer-based tools and learning environments that have been adapted or developed to function as intellectual partners with the learner in order to engage and facilitate critical thinking and higher-order learning" (p. 9). "Mindtools" will be discussed in further detail in the discussion of Online Environments below.

Despite the introduction of Jonassen's "Mindtools," McPherson and Nunes (2004) state that traditional perspectives of teaching and learning are the founding models on which online learning environments are often designed. Evidence of this is seen in Anderson's (2008) description of online environments. To Anderson (2008), an online learning environment is a series of interactions between the "knowledge/content interface," students, teachers, and content. It is a context whereby "teaching" and "learning" can occur. In other words, an online learning environment is an education experience – that is possible through interaction via a communication medium, and as a result of interaction learners access content, share opinions and ideas, and the teacher adds "content expertise through a variety of forms of direct instruction" (Anderson, 2008, p. 345). Although published more than a decade after Jonassen's *Computers in the*

Classroom: Tools for Mindful Thinking, Anderson's description of online learning remains teacher and content driven as opposed to learner and process driven.

Constructivism. This researcher was concerned with learner perspectives regarding the use of Problem Based Learning Objects (PBLOs). As such, she sought an education philosophy that would support this focus when considering online learning environment (OLE) parameters for this study. Despite the prevalence of behaviourist views in education, there has been a shift in learning theory over the past several decades, specifically regarding the use of digital technology. One result of this shift was constructivism, a philosophy that changed the focus of education from teachers and curriculum content (as in traditional views) to learners and cognitive process as the focus (Herrington, Oliver, Herrington, and Sparrow, 2000; Jonassen, 1991, 1995, 1996). From a constructivist perspective, thought and understanding of reality exist in the mind of the learner, and construction of meaning occurs through experience (Jonassen, 1991). In their discussion on Piaget's constructivist, Harlow, Cummings, and Aberasturi (2006) reveal that learners construct meaning about the world through action with the external environment. Further, actions can be physical (i.e. manipulating an object) or mental (i.e. growing and/or refining existing internal "schema") (Harlow et al., 2006). To learn or construct new meaning, a learner must first encounter an object or idea and make sense of it. The learner will attempt to assimilate the information into an existing cognitive structure. It is said the information must be "assimilated" into one's cognitive schema. If there is no "match" for the information, a learner will experience cognitive "disequilibrium" (Harrow et al., 2006, p. 5). The learner is then motivated to construct a new schema, to "accommodate" the new information, to reach a new "equilibrium" (ibid). Each time a learner is confronted with new experiences, "disequilibrium" reoccurs and the process repeats itself. In this way, construction of new knowledge occurs. Construction of new knowledge occurs when existing meaning is challenged in the form of a conjecture or exposure to "falsity" (Harlow, Cummings, and Aberasturi, 2006; Popper, 1963, 1972). Popper's paradigm of Three Worlds provides an explanation of how this occurs

(Harlow, Cummings, and Aberasturi, 2006). World One refers to nature and its processes. World Two refers to an interpretation of World One (as experienced through the senses) and takes on different meaning for different people. World Three represents artefacts or products of the mind. According to Piaget's constructivism described above and Popper's (1972) Three Worlds, new meaning cannot be constructed until one enters into World Three. At this point, a person's representation of meaning regarding one's experience of the world can be challenged, refutations stated, modifications made, and new meaning can be "accommodated" and "assimilated" into one's cognitive structure.

Despite more extreme views of constructivism such as vonGlasersfeld's (1995) "radical constructivism", which states that there is no external reality beyond one's own mind, the perspective discussed above assumes that an external reality does exist beyond the mind (Harlow, Cummings, and Aberasturi, 2006). What is important is that despite varying world views, learners come to their own conclusions about it (Jonassen, 1995). Herein lies the essence of constructivism.

As stated, this researcher was concerned with learner perspectives regarding the use of Problem Based Learning Objects (PBLOs). As such, a constructivist learning environment wherein the learner critically evaluates, makes decisions, and constructs meaning regarding an experience rather than having imposed viewpoints of a teacher forced upon him/her was included as a key guiding principle in establishing the OLE used in this study.

Online Learning Environments. In further examining the foundations underlying the development of the online learning environment (OLE) used in this study, it is important to highlight how the shift in learning theory – from behaviourist to constructivist – described above is accompanied by a shift in how digital technology is utilized in the classroom, as well as what constitutes an online learning environment.

A constructivist perspective concerning the use of computers in classrooms is evident in Papert's (1980) *Mindstorms*. As he describes "computer-aided instruction" of the time, he reveals that the purpose of the computer was "teaching the child" (p. 5). In other words, computers were being used to "program the child" (ibid). He believed the

opposite: "the child programs the computer" (ibid). By allowing children to learn "computer language", much in the same way a child learns to speak their first language (i.e. without being taught and from cues from the surrounding culture), communication with the computer is possible. The benefit, he conceded, was that by learning the language of computers children are not only able to recognize their own thinking and types of thinking (i.e. systematic vs. non-systematic), they can extend their abilities to thinking regarding other domains – such as mathematics and science. In other words, by learning to program, computers are accessible, and in turn, formal domains such as mathematics and science also become accessible. As such Papert (1980) and his team at MIT created "Turtle" controlled by the LOGO computer language - an "object to think with" (p. 11). Essentially, a student typed in a command, which directed the "Turtle" to move in a certain way on the computer screen. Commands involved formal concepts of geometry. Therefore, by learning the LOGO computer language, and directing the "Turtle," children also accessed formal geometry concepts. Essentially, the "LOGO environment" allowed learners to learn to create and control their own "micro-world" affording a situation where they were actively engaged and more self-directed than in traditional learning environments (i.e. those where computers were used to teach). Further, since learners were in control, what learners created - including the use of embedded formal content - was also more relevant (Papert, 1980). By putting the control in the hands of the learner, Papert (1980) incorporated the constructivist perspective ultimately resulting in more actively engaged and self-directed thinkers.

Although Jonassen (1996) generally agreed that "microworlds" actively engage learners in thinking, he believed that LOGO-based "microworlds" had limitations. First, he claimed that LOGO-based "microworlds" were not "generalizable" (p. 238). In other words, the problems addressed were limited in scope and "[engaged] a limited set of skills" (Jonassen, 1996, p. 238). Second, in order to truly create a "microworld," learners would need to learn the LOGO language, which required learning the programming language. Jonassen (1996) saw these limitations as barriers to using technology as what he coined as "Mindtools."

"Mindtools" are "generalizable computer tools [and environments] that are intended to engage and facilitate cognitive processing" (Jonassen, 1996, p. 10). As such,

they are cognitive processing tools intended to support, guide, and extend the thinking of learners (Jonassen, 1995). These tools are "unintelligent" ensuring that learners are required to make decisions, plan, and self-regulate (i.e. ideas come from learners, not the technology). Further, "Mindtools" function as an "intellectual partner" - one that performs low-level operations, in turn, enabling learners to experiment and problem solve. These tools, "share the cognitive burden of carrying out tasks" (p. 15). As such, "Mindtools" engage learners in constructing their own knowledge that reflects their understanding of information, rather than presenting knowledge provided by the teacher. Essentially, when a digital tool or learning environment is used a "Mindtool" learners are engaged cognitive processing and meaning making allowing learners to do what they would normally be able to on their own (Jonassen, 1995, 1996). This occurs as learners are engaged in critically analyzing content they are studying - allowing them to reflect and generate their own ideas about the world and their experiences - scaffolds their thinking, and actively engages learners in representing their comprehension of information (Jonassen, 1996). Through the use of "Mindtools," learners take on more responsibility for their own learning, become "self-reliant" thinkers, and can apply newly constructed meaning in new and different contexts (Jonassen, 1996, p. 14-15). The generalizability of skills developed via using "Mindtools" is what sets Jonassen's (1996) "Mindtool" apart from the original concept of "microworlds."

The online learning environment (OLE) designed for this study was based on Jonassen's (1996) model of a "Mindtool" and as such is a cognitive environment. It was intended to facilitate cognitive processing by engaging learners in critically analyzing content they were studying – prompting them to reflect and generate their own ideas about the situation – to scaffold their thinking, and to actively engage learners in representing their comprehension of information. The OLE was "unintelligent" empowering learners to make their own decisions, plan, and self-regulate. Finally, the OLE was intended to function as a cognitive partner sharing the load of carrying out tasks, so learners would be free to experiment and problem solve (i.e. seek, identify, define, and create solutions to problems). Essentially, it was intended that through the design, learners would be given the opportunity to construct their own meaning regarding information introduced via the environment (i.e. including the PBLO), and in doing so,

foster self-reliance, responsibility for one's own learning, all while providing the ability to apply newly constructed meaning to different contexts (i.e. beyond school science). Again, this researcher chose Jonassen's (1996) model of the "Mindtool" as it is founded in constructivism, a perspective that ensures that my learners are

> "…actively engaged in interpreting the external world and reflecting on their [own] interpretations. Active, constructive learning combats the occurrence of [inert] knowledge. If learners actively build their own interpretations of the world, they have more ownership of those thoughts, so those thoughts are less likely to degenerate over time" (Jonassen, 1996, p. 12).

In more recent years, constructivist perspectives continued to proliferate in the world of instructional design, both with the use of technology in the classroom and at a distance (i.e. online), particularly concerning adult learners. For example, Huang (2002) discusses the usefulness of a constructivist perspective in designing online learning environments for adult learners and highlights that this perspective affords necessary considerations in design for adults: "learner centered, collaborative environments that support critical reflection and experiential processes" (p. 35). Further, in a case study investigating constructivist-based instructional design and adult learners, Ruey (2010) found that foundational principles – activity and collaboration – helped learners become more self-directed and responsible for their learning. The references to collaboration are new in more contemporary examples of constructivist design.

While constructivism has been widely adopted in the field of instructional design, the traditional, teacher and teaching-centric perspective has remained. For example, defining online learning as including a "cognitive," "social," and "teaching" presence, Anderson (2008) describes an online learning environment as a series of interactions between the "knowledge/content interface," students, teachers, and content. He views it as a context whereby "teaching" and "learning" can occur, and through interaction via a communication medium, learners access content, share opinions and ideas, and the teacher adds "content expertise through a variety of forms of direct instruction" (Anderson, 2008, p. 345). Herein lies the evidence of a prevailing behaviourist perspective – and traditional perspective of learning – in online learning environments.

The Social Aspect of Online Learning Environments. Despite the differing perspectives of online learning environments – whether constructivist (learner, process centred) or behaviourist (teaching, content centred) – both perspectives acknowledge that learning environments have a social element (Anderson, 2008; Desjardins & vanOostveen, 2008; Huang, 2002; Jonassen, 1996; Ruey, 2010). Hence, a constructivist online learning environment is not only concerned with thinking; it is concerned with social interaction. For this study, the social parameter of the OLE design is crucial as learning – or construction of new meaning – occurs when people interact (Vygotsky, 1978). Specifically, social interaction is the means through which "social practice" – legitimate peripheral participation (LPP) within a community of practice (CoP) or "situated learning" – and hence engagement is possible (Lave & Wenger, 1991). Further, since PBLOs are most effective in social workspaces, inclusion of the social parameter in OLE design is essential (vanOostveen, Desjardins & Bullock, 2010).

As mentioned, online learning environments that afford social interaction provide the opportunity for learners to construct new meaning, which has been documented in research regarding design of online constructivist learning environments for adult learners. For example, to address the problem that "models of online distance education are seriously inadequate as they are constructed around the notions of objective content delivery and individual study and knowledge acquisition." Desjardins & vanOostveen (2008) consider the social parameter and design their collaborative online learning environment (COLE) to foster "collaboration and for collective knowledge construction" (p. 7). Also, as mentioned above, in the case study conducted by Ruey (2010) elements fostering collaboration are also recommended for constructivist online learning environment design. These researchers have adopted a social constructivist perspective. The question remains, how do these social parameters foster construction of new meaning?

Social constructivists not only believe that knowledge is constructed in and resides in the mind (Piaget, 1952; vonGlasersfeld, 1995), but that it also occurs as a result of interaction with others. To Vygotsky (1978), construction of knowledge was synonymous to expanding a learner's zone of proximal development (ZPD) – the space

between what a person can come to know on his/her own versus what he/she can understand with assistance of a more knowledgeable other (i.e. a mentor or peer) (Vygotsky, 1978). Brown, Collins, and Duguid (1989) stated that cognition is situated in the activities of everyday life, including interacting with people of the surrounding culture. Building on this idea, and as previously mentioned, Lave & Wenger (1991) argued that construction of new meaning could only occur when one is a legitimate peripheral participant (LPP) in a community of practice (CoP). In other words, learning is a characteristic of "social practice." Lave & Wenger's (1991) ideas are discussed in more detail in the section on "Social Practice" below, however, it is important to note that construction of new meaning can occur in social environments as there is opportunity to negotiate meaning by allowing learners to make conjectures and refutations (Popper, 1963). Negotiation of meaning allows for the assimilation of information into existing schema or accommodating new information by creating new schema, resulting in the growth of one's cognitive structure (Piaget, 1952), expansion of one's ZPD (Vygotsky, 1978), ultimately learning something new.

A common misconception of constructivism is that construction of knowledge is individual – that the existence of individual representations of the world will lead to "intellectual chaos" (Jonassen, 1996, p. 12). However, it is through "social negotiation of meaning" that shared perceptions of the world can exist. As stated, traditional instructional design perspectives do not recognize this nuance of a constructivist perspective. With this in mind, and the need to create an effective platform through which to introduce the PBLO to learners, it was the intent of this researcher to account for this misconception in her OLE design. Therefore, the social parameter was included. Nonetheless, how can a constructivist (hence cognitive) and social online learning environment be operationalized?

Problem Based Learning. Problem based learning (PBL) is an approach that, if adopted online, provides a context through which the design of a constructivist, online, and social learning environment is possible. It is a "generic term" referring to the various models of inquiry used in research, the use of case study, small group "guided design," engineering projects, as well as medical school design (Woods, 1996, p. 1). According to Woods

(1996), PBL is a learning environment that embraces active learning, cooperation, prompt feedback, and a focus on different learning preferences while empowering learners to take responsibility for their learning. Further, the approach focuses on "learning subject knowledge in the context of using and developing process skills" such as problem solving and collaboration skills, the ability to deal with change, and self-directed and assessment skills (p. 1). It is an approach whereby the learner is central, and the teacher is a facilitator or mentor (Woods, 1996). Savin-Baden (2007) describes PBL as "an approach to learning where curricula are designed with problem scenarios central to student learning in each curricular component (modules/units)" (p. 3). Further, she emphasizes that problem scenarios should be the focus of a PBL initiative, whether educators seek to design one module or an entire program using the approach.

The focus on the learner process – with the teacher as a facilitator and guide, the emphasis of group or teamwork (i.e. social interaction), the centrality of problem solving, and the outcome of learner accountability are evidence that this approach adopts the goals of a social constructivist perspective. The emphasis on the use of "problem scenarios" is the starting point to adopting such an approach (Savin-Baden, 2007, p. 4).

In reference to online environments, Savin-Baden (2007) introduces problem based learning online (PBLonline), which refers to the use of "web-based materials, including text, simulations, videos, demonstrations and resources, chat, whiteboards and environments" that have been created for PBL (p. 4). Although she identifies that there is confusion in the field regarding how to design PBLonline, she admits that there are many forms of this approach. One way of designing "PBLonline" is through the design and use of PBLOs in conjunction with a social constructivist (collaborative) online learning environment (OLE) as described above (vanOostveen, 2011; vanOostveen et al., 2010). PBLOs use video case scenarios as a starting point and offer context through which learners can construct content knowledge as they simultaneously build cognitive processing skills (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). Learners control them, and the teacher is the facilitator. As such, this researcher chose to design and implement a PBLO as her expression of PBLonline. Problem Based Learning Object (PBLO) structure and its affordances are thus discussed in Section 2 below.

PROBLEM BASED LEARNING OBJECT (PBLO) STRUCTURE

As mentioned, a common strategy in PBL design is beginning with a "problem scenario" (Savin-Baden, 2007). With respect to implementation of PBLonline, various multi-media tools - including video - have been widely adopted for this purpose (Savin-Baden, 2007). However, the use of video stories (or case scenarios) to engage learners in problem solving is not new. The Jasper Series created by The Cognition and Technology Group at Vanderbilt (CTGV) (1990) is a prime example. In short, The Jasper Series was a set of stories (or "macro-contexts") developed on "videodiscs" that outlined scenarios involving a character named Jasper. The first scenario in the series posed a complex mathematical problem, which generated several sub-goals relevant to Jasper. The goal of this scenario was to "engage [students] in problem-finding and problem-solving activities" (p. 5). The Series incorporated several design elements, those defining "anchored instruction" (CTGV, 1990, 1992). The first included the use of a case scenario - a "macro-context," an "anchor" (CTGV, 1990, 1992; Oliver, 1999). Since video cases are motivating, provide a more realistic representation of events than text, and allow students to "more easily form rich mental models of the problem situations," video case scenarios were used for this Series (CTGV, 1990, p.3). A second feature included "embedded data design," which refers to incorporation of all information necessary to solve problems identified by learners from the video case. Video stories, including the "embedded data," provided scaffolds necessary for teachers to help students define authentic problems to solve (i.e. those relevant to the case), find the necessary information to do so, attempt to "retrieve the information from memory," and then review the video to evaluate their information accuracy (p. 6). These three steps form the essence of "anchored instruction:" the use of multimedia, web-media, or other interactive technology to tell stories; the encouragement of student groups to extract key information; and the encouragement of students to review the stories to retrieve necessary information for solving problems (Oliver, 1999).

Anchored instruction is rooted in situated cognition and situated learning theory (CTGV, 1990, 1992; Oliver, 1999; Herrington and Oliver, 2000). Brown, Collins, and Duguid (1989) stated that meaningful learning could not occur unless it was embedded in

both the social and physical context within which it was being used. They proposed that the only way to accomplish this was to engage learners in the activities of the culture (i.e. authentic activities) – a "cognitive apprenticeship" – a means of "enculturing learners into authentic activities through activity and social interaction" (Brown, Collins, & Duguid, 1989; Herrington and Oliver, 1995, p. 2). Further, as mentioned earlier in this chapter, and as described by Herrington & Oliver (1995), Lave & Wenger (1991) stated that foundational to this model was observation of a "community of practice" (CoP) – being a "legitimate peripheral participant" (LPP) in the community – as a means to learn what it means to be a full member. As such, using the notion of "cognitive apprenticeship" and situated learning as the foundation for their "anchored instruction", the Cognition and Technology Group at Vanderbilt (1990) sought to engage learners in "authentic activities," or "ordinary practices of culture" (Brown, Collins, & Duguid, 1989, p. 34). By doing so, learners could not only identify and solve context-relevant problems, they could experience the changes in thinking that an expert would upon being introduced to new information, rather than simply experiencing the new information as something to be memorized (CTGV, 1992). They could experience what it was to be an apprentice (an LPP within a CoP) (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991).

The use of "anchored instruction," hence situated learning, is the foundational concept underlying the structure of a Problem Based Learning Object (PBLO) (Herrington and Oliver, 1995). Learning objects are reusable, digital software applications that address curriculum content (vanOostveen, 2010). Although considered learning objects, PBLOs differ in that they "are specifically designed to motivate or to initiate a process rather than to deliver actual curriculum content" (vanOostveen et al., 2010, p. 6). Therefore, "PBLOs are small, reusable digital multimedia objects that have a very specific '4-page' structure designed to conform to many of the characteristics of constructivist learning environments" (vanOostveen, 2011, p. 15). They engage learners in seeking, identifying, and defining problems, actions anchored within a realistic context (or situation), all prompting discussion and collaborative solution creation (vanOostveen, 2011; vanOostveen et al., 2010).

This researcher argues, that since cognition and associated construction of meaning

(i.e. learning) is situated in the context and activities of everyday life (including culture), and since situated learning is afforded through environments that foster "cognitive apprenticeship" (i.e. LPP within a CoP), any use of digital technology affording a situated learning experience engages or prompts learners to act (Brown, Collins, and Duguid, 1989; Lave & Wenger, 1991). Since PBLOs provide context within which problems are defined and solutions created, have been documented to afford a situated learning experience, they, by virtue of their structure, afford learner action or engagement. Although an operational description of PBLO '4 page structure' is discussed in Chapter 3, the remainder of this section describes essential structural components that afford a situated learning experience, including how the essential structure of the PBLO is based on elements of "anchored instruction" design. Specifically, the following paragraphs describe the video case scenarios, the analysis/synthesis question structure, and embedded contextualized problems of a PBLO, as depicted in Figure 2.1 (above). Section 3 - Social Practice subsequently outlines how PBLOs, used in conjunction with the online learning environment (OLE) described in Section 1 can result in "social practice" or "situated learning" – LPP within a CoP (Lave & Wenger, 1991), followed by Section 4 which provides a discussion on the use of Csikszentmihalyi's (1990) "Flow" framework as a means to measure "social practice" – learner action, learner engagement.

Video Case Scenarios. The video case scenario is the main component of the PBLO that affords learner action or engagement by promoting authenticity, hence relevancy. Just as in the Jasper Series, the video case scenarios in PBLOs provide real – life or realistic scenarios (Herrington and Oliver, 2000), "macro-contexts" within which instruction is "anchored" or "situated" (CTGV, 1990, 1992; Oliver, 1999). By introducing learners to the video cases, they are introduced to a cultural context/situation, the first step in providing a situated learning experience. According to Brown, Collins, and Duguid (1989), by situating learners in the events of real-life, abstract concepts (e.g. "school science") become concrete and relevant (e.g. science as performed in real life). This occurs through "enculturation," situating a learner within the culture within which one is expected to think, act, and problem solve (Brown, Collins, and Duguid, 1989). "Enculturation" promotes authenticity of activities. In other words, via "enculturation,"

actions – and therefore cognition - are in response and relevant to the context/situation. Providing access to abstract concepts (e.g. those related to "school science") via a video case scenario that provides a real-life context affords "enculturation" into the culture of the domain of study (e.g. "school science)," affording authentic activities, and ultimately providing access to that domain. In other words, the video case scenario element of the PBLO structure provides a context through which situated cognition (i.e. thinking associated to activities of every day life) is possible (Browns, Collins, & Duguid, 1989). Context entices learners to engage or act (CTGV, 1990, 1992). Without being able to identify with the situation, without authenticity and relevancy, learners can't act (Brown, Collins, and Duguid, 1989). If they cannot act, according to situated cognition theory, they cannot learn (Brown, Collins, & Duguid, 1989). However, the video case scenario – and the context it provides – is not the only structural component of a PBLO that prompts action.

Analysis/Synthesis Questions. The analysis and synthesis question structure of the PBLO also prompts action through initiating problem solving. The questions appear during the first and last view of the video case scenario (i.e. pages 1 and 4 of the PBLO – see Chapter 3) and intend that users first analyze the video case scenarios and then synthesize information that has been gathered by learners (vanOostveen, 2011; vanOostveen et al., 2010). This structure encourages learners to seek, identify, and solve self-defined problems relevant to the context introduced in the video case-scenario. As stated, anchoring instruction promotes relevancy and authenticity, providing access to the domain of study (e.g. "school science") (Brown et al., 1989; CTGV, 1990, 1992; Herrington and Oliver, 1995; Oliver, 1999). As an example of the "anchored instruction" model, the questions direct learner attention to embedded information within video cases (CTGV, 1990, 1992; Oliver, 1999). This prompts learners to not only view the video-case but to think about the situation including how the information in the video-case relates to the given context, hence allowing learners to seek and define relevant problems to solve. By engaging learners in thinking about the situation with which they are introduced, and subsequently directing them to specific information (i.e. embedded data) within the video, instruction is "anchored" and learners are further situated within the context, and

the process of problem solving can begin. According to vanOostveen, Desjardins, and Bullock (2010), the analysis/synthesis question structure is to prompt discussion amongst learners ultimately allowing for "inductive and deductive reasoning along with hypothesis creation, defence and refutation within a PBL context so that video cases are not simply presentations of ideas to be absorbed" (p. 5). In other words, the question structure prompts action in the form of discourse and associated thinking. Since there is no thinking without action, the questions prompt action, and learners engage (Brown, Collins, & Duguid, 1989). In this way, learners are provided with the opportunity, not only to relate to the given context, but to access embedded, contextualized problems.

Embedded Contextualized Problems. Problems embedded in PBLO structure via the video case scenario and analysis/synthesis questions do not only provide micro-contexts for learning; they prompt action as learners are driven to find solutions (vanOostveen et al., 2010). According to Watts (1991), problems are goals that cannot be directly achieved due to the existence of barriers or obstacles, which must be overcome. Watts (1991) defines three types of problems – "given," "goal," and "own" (p. 8). "Given" problems provide learners with both a problem statement and suggested strategies for solution. "Goal" problems provide the problem statement but no suggested strategies for solution. Finally, "own" problems simply provide a context. Learners are required to provide their own problem statement and strategies for solution. This is similar to the use of problems within the Jasper Series mentioned above; however, the sub-problems identified and subsequent solutions created are determined by the learner, not the instructional designer. Problem definition and solution creation with "own" problems is completely in the control of the learner (Watt, 1991).

The problems learners identify when using the PBLO created in this study are "own" problems (Watts, 1991). To provide an operational definition to this type of problem, vanOostveen, Desjardins, and Bullock (2010) state that a problem (P) refers to the difference between a person's desired situation (SD) and the current situation (SC), which is inversely related to the sum of the amount of available knowledge (K) and resources (R). Further, the problem is defined by contextual factors, or the role (R) of the learner, which identifies the perspective from which the problem is defined. Figure 2.2

depicts this relationship as an equation, one that reveals the complexity of different problems. For example, if a learner has ample knowledge and resources, which can be applied to a given problem, the problem is not very complex. If, however, the problem requires more knowledge and resources – or a learner does not know how to apply knowledge and resources, the problem becomes more complex. Finally, should a learner's role change, the need for knowledge and resources, as well as the learner's situation changes, all of which may render a problem more or less complex. In essence, problems and solutions are owned by the learner.

Figure 2.2: Model of a first level analysis of "Problem"

$$P = \left(\frac{S_D - S_C}{K + R} \right) Role$$

(Taken from: Desjardins & vanOostveen, 2008; vanOostveen et al., 2010)

By embedding "own" – contextualized – problems within the PBLO structure, this researcher intended to design an environment whereby learners were in control and self-directed and that was authentic, thus relevant. By using the video case scenarios and analysis/synthesis questions as a means to situate the learner within a given context, learners were then able to identify with the situation, seek, and define problems that were context-specific. By solving contextualized problems, learners could engage in authentic activities (Herrington and Oliver, 1995), and as a result, abstract concepts were more likely to become concrete, learners were more likely to function as "cognitive apprentices" – LPPs within CoP, and ultimately learners were more likely to access the domain of study in question - "school science" (Brown, Collins & Duguid, 1989). In other words, the PBLO structure designed in this case study – video case scenarios, analysis/synthesis question structure, and resulting embedded contextualized problems – provides a situated learning experience whereby learners can learn (construct meaning) by engaging in contextualized problem solving.

Although PBLO structure affords a situated learning experience for individual learners by providing the environment necessary to engage in problem solving within a given context, the PBLO on its own does not necessitate discourse with others, which is contrary to the PBL approach in general (Woods, 1996; Savin-Baden, 2007). Models of PBL, including the PBLO and other examples such as the Jasper Series, involve other people (CTGV, 1990, 1992; Oliver, 1999; Herrington and Oliver, 1995; Savin-Baden, 2007). For this reason, the researcher introduced the PBLO designed for this study to learners via the OLE discussed in the previous section as the OLE incorporated the social parameter in its design. As such the combination of the OLE and the PBLO afforded possible collaborative problem seeking, defining, and solution creation. In this way learners would then have the potential to become legitimate peripheral participants (LPP) within a community of practice (CoP), to experience "social practice" (i.e. situated learning). Ultimately, they would be able to act or engage (Lave & Wenger, 1991).

SOCIAL PRACTICE

As mentioned, to remain within a the problem based learning approach, problem based learning objects (PBLOs) cannot only employ video case scenarios as a starting point, but they must engage learners in discourse and potential subsequent collaboration with others (Savin-Baden, 2007; Woods, 1996). The literature regarding PBLOs reveal this on several occasions, and research with pre-service teachers documents that PBLOs are intended to be used in conjunction with a collaborative online learning environment (COLE) (Desjardins and vanOostveen, 2008). The purpose of the combination is not only to provide context and to prompt problem seeking and solving, but to engage learners in collective problem solving and knowledge construction (Desjardins and vanOostveen, 2008; Lave & Wenger, 1991). PBLOs have been used in the past to offer learners the opportunity to become "cognitive apprentices" or legitimate peripheral participants (LPPs) with a community of practice (CoP), to engage in "social practice" or "situated learning" (vanOostveen et al., 2010; Lave & Wenger, 1991). In one study, learners were asked to examine video case scenarios of a biology teacher, each case highlighting a different context of teaching secondary science (Desjardins and vanOostveen, 2008). Pre-service teachers were intended to analyze the pedagogical strategies of the teacher,

classroom materials the teacher used, theoretical information regarding pedagogical strategies related to secondary school science, and further were to critically analyze the situation including thinking about how they would incorporate strategies (or not) into their own practice. Although pre-service teachers could view the video case and additional materials individually, discourse was also intended to further prompt thinking regarding the situation. Desjardins and vanOostveen (2008) embedded tasks within their Moodle-based COLE to ensure that learners communicated in order to analyze the situations presented via the PBLOs. Although the OLE designed for this study uses different technology (see Chapter 3 for details), the intent is similar to that described above. As such, the researcher embedded tasks within the OLE to guide learners not only to engage or act individually but to collaborate to examine the video case scenarios – the context within which they had been situated via the PBLO – ultimately providing the opportunity for learners to become LPPs within a CoP, to engage in "social practice" or situated learning (see Figure 2.1).

Lave & Wenger (1991) argue that "learning is an integral and inseparable aspect of social practice" or "situated learning" (p. 31). Their view of situated learning shifts the focus from cognitive processes or learning as central to "social practice" as central with "learning as one of its characteristics" (p.34). Further, learning to Lave & Wenger (1991) is not simply situated in practice; it is "an integral part of generative social practice in the lived-in world" (p. 35). In other words, via situation within a community of practice – LPP within a CoP – learning occurs. Also, since "there is no activity that is not situated," situation within a community of practice, in theory, fosters learner action or engagement (Lave & Wenger, 1991, p.33). This shift to situated learning as "social practice" is important, as it is this researcher has intended with the design and use of her PBLOs and OLE.

Prior to discussing the intended actions afforded by PBLOs (see Figure 1), it is important to understand situated learning as legitimate peripheral participation (LPP). Generally, "legitimate peripheral participation is…a descriptor of engagement in social practice that entails learning as an integral constituent" (Lave & Wenger, 1991,p. 35). It refers to the degree to which a learner is participating within a community of practice (CoP). A CoP refers to "a set of relations among persons, activity, and world over time

and in relation to [other overlapping communities of practice]" (ibid, p. 98). It is a context within which collaboration and co-construction of meaning regarding the nature of the group, as members act as more knowledgeable others (Lave & Wenger, 1991; Vygotsky, 1978). Further, the community is a context whereby learners can collectively construct meaning regarding what it means to be a part of the community. Legitimacy refers to characteristics of belonging such as social organization and control over ones resources (Lave & Wenger, 1991). Peripherality, on the other hand, implies that there are different levels of engagement (participation or action) within a community. It suggests "an opening, a way of gaining access to sources for understanding through growing involvement" (p. 37). Intended to be taken as a whole, LPP therefore refers to the level to which a learner's sense of belonging and control over resources relates to level of participation with the community of practice and vice versa. Through a stronger sense of belonging and more control over one's resources, the more likely a learner will feel empowered to participate – to engage or act – within a group, and vice versa. Through empowering learners, and through discourse and collaboration with members of a CoP, learners can move from partial to full participants within a community, from "apprentice" to "master" (Lave & Wenger, 1991).

Intended Actions Prompted by PBLOs. There are two types of actions – independent and collaborative – intended by researchers when introducing PBLOs via online learning environments ultimately leading to social practice (see Figure 2.1). First, learners are required to read and comprehend all text and diagrams, which tends to be independent. Second, learners are to view and identify with the video case scenarios, which is also independent. Third, learners are intended to collaborate to analyze the situation, identify and define problems, as well as create solutions. For example, in Desjardins & vanOostveen's (2008) COLE, learners are presented with tasks via the interface, directing them to view the PBLOs and work together in pairs. This strategy is used to ensure learners view the video cases, read the analysis and synthesis questions, and are introduced to further contextual and theoretical information presented by the PBLOs. Further, the request to work with a partner, in an online environment that affords communication via several tools, is intended to prompt learners to engage in collaborative

problem seeking and solving, ultimately creating a community of practice (CoP) whereby members can act as more knowledgeable others. In this way, it is intended that learners become legitimate peripheral participants (LPPs) – situated within a real-life context – and as such is intended to engage learners in "social practice".

In this study, the researcher used her OLE to introduce similar tasks to learners, again directing them to the PBLOs, including the video case, text and diagrams (see Chapter 3 for details). Her intent was similar to that described above. Essentially, the independent activities of reading text and diagrams and viewing the video-case scenarios was intended to prompt discourse and analysis of the situation and subsequent problem identification, definition, and solution creation. It is important to note that as participants of this study were adult literacy learners, reading was intended to be an independent activity; however, discussion regarding perceptions of what was read was intended to be collaborative. Ultimately, the researcher intended to situate her learners within a realistic context of how "school science" may be utilized in the "lived world," via introduction of PBLOs in conjunction with the OLE, in hopes that a CoP would emerge and that learners would engage in would be able to access the domain of "school science," that they would be able to act.

Social practice – hence action or engagement – is difficult to measure. As such, this researcher required a means through which to do this. Csikszentmihalyi's (1990) "Flow" framework offered a means through which this was possible. The next section describes the "Flow" framework and how it can be used to measure action or engagement – hence social practice.

MEASURING ENGAGEMENT VIA "FLOW"

As stated, in this study, the use of problem based learning object (PBLO) was introduced to learners in conjunction with the online learning environment (OLE) to situate learners within a real-life context, including that of a community of practice (CoP). The intent was that if learners acted as intended – read the text and diagrams, viewed the video case scenarios, and subsequently analyzed the situation to seek and solve problems – in a group, they would experience social practice or a situated learning experience (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991).

Similarly, "Flow" also requires action (Csikszentmihalyi, 1990, 1997). "Flow" is impossible without engaging in a challenge (Csikszentmihalyi, 1990). According to Csikszentmihalyi (1990) "Flow" – a state of being whereby a learners simultaneously experience interest, concentration, and enjoyment – occurs when a learner is introduced to an optimal challenge, one where the learner perceives his or her skills to be equal to that of the challenge. According to Csikszentmihalyi (1990, 1997), a learner may experience several states of being as they try to achieve a balance between perceived challenge and skill, as they either converge on a "Flow" state. If a challenge is deemed too complex in relation to one's perceived skill level, a learner will experience initial anxiety until the learner chooses to either increase skill level or move to a less complex challenge (or until one is provided for the learner) (Shernoff, Csikszentmihalyi, Schneider, and Shernoff, 2003). Alternatively, one's perceived skill level may be higher than what is required for the given perceived challenge resulting in relaxation, eventual boredom, and apathy. At this point, a learner must select a more complex challenge in order to return to "Flow." Once a state of balance is achieved between perceived challenge and skill, a learner experiences "Flow," and since "Flow" is a more positive experience than either anxiety or boredom, learners will continue to act in a way that returns them to "Flow" (Csikszentmihalyi, 1990, 1997; Shernoff et al., 2003). Once in "Flow," a person experiences the following: 1) complete focus on the task at hand (i.e. no space for distracting thoughts or irrelevant feelings); 2) disappearance of self-consciousness (i.e. no attention left to have awareness of our own self); 3) increased sense of control over a situation or activity; 4) distortion of time (i.e. measures of time are "rendered irrelevant by the rhythms of the activity" and hours pass by as minutes (Csikszentmihalyi, 1990, p. 66); and 5) an autotelic experience (i.e. a sense that the activity at hand is intrinsically rewarding) (Csikszentmihalyi, 1990, 1997).

Collaboratively solving contextualized problems as embedded within a PBLO – or "social practice" – as well as negotiating the challenges within a CoP are problems that can indeed prompt learners to converge on a "Flow" state. Therefore, by observing learner emotional states – either anxiety, relaxation, or emotions related to a "Flow" state, and action in response to such states (i.e. as learners either converge or diverge from "Flow") can allow for the observation and measurement of engagement.

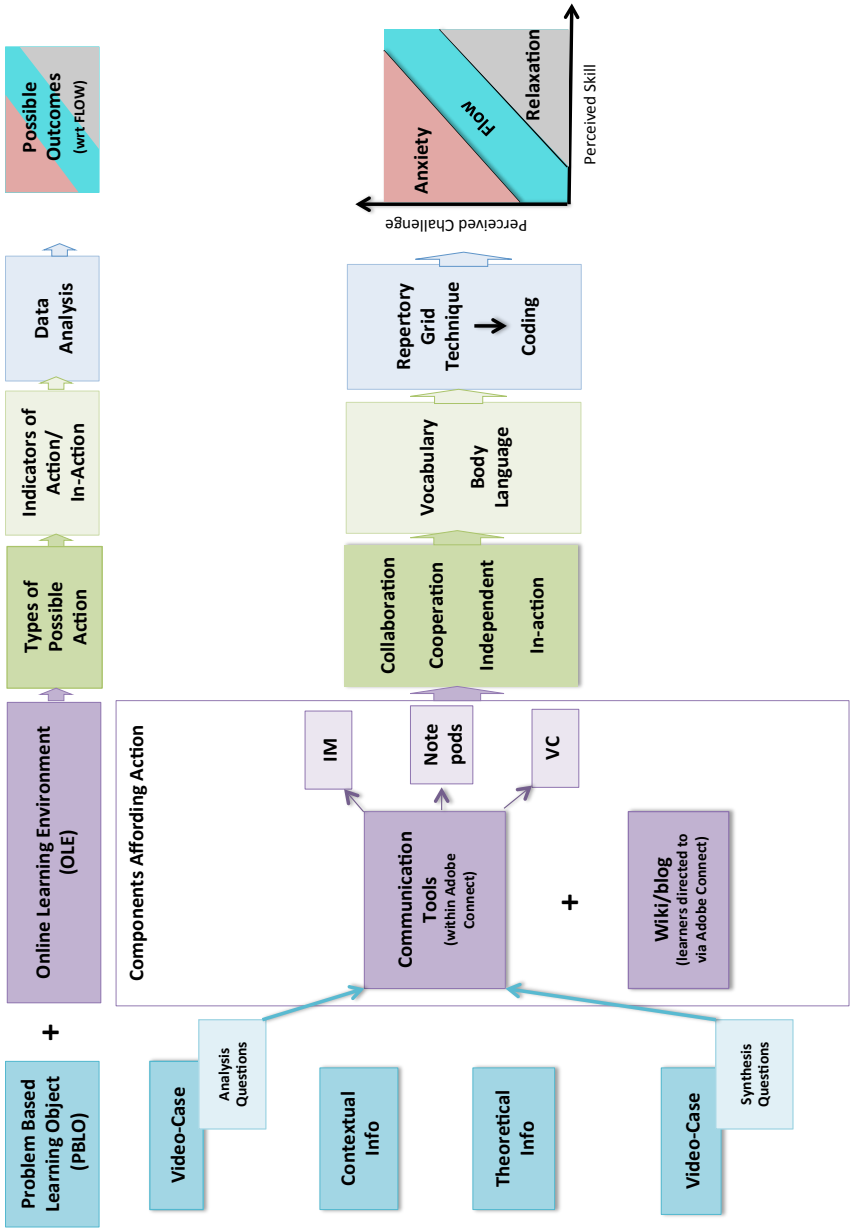
In conclusion, learning environments that are constructivist, online, and social afford the possibility for situated cognition and situated learning in the form of social practice (Brown, Collins & Duguid, 1989; Desjardins & vanOostveen, 2008; Jonassen, 1995, 1996; Lave & Wenger, 1991). Further, when introduced to learners in conjunction with a constructivist, social online learning environment (OLE), PBLOs foster opportunity for social practice (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). Social practice requires legitimate peripheral participation (LPP) within a community of practice (CoP) (Lave & Wenger, 1991). It requires action – engagement - on the part of the learner. However, LPP within a CoP is difficult to measure. Achieving "Flow" also requires action (Csikzentmihalyi, 1990, 1997). As such, the "Flow" framework shows promise in allowing direct observation of action – engagement - within a group, during "social practice." In other words, through observing elements of "Flow" (or lack there of), one can determine whether the use of a PBLO introduced in conjunction with the OLE discussed prompts engages adult literacy learners in "school science" preparing for PLAR. Chapter 3 outlines the operational design of the PBLO and OLE and provides a description of the theoretical foundation of this case study design, data collection, and analysis.

CHAPTER 3 - METHODOLOGY

The Theoretical Framework (Figure 3.1) outlined in this Chapter, provided guidance in answering the following question: As participants prepare for their science PLAR assessment, can they act – engage – in response to using a Problem Based Learning Object (PBLO) introduced in conjunction with an Online Learning Environment (OLE)? This Chapter first discusses ethical considerations and participant recruitment relevant to this case study, followed by Problem Base Learning Object (PBLO) and Online Learning Environment (OLE) design, and concludes by outlining methodology regarding data collection and analysis.

According to Figure 3.1 below, it was the use of PBLOs in conjunction with communication and information management tools afforded by the Online Learning Environment (OLE) that provided the opportunity for participants to act, as they were enabled to act independently, interact with each other, the researcher, and/or information via the OLE (Ally 2008; Anderson 2008; Desjardins, Lacasse, and Belair, 2001; Desjardins & vanOostveen 2008; Jonassen 1995, 1996; Lave and Wenger 1991; Savin-Baden, 2007; vanOostveen, Desjardins, & Bullock 2010). Although the intent of the researcher was to foster collaboration (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010), possible actions addressed included cooperation, independent action, and/or in-action (no engagement). Vocabulary – and when possible, learner behaviour – were observed as to enable the researcher to connect action type to outcomes described in Csikszentmihalyi's (1990, 1997) "Flow" model – anxiety, relaxation, and emotions related to a "Flow" state. Repertory grid technique and subsequent analysis were employed to determine the relationship between perceived challenge and perceived skill (if any) (Feixas and Alvarez, 2000; Kelly, 1955; Shaw, 1980; Gaines and Shaw, 1993). Further, additional data collected was coded, to enable the researcher to describe the case in such a way that the relationship between participant states/emotions (with respect to the "Flow" framework) and actions were revealed. In doing so, the researcher gained further insight into learner experience, in terms of states experienced during work with the PBLO and the OLE, and in turn participant actions - engagement.

Figure 3.1: Measuring Possible Outcomes of the Use of a PBLO on Learner Action – A Theoretical Framework



ETHICAL CONSIDERATIONS & PARTICIPANT RECRUITMENT

It is pertinent at this point to outline the processes that the researcher underwent prior to commencement of the study. During the fall of 2011, the researcher received approval from the Research Ethics Board (REB) at the University of Ontario Institute of Technology (UOIT). Second, the researcher sought and was granted similar approval from both the Principal of the schools in question and from the Research Ethics Advisory Committee of the school board in question. Once ethics approval was awarded, the researcher continued to recruit volunteers for the study.

To recruit participants for this study, the researcher first prepared a Letter of Consent, which included a full description of the project, was developed (see Appendix 3-A). Once this document was prepared, the researcher asked learners individually during regularly scheduled classes if they would be interested in volunteering for the study. Only learners eligible for the study were recruited. This meant that participants needed to have a reading level that enabled them to read and comprehend information presented via the PBLO. The researcher depended on the results of participant intake assessments – information gathered upon entrance into the LBS/PLAR Preparation Program – to determine eligibility. To gain access to the assessments, the researcher sought permission (via the Letter of Consent) to review participant files. Further, participants were only eligible for this study if they were over 18 years old and had been off of a day-school register for a period of 10 consecutive months (or one school year), as per PLAR policy (Ontario Ministry of Education, 2006).

Learners expressing interest in the study were given a copy of the Letter of Consent, and the full document was read to each learner, including information regarding eligibility to ensure full comprehension as well as to address learner questions/concerns. Upon agreement that learners understood their roles and responsibilities regarding the study, and that they could withdraw at any point by simply telling the researcher they were no longer interested, participants signed the consent forms. Ultimately, four participants volunteered, three from one school, one from another. Participants were formed into two groups: Group 1 – Jane and John; Group 2 – Victor and Dan. All learners participated in November and early December 2011.

PROBLEM BASED LEARNING OBJECT (PBLO) DESIGN

PBLOs have been documented to engage adult learners when introduced to learners via a collaborative online learning environment (COLE) (Desjardins and vanOostveen, 2008; vanOostveen, Desjardins, and Bullock, 2010). Since the researcher sought to engage adult learners, the PBLO design for this study was similar. The design consisted of a "4 page" structure that included: 1) video case scenarios and associated analysis questions, 2) contextual information, 3) theoretical information, and 4) video case scenarios and associated synthesis questions (vanOostveen, Desjardins, and Bullock, 2010) (see for the PBLO template used).

Video Case Scenarios & Questions. The purpose of using PBLOs in this study was to take advantage of the use of video cases embedded within a "specifically designed Learning Object (LO)" – as a means to present realistic situations to initiate problem-based learning (PBL) activities in an online environment (CTGV, 1990, 1992; Oliver, 1999; Savin-Baden, 2007; vanOostveen et al., 2010, p. 3). The use of video-case scenarios in vanOostveen, Desjardins, and Bullock's (2010) design are two-fold. First, the initial viewing of the video-case scenario is accompanied by a set of analysis questions which are designed to draw learner attention to specific elements presented in the video-case scenarios with the intent of prompting inductive reasoning and initial conjectures; they provide an initial focus for discourse (Piaget, 1952; Popper, 1963: vanOostveen et al., 2010). Conversely, in the final "page" of the PBLO design, video-cases are utilized in concert with a set of synthesis questions, which are designed to prompt synthesis and evaluation of information presented throughout the PBLO with the intent of prompting deductive reasoning and refutations - a final focus for discourse (Piaget, 1953; Popper, 1963; vanOostveen, 2010).

In this study, the video-case scenario combined two existing You Tube videos together and presented examples of people (including professional scientists) discussing the process of and demonstrating production of hydrogen and biodiesel fuels. The initial analysis questions were intended to prompt responses derived specifically from video content (i.e. including secondary science curriculum). The "realistic" situation presented included the materials needed and processes used to make two types of alternative fuels;

however, this was not explicitly stated in the video-case. The analysis questions were intended to direct learners to come to their own conclusions about the situation by answering the analysis questions (i.e. to use inductive reasoning and make conjectures). The synthesis questions were based on the same video-case scenario; however, they were intended to prompt higher order thinking, critical analysis, and application to learners' lives. Rather than direct learner attention to specific information within the video, this set of questions prompted learners to apply information from the video and other information presented via the PBLO to their own lives by prompting them to do the following: 1) choose a preferred type of alternative fuel and provide justification for the choice, 2) describe their choice of alternative fuel in terms of physical and chemical properties (using "school science" jargon), 3) to use newly constructed meaning regarding chemistry to take action with respect to a societal, technological or environmental issue of choice, and to define the action, and 4) to explain how the information in the video-case scenario added to the learners understanding of chemistry. As per vanOostveen, Desjardins, and Bullock (2010), this set of questions prompted learners to deduce how they would use the newly constructed meaning (if any). Ultimately, learners were in a situation whereby they could refute their own prior conceptions of chemistry – or those of their peers – through further discourse, offering a change in perspective regarding chemistry.

Contextual Information. The contextual information presented to the learners on the second "page" of the PBLO (see Appendix 3-C) was intended to provide further information regarding the situation presented in the video case scenario, thus rendering the situation less abstract and more accessible (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; vanOostveen et al., 2010). As this was the section whereby the original PBLO design included documents that would be used in the environment within which the PBLO is being presented to learners (e.g. a PLAR Preparation classroom), a paragraph outlining the need for alternative fuels as well as complementing PDF documents were included – documents similar to readings and/or handouts that students would receive in a secondary school science class (vanOostveen et al., 2010). This contextual information was included as an attempt to render the concept of the chemistry

of alternative fuels less abstract, thus more relevant and accessible (Brown, Collins, and Duguid, 1989).

Theoretical Information. The theoretical information provided in the third "page" of the PBLO (see Appendix 3-B) was intended to provide an alternative perspective of the situation presented in the initial video-case scenario (vanOostveen et al., 2010). The purpose was to challenge learners' pre-existing notions of the situation presented in an attempt to deconstruct previous understanding and reconstruct new meaning (Bencze, 2001). In this study, alternative fuels were explained as examples of matter (i.e. a foundational school chemistry concept) on the third "page" of the PBLO. The information presented was in the form of text a learner would find in a school science context (e.g. in a textbook or text found online). The purpose of including this information was twofold. First, the researcher intended to provide a new perspective of alternative fuels – the "school science" or curriculum content perspective (Hodson, 2008, 2009) – as the researcher was required to cover curriculum related to the PLAR assessment. It was pertinent to include this information at this stage as learners had already had a chance to relate to the given context, thus rendering any new information more accessible. Second, by presenting learners with a fresh perspective of alternative fuels, the researcher provided opportunity for de-construction of existing notions developed by viewing the video cases and reading subsequent contextual information; as such, re-construction of new meaning given the new perspective (Bencze, 2001). Such content was included at this stage, as the researcher did not want it to be presented in a way that participants were simply passive consumers of information (Bencze, 2001; vanOostveen et al., 2010). It was intended that this theoretical information was made more accessible and relevant by first providing a realistic situation and further by situating the learner within a context prior to presenting this abstract theoretical information.

ONLINE LEARNING ENVIRONMENT (OLE) DESIGN

According to vanOostveen, Desjardins, and Bullock (2010), an online learning environment is an "interface" or "workspace" which supports the collective knowledge

construction process" and is organized by "types of interactions afforded by the technology" (from Desjardins, Lacasse & Belair 2001; Desjardins 2005) (vanOostveen et al., p. 10). It is a "group of tools and resources" that serves specific functions and is accessible to the learner via an interface (ibid). The OLE designed in this study was based on vanOostveen, Desjardins, and Bullock's (2010) Collaborative Online Learning Environment (COLE), as the COLE affords collaborative knowledge construction resulting from "social practice" or "legitimate peripheral participation" within "communities of practice" (CoP) (Lave & Wenger, 1991). The COLE workspace offers four sets of tools each with their own set of affordances: communication, information access & management, information production & processing, and time management. Since the researcher had no control over whether the environment designed for this study was collaborative – although it was the intent of her design– and since the COLE was not available for use at the time of this study, a modified version was created. The online learning environment (OLE) design included communication and information management tools, minimum requirements in affording "social practice" (Lave & Wenger, 1991).

Communication Tools. Communication tools were included to ensure that learners could interact with each other, with the intent of providing the means through which collaboration and related social negotiation of meaning could occur (Jonassen, 1996; vanOostveen, 2010). The researcher made use of Adobe Connect 8.0. Tools available via Adobe Connect 8.0 include instant messaging (IM) chat, video conferencing (VC) options (via a webcam and microphone), the ability to share files and computer screens, as well as collaborative whiteboards and note pods, which allow users to simultaneously brainstorm and edit text (Schullo, Hilbelink, Venable, Barron 2007 from Finkelstein 2006, p. 58). These tools are also a means through which learners can indicate that they have questions, are confused, or are expressing certain moods and opinions (Schullo, Hilbelink, Venable, and Barron, 2007). Further, since Adobe Connect 8.0 was widely used for online courses at UOIT, and as such was available at no cost while ensuring the security of UOIT servers, this platform was an ideal choice as it ensured an accessible and secure workspace for learners.

The researcher embedded five tasks, via a Notepod, in the "workspace" that not only prompted learners to orient themselves with the tools but directed learners to view the PBLO (see Appendix 3-D). Task presence (and in turn PBLO presence) in concert with the communication tools afforded by Adobe Connect 8.0 provided the opportunity for learners to communicate with each other, a precursor to potential "social practice," and revelation of states associated to the "Flow" framework (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; Csikszentmihalyi, 1990, 1997). The Orientation task was presented to learners in the form of a Power Point presentation/PDF document (see Appendix 3-E), available via the Adobe Connect 8.0 Platform. One hour was allotted for the Orientation. Further, the purpose of the Orientation was to provide participants with a space and opportunity to play with the technology (Papert, 1980), familiarize themselves with the affordances of Adobe Connect, and to ensure that all were able to log into and use the Wiki. This strategy was key, as the researcher attempted to avoid technical issues (e.g. use of microphones or webcams) that may have inhibited learners' abilities to use the PBLOs.

Information Access & Management Tools (wiki/blog). As mentioned, the Orientation task embedded into the Adobe Connect 8.0 platform, directed learners to a wiki, which included a search portal. This information management tool was included in the design for three reasons. First, it provided a space whereby learners could co-construct and document socially negotiated meaning (i.e. evidence of a community of practice), as per the COLE (Lave & Wenger, 1991; Jonassen, 1996; Rodrigues, 2013; vanOostveen et al., 2010). Specifically, the wiki allowed learners to blog about their initial, group, and final consensual definitions of chemistry, prior to and after working with the PBLO, as per the tasks. The researcher created the wiki page for learners to ensure ease of use of the technology as it was unclear whether learners had used wiki's previous to the study; however, it was their responsibility to negotiate content and "self-monitor" the space (vanOostveen et al., 2010). Second, as the wiki was housed on UOIT servers as part of the Learning Management System (LMS) in use at the time, it was a logical choice to ensure accessibility and security for learners. Third, a second wiki page provided a space whereby learners could document their perspectives regarding their experience with OLE

in response to questions posed by the researcher, as part of data collected (see Appendix 3-F). This was an important, additional function of the wiki, as it allowed the researcher to collect information regarding learner experience.

Using the OLE and PBLO. Although the PBLO was designed with the purpose of engaging learners, to observe action in response to the PBLO, the online learning environment (OLE) was necessary to provide learners with access. Two hours were allotted for PBLO use, in addition to the one-hour orientation session. During this time, the researcher interjected to ensure learners followed this timeline and did not work beyond the two hours they had agreed to when consenting. Within this timeframe, learners were not able to complete the first PBLO on Matter. However, learners were willing and continued to work for a total of three hours with the PBLO. To remain within the ethical requirements of this study, the researcher cut the session short after three hours. Once learners were introduced to the PBLO, the researcher could observe their actions – of ways of engaging – the topic of the next section.

TYPES OF POSSIBLE ACTION

As mentioned above, it is the use of PBLOs in conjunction with communication and information management tools afforded by the online learning environment (OLE) that provides the opportunity for different types of action (engagement) (see Figure 3.1) (vanOostveen et al., 2010). Action or engagement in online environments is often described as various forms of interaction (Anderson, 2008; Desjardins 2001, 2005; Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). To meet the needs of a human-computer-human-interaction (HCHI) situation (i.e. to move beyond promotion of working in solitude in an online environment to working together in an online learning environment), Desjardins and vanOostveen (2008) discuss several types of interaction that are considered in the design of COLE. First, learners must be able to understand and use the tools afforded by the online learning environment. This is referred to as "user-computer interaction" (Desjardins and vanOostveen, 2008, p. 2). Second, learners must be able to interact with others online using "computer-mediated communication tools" (Desjardins and vanOostveen, 2008, p. 2). Third, learners must be able to interact with

information and to use information processing tools. Action – or interaction - was imperative to this study; without it, there was no possibility for engagement in the form of convergence on a "Flow" state (Csikszentmihalyi 1990, 1997).

Building on the intended outcome of states related to the "Flow" framework, the intent of this study was to create conditions that could foster human-computer-human-interaction (HCHI) in the form of collaboration, ultimately "social practice." Since collaboration was not guaranteed by this OLE, it was necessary that the researcher observe alternative types of action. Specifically, the researcher sought differing degrees of potential interactions that could occur in the OLE: in-action, independent action, cooperation, and the intended collaboration.

In-Action. A first thing to consider when thinking of learner interaction within the OLE was the possibility that learners would not act or that no action occurred. There are two possible types of in-action that are possible. First, temporary inactivity is in-action that may occur as a learner recognizes a significance imbalance between his or her perceived challenge and skill level (Csikszentmihalyi, 1990, 1997). In this case, in-action could be associated with initial frustration and associated anxiety and a realization that one needs to re-evaluate the situation and/or strategy. This is a time period whereby the learner has identified a challenge and decides whether or not he or she will pursue the challenge or withdraw effort (Csikszentmihalyi, 1990, 1997). This first type of in-action - or pause in action - may indicate a mismatch between learner perceived challenge and skill (Csikszentmihalyi, 1990, 1997). It is a time period during which a learner may decide to continue to act within the environment in the form of thinking about the situation, but from the perspective of a researcher who is observing external indicators of action, this time period may appear like a period of in-action. Also, in-action in the form of a temporary pause in action may be a part of a learner's process that may lead back to "Flow". It is and is, therefore, an important to make a clear distinction between this and the second type of in-action, which is full permanent disengagement in-action from the situation. Permanent in-action may occur if the learner decides that action is not possible; further challenges cannot be identified, as the learner may be unaware of them despite their presence (Csikszentmihalyi, 1990, 1997). In this case, a learner may choose not to

continue with an activity (i.e. to disengaged altogether by leaving and not returning to the OLE, and potentially by leaving the study altogether). Again, this distinction between the two types of in-action are important as, to the researcher, each scenario may be observed as no action within the OLE but could imply two very different stories.

Independent Action. Another type of possible action observed with learners working within the OLE was independent action. Independent action, for the purpose of this study, refers to working in solitude – absence of interaction with other people (Csikszentmihalyi, 1990, 1997). In terms of work within an online environment, independent action refers to a learner acting in solitude while interacting with elements of the environment – the interface (including the tasks and PBLO) and information management tools (Desjardins and vanOostveen, 2008). It is important to note that if a learner is working independently, convergence on a "Flow" state may or may not occur (Csikszentmihalyi, 1990, 1997).

Cooperation. Although the next two types of action discussed in this chapter involve ways in which learners work in a group – namely cooperation and collaboration – the two types of action differ, and a distinction is warranted. Resta & Laferriere (2007) state that there are various definitions of cooperation and collaboration in the literature and that this "may result from the fact that educational researchers often have different purposes, goals, and perspectives, which prohibit a clear distinction between these two approaches" (p. 2). Therefore, for the purpose of this study, cooperation refers to a group of learners working together to solve a problem (Resta & Laferriere, 2007; Roschelle & Teasley, 1995) whereby the group breaks down a problem (or group goal) into tasks, and each group participant is responsible for completing his or her own work in relation to the given task independently (Eaves, 2007; Roschelle & Teasley, 1995; vanOostveen, 2011). In a cooperative situation, learners do not necessarily need to interact with one another (Eaves, 2007; vanOostveen, 2011). However, although work may be completed in solitude, cooperation differs from independent action discussed above as it involves a group with a common goal whereas independent action refers to a learner working in solitude (Roschelle & Teasley, 1995, p.2). Again, as with independent action, cooperative action does not necessarily preclude convergence on a "Flow" state. According to

Csikszentmihalyi (1990), "Flow" cannot be observed in a group until an individual first experiences it. However, "Flow" is possible in a cooperative situation if, again, the necessary conditions are available: a clear goal, relevant feedback, and a perceived balance between challenge and skill (Csikszentmihalyi, 1990, 1997). Further, when looking for evidence of "Flow" in a group as a whole, there must first be "optimal interaction" (p. 81). For "optimal interaction" to occur, not only must each member of the group experience "Flow," but the following conditions must be met: a defined shared goal, a willingness to share in others' goals, the ability of each individual member to "concentrate one's psychic energy, to pay attention to feedback, and to make certain that the challenge is appropriate for one's skill" (Csikszentmihalyi, 1990, p.190). In cooperative action, one or some of the learners may converge upon or experience "Flow" while others may not. Furthermore, learners may experience "Flow" at different times, and if and when "Flow" is experienced, it may not be experienced for same length of time for each individual. Further, "optimal interaction" can only be possible when others are working together: during initial stages of the group work when the group is subdividing tasks, during the final stages when the group comes together to discuss individual contributions, or as individual members choose to work together in a different capacity during the cooperative effort (Csikszentmihalyi, 1997).

Collaboration. The second type of group work considered is collaboration – "[a] coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem" as well as a "coordinated effort to solve a problem together" (Roschelle & Teasley, 1995, p. 2). Collaboration differs from cooperation as the problem is not subdivided into tasks and delegated to group members. Rather, during collaboration ideas and meaning can be shared and negotiated, resulting in a collective understanding of the group (Eaves, 2007; vanOostveen, 2011; vanOostveen et al., 2010). Again, learners in a collaborative situation may or may not experience or converge upon "Flow." In collaboration, the experience of "Flow" as a group requires experience of "Flow" by its members in concert with the necessary conditions required for "optimal interaction" (Csikszentmihalyi, 1990, p.190). During collaboration, learners may experience "Flow" at different times and for different lengths of time; however, if

the conditions for "optimal interaction" are met, "sooner or later the interaction will begin to hum" and "Flow" as a group experience is possible (ibid).

RESEARCH DATA

Data Sources. In all, seven sources of data were collected: Repertory Grids, Repertory Grid Interviews, Adobe Connect audio/video recordings, Wiki blogs, video external to the OLE, a survey, and researcher field notes. Major data sources included the Repertory Grids and the corresponding interviews, the wiki blogs, as well as the audio/video recordings of the Adobe Connect sessions and participant's work external to the OLE. Researcher field notes were consulted as a means to write the thesis and to informally corroborate findings from the other data sources. The survey was not deemed useful for this case study as it investigated complex phenomenon (i.e. learner engagement), sought deep insights and was part of an action research project addressing a practical problem (i.e. suspected lack of engagement) (Denscombe, 2010). Further, the study involved a small number of participants, for which a survey was not necessary given the myriad of other data sources collected. For this reason, the survey was disregarded. Ultimately, then, five data sources were considered for analysis, with the intent of corroborating findings across a minimum of three sources (Guba, 1981).

Data Management. All Repertory Grids were collected and placed in folders, along with all cue cards used during the Repertory Grid Interviews. SD cards containing Repertory Grid Interview and OLE External videos were collected. All data was kept in the researcher's locked office at home. This measure was taken to ensure that data was kept confidential as the researcher often moved between schools and did not have a locked office at school. Adobe Connect recordings were stored on UOIT servers and password protected. Wiki data was also stored on UOIT servers and was also password protected. The researcher kept her Field Notes on her own personal laptop, which was also password protected. Once data was fully analyzed and the thesis written and successfully defended, all data was erased and disposed of. Although the researcher was to dispose of all data one year after it was collected (as per ethics approval and consent granted by participants), her progress with analysis was delayed and this was not possible. This part

of the study could have been conducted more effectively, a consideration for future research.

Indicators. In order to consistently document and describe the observation of participants in research studies, researchers use indicators including the "words and actions" of participants – to determine meaning from data as "framed by the researcher's focus of inquiry" (Maykut and Morehouse, 1994, p. 128). Researchers use different types of indicators and data analysis techniques depending on the type of data they hope to analyze. In this study, vocabulary, and when possible body language or behaviour, was employed to both observe and index learner experience in terms of perceived challenge and skill and affective responses – anxiety, relaxation, and/or emotions related to Flow," as well as activity during work with the PBLO and the OLE. In other words, indicators were the means by which the researcher created and accessed the data pertaining to learner experience. Subsequent data analysis techniques allowed the researcher to interpret learner perceptions of experience via these indicators. Data creation and subsequent analysis included the use of George Kelly's (1955) Repertory Grid Interview Technique and subsequent coding of additional text-based and video data (Bencze, Hewitt, Pedretti, Yoon, Perris, vanOostveen, 2003; Bencze, Bowen, and Alsop, 2006; vanOostveen, Desjardins, and Bullock, 2010).

Repertory Grid Development. The repertory grid interview technique, based on George Kelly's (1955) Personal Construct Theory (PCT) (Feixas and Alvarez, 2000; Gaines & Shaw, 1993; Shaw, 1980) was used as it allows researchers to record...

> "…the dimensions and structure of personal meaning. Its aim is to describe the ways in which people give meaning to their experience in their own terms. It is not so much a test in the conventional sense of the word as a structured interview designed to make those constructs with which persons organize their world more explicit. The way in which we get to know and interpret our milieu, our understanding of ourselves and others, is guided by an implicit theory which is the result of conclusions drawn from our experiences. The repertory grid, in its many forms, is a method used to explore the structure and content of these implicit theories/personal meanings through which we perceive and act in our day-to-day existence (Feixas and Alvarez, 2000).

The repertory grid interview process results in the production of a repertory grid (Feixas and Alvarez, 2000; Shaw, 1980). The grid consists of three components: 1) elements, 2) personal constructs, and 3) a rating system (Feixas and Alvarez, 2000). Elements represent the content of the focus of inquiry. Personal constructs are continuum that study participants use to compare and contrast the elements, as a means to "make sense" of them (Feixas and Alvarez, 2000; vanOostveen et al., 2010, p. 25). The rating system "evaluates the elements based on the bipolar arrangement of each construct" (Feixas and Alvarez, 2000).

In this study, the repertory grid technique provided a means through which the researcher could determine whether a relationship (or not) between perceived challenge and perceived skill was apparent. Specifically, the repertory grid interview technique was used as a means to gain insight into learner perceptions of their experience of working with the PBLO and the OLE. As with the vanOostveen, Desjardins, and Bullock (2010) study, constructs were initially elicited from learners. Since the researcher altered her methodology between interviews conducted with Group 1 and 2 participants, the procedure of developing grids are discussed by Group. This is necessary not only for explanation of data analysis and findings but also in understanding the growth that this researcher experienced in using the Repertory Grid Interview technique.

Group 1 – Jane and John. As noted, both Jane and John participated in the Repertory Grid Interview separately on November 14, 2011. During the interview, each learner was presented with the Repertory Grid Interview Template providing learners with a choice of 7 constructs related to the Flow framework and 11 elements related to the PBLO and OLE (see Appendix 3-G). Each construct and element was explained to and discussed with learners to ensure that all parties understood the intended meaning. This was necessary in order to proceed to the rating of each element.

Although constructs and elements are commonly elicited with learners via a process called triadic elicitation (Gaines and Shaw, 1993; Bencze et al., 2003), the researcher did not follow this process with Group 1 learners. Rather, to measure learner perception regarding constructs in terms of the Flow framework and elements related to the PBLO and OLE designed by the researcher, the researcher provide both constructs

and elements for these learners (Feixas and Alvarez, 2000). Although this decision did not provide the most accurate portrayal of learners' perceptions, and negatively impacted internal validity, it did provide a means to understand their perception within the context of the "Flow" framework. Further, this decision was that of a novice, of a researcher using the technique for the first time. Finally, at the time, the researcher was depending on survey data and did not realize the full potential of the Repertory Grid Technique in understanding learner perception. She attempted to ameliorate her methodology for Group 2 interviews (see Group 2 – Dan and Victor below).

Once the researcher was confident learners were ready to rate each element, the researcher reviewed the rating scale for the constructs (see Appendix 3-H). Each learner was also provided with, as part of the Repertory Grid handout, a hard copy of the constructs and rating definitions. The researcher asked each learner the following question for each element: "On a scale of one to five, please rate [the element]." She then read each rating to the learner to ensure clarity. For Jane, the researcher was only required to ask the leading question for one of the elements, and did not require to read the ratings aloud. She was confident enough to read the handout and rate the remaining elements independently. For John, the interview took on a more structured character as the researcher asked the question for each element. Again, due to lack of experience with this technique, the researcher did not ask why each learner rated elements the way they did, unless the information was volunteered, as was the case with John. She decided not to do this as she was attempting to allow the learners to have as much control over the interview as possible, to ensure that she did not intimidate learners, and to minimize researcher input. In hindsight, such probing questions would have allowed the researcher to gather far more information regarding learner perception. Again, the interview procedure was altered during interviews with Group 2. Despite misconceptions and mistakes in conducting these Repertory Grid interviews, the researcher did video record the interviews as a means to gather further information regarding learner perceptions and emotional response regarding the elements.

Group 2 – Dan and Victor. Although the purpose of the Repertory Grid Interview was the same for Dan and Victor, the researcher attempted to gain further insight into learner

perceptions. To do this, the interview took place in three parts: 1) triadic elicitation of constructs and elements, 2) rating of the elements (i.e. creation of the Repertory Grid), and 3) a structured post-rating interview to determine why each learner had rated the elements the way they had. The researcher conducted the interviews with Dan and Victor on separate occasions; however, all three parts of the altered procedure were conducted in one session with each participant.

To begin, each participant was presented with a Repertory Grid Interview template, one that provided only two constructs (i.e. Low skill-High skill and Low challenge-High challenge) and the same 11 elements as were presented to Group 1 members (see Appendix 3-I). However, based on the researcher's observations and field notes, it was evident that Dan had difficulty reading the text when using the PBLO. Therefore, to ensure that both members of Group 2 could read and comprehend the Interview template, the elements were written with fewer words, despite having the same meaning as the 11 constructs used for Group 1. For example, "The PBLOs – viewing the video case scenarios" was changed to "PBLO – Video Case Scenarios."

During each interview, the researcher presented participants with the Interview template, reviewed the two given constructs and 11 elements to ensure that both researcher and learners mutually understood the terms. The researcher subsequently used the process of triadic elicitation with each learner to define additional elements and constructs (Gaines and Shaw, 1993) This was done, again, to better understand learners' perception of the elements of the PBLO and OLE while capturing their perception in their own words, and to improve internal validity of the study (Centre for Person-Computer Studies, 2009). Participants were given a set of cue cards on which to write their elements and constructs. To elicit elements and constructs, learners were asked to do the following: 1) Please identify single words that you would use to describe the environment you worked in for the Chemistry Unit. 2) Please identify single words describing your ability to use the environment. 3) Please identify single words you would use to describe your feelings – both emotional and physical – about the environment. Each participant was asked to write one word per card and to notify the researcher when they had completed the task. This process resulted in several terms, on separate cards, as answers for each of the three questions (see Table 3.1). The first question was intended to elicit additional

elements that the researcher did not include in her original list of 11. The second question was intended to elicit constructs related to the "Flow" framework (i.e. regarding perceived challenge and perceived skill). The third question was intended to elicit terms that participants used to describe their own emotions, those that could then be associated with the "Flow" framework. It is pertinent to note that during this process, each participant found it difficult to communicate his or her thoughts with one word. The researcher adapted her methodology to allow learners to use more than one word, if necessary; however, each participant persevered and provided one-word descriptions. Also, both learners mentioned an inability to spell. The researcher assisted with spelling and to clarify terms only when needed. For example, one learner used "navigatable," and the researcher suggested "navigable." This was a problem that the researcher did not expect, and this portion of the interview most likely caused unnecessary anxiety for learners. Again, the researcher was a novice in using the triadic elicitation technique and will consider such occurrences in future research.

Once participants had recorded all terms and answered all questions, the researcher arranged terms into triads based on similarity and whether they could be situated within the context of the "Flow" framework. For example, from the terms Dan provided, the researcher grouped embarrassing, shameful, and frustrating together as they represented more negative states of being related to a state of anxiety – to the "Flow" framework. From the terms Victor provided fun, joyful, and fruitful were grouped together. As learners were presented with triads of terms, they were asked the following questions: Which two are the same? Why? This allowed the researcher to categorize terms the learner identified as the same into one group. The researcher then presented each participant with the resulting two terms. Participants were then asked the following question: Which [term] is different? Why? The purpose of this process was to categorize the terms that were perceived as the same together, ultimately providing fewer terms describing the learners' views about the environment, ability to use the environment, and associated emotions. Ultimately, this process resulted in a shortened list of terms from which the researcher and participant could then create the final constructs to be used for construction and rating of the Repertory Grid. It was noted that Dan nor Victor provided any terms that could be construed as elements. Therefore, only constructs were elicited,

despite efforts to elicit elements.

To create the constructs, the researcher presented participants with each of the final terms (see Table 3.1) and asked participants the following question: What one word or phrase would you use to describe the opposite of [the term]? This was repeated for each term elicited, resulting in the constructs (see Table 3.1). For Dan, five constructs were elicited. For Victor, four constructs were elicited. As mentioned, both "low challenge – high challenge" and "low skill – high skill" were added by the researcher to ensure that she could discuss findings within the context of the "Flow" framework.

Table 3.1: Results of Triadic Elicitation of Constructs for Group 2 Participants

Participant	Elicited Terms	Final Terms	Final Elicited Constructs*
Dan	embarrassing, shameful, frustrating, hard, friendly, easy, calm, fun, surprised, structured, accessible, navigable, knowledgeable, and learnable	Navigable Learnable Fun Calm Easy	1) Can't find my way around – Navigable 2) Cannot learn – Learnable 3) Unhappy – fun 4) Frustrating – calm 5) Hard – easy *Added by researcher:* 6) Low challenge – high challenge (refers to perceived challenge) 7) Low skill – high skill (refers to perceived skill)
Victor	easy, surprised, relaxed, fun, fun, joyful, fruitful, educational, not time consuming	Educational Joyful Relaxed Easy	1) Not educational - Educational 2) Unhappy - Joyful 3) Tense - Relaxed 4) Easy – Hard *Added by researcher:* 5) Low challenge – high challenge (refers to perceived challenge) 6) Low skill – high skill (refers to perceived skill)

Once constructs were elicited, the researcher wrote the 11 elements on cue cards and subsequently created a grid, using the cue cards, for participants to see. This grid was created to provide a model for participants (see Figure 1 for an example of the set-up). Participants were then asked to fill in the remainder of their Repertory Grid Interview Template with which they were provided at the beginning of the interview (see Appendix 3-I). Once constructs were written into the Template, learners were asked to write 1 under the left hand column and a 5 under the right hand column of the grid. The researcher then facilitated the rating, in a more informal manner than with Group 1 participants, asking learners to rate on a scale of 1 to 5 how they perceived each construct with respect to each element. This process resulted in a Repertory Grid for each participant that was based on terms that they provided to describe their perspectives of the PBLO and OLE, their ability to work within the environment, and their emotions regarding their experience (see Figure 3.2).

Figure 3.2: A Repertory Grid Model and the Grid Template

Finally, during the third part of the Repertory Grid Interview, the researcher simply asked the same question for each rating in the grid. For example, "Considering Viewing the Video Case Scenario in the PBLO, you rated perceived challenge as a ___. Can you explain why you rated this the way you did?" This was an attempt to gain further

insight regarding participants' perspectives on each element associated with the PBLO and OLE with respect to constructs they had created. The intent was to come to a full understanding of how each participant experienced the PBLO and OLE (Feixas and Alvarez, 2000).

Repertory Grid Analysis. Repertory grids – a major data source for this study – are graphical, numerical, and computer generated depictions of relationships between an individual's constructs and elements (Bencze et al., 2006; vanOostveen et al., 2010). Rep 5 is the most recent versions of a series of software provided for researchers to create and analyze repertory grids (Gaines and Shaw, 2009). Further, WebGrid5 is a tool that was a part of the RepGrid 5 tool kit, providing several analysis options, including focus cluster analysis (Gaines and Shaw, 2003; Gaines and Shaw, 2009). It has been documented that some researchers in adult and school science education have used the FOCUS format of RepGrid 2.0 to determine "degree of association" between elements (e.g. pedagogical strategies) and constructs (e.g. learning outcomes) (Bencze et al., 2003, 2006). Similarly, during their investigation of pre-service science teachers' conceptions of Problem Based Learning Objects (PBLOs) embedded in the Collaborative Online Learning Environment (COLE), vanOostveen, Desjardins, and Bullock (2010) also utilized the FOCUS option in WebGrid for the same purpose.

In this study, the researcher used WebGrid 5 – the online portion of RepGrid 5 available via http://www.repgrid.com/ - to conduct a "factor cluster analysis" producing a Focus Cluster Plot, Pin Grid, and Crossplot (see Chapter 4 – Repertory Grid Analysis Results). The "focus cluster analysis" (Gaines and Shaw, 2009) provided a measure of percent association between relative constructs (e.g. perceived challenge and perceived skill) and relative elements (i.e. characteristics of the PBLO and OLE), as well as an indication as to which elements were associated with which constructs. The analysis provided the researcher with the ability to determine which factors (both constructs and elements) were not only of importance to the learner (Feixas and Alvarez, 2000) but the degree of association between learner states/emotions (i.e. constructs) and specific activities (i.e. elements of the PBLO and OLE). Further, plots resulting from the Repertory Grid analysis allowed the researcher to determine whether there was an

imbalance (or balance) between perceived challenge and skill. Ultimately, the researcher could begin to see evidence (or not) regarding which elements and constructs were associated (or not) with states/emotions related to the "Flow" framework, hence perceived challenge and skill.

Coding – Other Data Sources. Repertory grids provide researchers with some insight into learner perception regarding an experience; however, the grids may not tell the entire story (Bencze et al., 2003; Bencze, et al., 2006; vanOostveen et al., 2010). However, repertory grids can provide direction for researchers as to which portions of the data require further investigation (Bencze et al., 2003). As such, researchers have been noted to complement the Repertory Grid technique with other data creation techniques such as coding, as the process of coding is a key link between data collection and a researcher's explanation of meaning (Bencze et al., 2003; Bencze et al., 2006; Maykut and Morehouse, 1994; Saldaña, 2013). Therefore, to further her understanding of participant experience, this researcher utilized Repertory Grid analysis results for each learner to direct which portions of each additional source to code (see Chapter 4 - Repertory Grid Analysis Results). Although coding is a process through which researchers find meaning from data, different methods are often employed as researcher decisions regarding coding are affected by approach to qualitative inquiry (e.g. case study) and models that inform the study (e.g. "Flow") (Creswell, 1998; Denscombe, 2010; Saldaña, 2013). As such, this section outlines methodology in selection of sources and information for coding, preparation for coding, and analysis procedures.

Based on direction from the Repertory Grid analysis results for each participant (see Chapter 4), several other sources were transcribed for coding purposes using NVivo 10 for Mac. The researcher relied on four other sources of information, including the following: 1) audio/video recordings of all Repertory Grid Interviews (Rep Grid Interview), 2) audio/video recordings of all sessions whereby learners were using Adobe Connect (AC Recording), 3) participant blogs (Wiki text), and 4) audio/video recordings – external to the OLE – of participants working with the PBLO and OLE (OLE External). Rep Grid Interviews, AC Recordings, and Wiki Text were considered major data sources, whereas OLE External videos were consulted only when necessary – when information

necessary to draw conclusions for a participant was lacking from other information sources. It is pertinent to note that participants exhibited different preferred modes of communication, which was not originally considered by the researcher when collecting information but became apparent upon review of information. This realization greatly shaped data analysis. For example, Jane communicated more information in writing, and the Wiki text was considered first as a major source of information in understanding her experience. John, on the other hand seemed more comfortable in conversation; hence the Repertory Grid interviews and AC Recordings became major sources of information in understanding his experience. Ultimately, focus on certain information sources was based on the researchers perception (post-study) of which communication style provided the most information for each participant. If a source did not provide sufficient information, the researcher would move on to other sources to gain further insight regarding learners' perceptions of their experiences (see Chapter 4 for details regarding sources of information used for each learner).

In all, the researcher collected just over four hours of Rep Grid Interview recordings, approximately five hours of AC Recordings, and approximately 10 hours of OLE External video. The Repertory Grid Interview videos and the AC Recordings resulted in 40 partial transcripts, which were subsequently coded. Only the audio portion of the Repertory Grid interview and AC recordings were transcribed. Finally, videos external to the OLE were not transcribed nor coded due to inconsistency in learner behaviour. Rather, this source was used as a complement to other information gathered, when relevant.

Initial Coding Scheme Development. Coding occurred in several phases (Creswell, 1998; Denscombe, 2010; Saldaña, 2013). First, the researcher focused on transcripts from which she could code learner vocabulary. Prior to formally coding any transcripts, the researcher coded a sample of eight transcripts from a range of data sources (i.e. Repertory Grid Interviews, AC Recordings, and Wiki text) from all four learners. This strategy was used as a means to develop a Code Book (see Appendix 3-J) including codes, descriptions, inclusions, exclusions, and examples, which was used to introduce the initial coding scheme to an external coder (Saldaña, 2013). Despite using existing coding

categories (i.e. those related to the "Flow" framework) (Saldaña, 2013), the researcher included both elicited constructs as the definitions of each code. For example, although some codes were related to the "Flow" framework - anxiety, relaxation, and "Flow" - the researcher decided to use elicited constructs as a means to ensure that participants' terms and associated perceptions of experience infiltrated the methodology from Repertory Grid creation, to Rep Grid analysis, to code definition and description, down to the coding itself. Essentially, the researcher attempted to ensure that participants' views were incorporated into the analysis, despite the researcher deciding to work with a pre-existing framework. Inclusions, exclusions, and examples were added to the codebook as the researcher became more familiar with the data samples.

Initial categories of the coding scheme included anxiety, relaxation, and "Flow," indicating perceived high challenge/low skill, perceived low challenge/high skill, and perceived balance between challenge and skill, respectively (Csikszentmihalyi, 1990, 1997). Further, to be able to analyze the results in terms of learner engagement (i.e. "social practice"), the researcher included codes related to independent, cooperative, and collaborative action as per her Conceptual Framework (see Chapter 2 and Appendix 3-J).

Coding Procedure. In terms of an initial coding procedure, once the researcher decided upon a first set of codes, transcript were scanned several times, coding for one code for each scan (see Appendix 3-K). To ensure inter-coder agreement and to improve reliability, the researcher recruited an external researcher to code a sample of data. This peer was a fellow graduate student with previous experience in coding with NVivo 10 and who held a similar epistemological perspective (Bencze et al., 2003; Bencze et al., 2006; Saldaña, 2013). The researchers met on two occasions. During the first meeting, the Principal Investigator (PI) outlined the project context, background, as well as conceptual and theoretical frameworks to ensure that both researchers were in agreement with what was being measured. Second, the PI reviewed the Code Book in detail answering questions and clarifying statements whenever prompted. The external researcher suggested adding two codes – "knowledge" and "resources" – to complement the "ID & Define Problems" code. The PI agreed and amended the Code Book as such.

The PI then reviewed the coding procedure to ensure clarity. Finally, both agreed to code the same sample transcript within the agreed upon guidelines from the first meeting.

Prior to the second meeting, the PI compared both coded samples. She identified that some codes needed to be clarified, the content of the second meeting. During the second meeting, both coders discussed codes that needed clarifying (e.g. "Flow," knowledge, resources, ID Problems, and Define Problems). Both researchers negotiated and came to a consensus regarding descriptions of, as well as inclusions and exclusions for codes that were unclear (Saldaña, 2013). The Code Book was updated one last time by the PI.

Connecting Repertory Grid Analysis Results and Coding. In this study, coding was a second data analysis strategy employed, and it provided meaning for the researcher in two ways: 1) as a means to corroborate or identify inconsistencies between the Repertory Grid focus cluster analysis and the text, audio, and video based data, and 2) as a means to be able to explain data other than Repertory Grids in terms of the "Flow" framework. First, and as mentioned, the focus cluster analysis informed the researcher as to which constructs and elements were associated, not only with each other but with the major components of the "Flow" framework (i.e. perceived skill and perceived challenge). As such, the cluster analysis provided direction and led the researcher to code key pieces of text, audio, and video data, to corroborate or find inconsistencies between the data sources. For example, if the element "PBLO – video scenario" was closely associated with the construct "enjoy" in a participant's Repertory Grid analysis results, then the researcher sought text, audio, and video data during the learner's interaction with the PBLO that was related to that participant's use of the PBLO in order to find evidence of enjoyment or inconsistencies (i.e. states or emotion other than enjoyment). In this way, coding of additional data collected complemented the focus cluster analysis.

Analysis of Coded Sources. Content analysis was the strategy used to analyze and present the coded data. Content analysis was useful for the researcher as it allowed her to choose relevant samples of text and video (i.e. based on emphasis provided via the focus cluster analysis), to break data into smaller units (i.e. words, phrases, sentences, paragraphs, or images - in this case video clips), to use the existing coding scheme, and to

analyze both the text and images in terms of relationship to other units in the data set (Denscombe, 2010). In other words, content analysis highlighted the relationship between states/emotions related to the "Flow" framework to content related to learner activity – engagement. Although it is well documented that content analysis, on its own, is limited in that "it has an in-built tendency to dislocate the units and their meaning from the context in which they were made" and that it is difficult "to deal with the meaning of the text in terms of its implied meanings" (ibid, p. 283), the purpose of the content analysis in this study was not to imply meaning. It was intended to corroborate or highlight inconsistencies between repertory grid analysis and other data collected during this study to add to the meaning that was initially derived from the results of the focus cluster analysis. As stated by Denscombe (2010), content analysis is "at its best when dealing with aspects of communication which tend to be more straightforward, obvious, and simple" (p. 283). Since there were only four participants in this study, and since only three categories of codes were used, the analysis warranted a simple approach. Further, by employing a straightforward coding method and analysis, the researcher intended that the methodology be repeatable (Denscombe, 2010).

POSSIBLE OUTCOMES

Through analysis of the repertory grids and subsequent coding of text, audio, and video data collected, as discussed in the previous section, the researcher was able to describe learner experience in terms of the "Flow" model depicted under the "Possible Outcomes" section of the theoretical framework presented in Figure 3.1. According to Csikszentmihalyi's (1990, 1997) model, if a learner experiences a balance between perceived challenge and skill, "Flow" may be experienced, as depicted by the middle "channel" of the diagram. If a learner experiences emotions related to anxiety, he or she perceives his or her skill level as inadequate in meeting the level of challenge, as depicted in the section of the diagram above the "Flow" channel. Conversely, if a learner experiences emotions related to boredom, he or she perceives his or her skill level as greater than that required to address the perceived challenge, as depicted in the section of the diagram below the "Flow" channel. As stated, the Repertory Grid focus cluster analysis and subsequent coding of additional data provided the researcher with evidence

regarding which factors (constructs and elements) were associated, specifically with respect to a learner's perceived challenge and skill. By superimposing the "Flow" framework on the data analysis results, the researcher was able to draw conclusions regarding the presence of a balance (or imbalance) between perceived challenge and skill, and further could determine if there was a connection between learner action in response to the PBLO and OLE. This gave the researcher the ability to describe first if learners were engaged, and second how learners were engaged in an attempt to determine if the PBLO and OLE provided the conditions necessary for "social practice" or "legitimate peripheral participation" (LPP) within a "community of practice" (CoP) as intended.

CHAPTER 4A – THE CASE

Prior to outlining findings, it is important to briefly review the purpose of this study. Through creation of both an online learning environment (OLE) and Problem Based Learning Object (PBLO), this researcher attempted to determine whether this social, constructivist OLE, introduced to learners within a problem-based learning context, would situate learners within a realistic context. Specifically, the researcher sought to determine if the PBLO would engage learners in "social practice" (Lave & Wenger, 1991). Csikszentmihalyi's (1990, 1997) "Flow" framework was used to measure learner states of being, in association with their perceived challenge and skill level, to determine if participants engaged (or not) in such a way that they either converged or diverged from a "Flow" state. Further, reasons for engagement (or not) were investigated as a means to investigate learner engagement in light of "social practice" or "legitimate peripheral participation (LPP)" within a CoP (Lave & Wenger, 1991).

Chapter four begins with a description of the case - the situation within which participants found themselves - beginning with a general description of the participants followed by a description of the physical setting and timelines. These descriptions outline the boundaries of this case, and hence the context for which the findings are relevant (Creswell, 1998; Denscombe, 2010). Chapter 4B continues with a detailed description of each participant in terms of his/her experience while working with the OLE and PBLOs. A detailed description of data derived from the Repertory Grid interviews and corresponding coded data sets is provided. Finally, a discussion regarding "trustworthiness" (Guba, 1981) is warranted, again to ensure clarity regarding the limits and use of findings of this study.

PARTICIPANTS, SETTING, AND TIMELINES

Four learners volunteered to participate in this study. Three learners – John, Jane, and Victor – attended an adult and continuing education school located in a suburban community, servicing over 300 students aged 16 and over (see Table 4.1 for details). These learners were not technically registered in a Literacy & Basic Skills (LBS) program, as another community agency was the legal LBS service provider in the community of the school in question. However, Dan, the fourth volunteer, attended an

urban adult and continuing education school within the same school board. Dan was registered in the LBS program there, which operated out of the basement of a local church. In this region, the board was an official LBS service provider. Although the associated school also serviced over 300 students aged 16 and up, the LBS program serviced fewer than 100 learners and all learners were over 19 as per government policy for LBS programs in Ontario (see Chapter 3 - Ethical Considerations & Participant Recruitment). Regardless of program registration and entry requirements, all learners had a common goal of preparing for the science PLAR assessment. Essentially, participants had volunteered for the study for the same purpose – to prepare for the science PLAR assessment in an alternative manner (see Table 4.1).

Participants were paired in groups. Jane and John formed Group 1, while Dan and Victor formed Group 2 (see Table 4.1). Learners worked in pairs at a distance. Jane and John were situated in different locations within the same school, simulating an online environment, (Desjardins and vanOostveen, 2008). As the regular program was conducted out of a common space located at the hub of school board offices (i.e. janitorial and counselling staff offices), no classrooms or computer labs were available. Therefore, the researcher reserved the private office she regularly used for herself and the common space regularly used for PLAR preparation classes as the two locations from which members of Group 1 could work. Jane used the office space while John used the common space. Both learners used laptops, and this arrangement was the best the researcher could arrange given the existing space allocated for the PLAR Preparation class at this school (see Table 4.1). Group 2 members worked in real-life distance education setting, as learners were located at separate schools and from each other (Anderson, 2008). Dan worked in the computer lab on a desktop computer available to LBS program students at the church. Victor, on the other hand, used a laptop and worked in the same office as mentioned above, again due to lack of classroom or computer lab space at his school (see Table 4.1).

Although it was the intent of the researcher to provide the most authentic online environment as possible, authenticity was compromised. First, Group 1 learners were situated across the hall from each other, which was not authentic. Second, both Jane and Victor worked in the office space also utilized by the researcher. This affected

authenticity as these participants – during their work with their partners – could hear the researcher both online and in the same room. Further, these participants could speak to the researcher in person if they so chose. Ideally, each group would have consisted of one learner from each school, ensuring an authentic online experience, but this was not possible. However, this was an action research initiative involving not only engagement and learning of the participants but that of researcher. The researcher was also situated within a real-life context – that of trying to solve the immediate problem of a lack of engagement suspected within her class– as such she was a participant in this research and was "learning by doing" (Brown, Collins & Duguid, 1989; Lave & Wenger, 1991; O'Brien, 1998).

In terms of timelines, the study took place over two days for each participant (see Table 4.1). In general, all learners completed an orientation session, worked with the PBLO via use of the OLE, blogged regarding their experience with the PBLO and OLE in the Wiki, participated in a Repertory Grid Interview, and completed a survey. The researcher realized post-data collection that a survey was not the ideal tool that could provide much information regarding a learner's experience, and as stated, any survey results were disregarded. Although the same information was collected from each participant over two days, the researcher ensured that the timelines were responsive to learner schedules and needs (e.g. regarding learner availability and nutrition breaks). It is pertinent to note that refreshments were provided for participants who stayed full days to complete the work. Also, each volunteer was given a $10 Tim Horton's gift card at the end of the study. Participants were not informed of refreshments or the gift prior to giving consent to participate to ensure that learners did not feel coerced and that participation was fully voluntary.

Table 4.1: Participants, Setting, and Timelines

Pseudonym/ Age Range	School	Program	Group/ Physical Setting	Participation Dates
Jane Female 19-25	• Suburban (<100,000) • 300+ students (16+)	PLAR Preparation	• Group 1 • Private office with laptop	November 10 and November 14, 2011
John Male 19-25	• Suburban (<100,000) • 300+ students (16+)	PLAR Preparation	• Group 1 • Common space between group of offices with laptop	November 10 and November 14, 2011
Dan Male 19-25	• Satellite site (local church) of an urban school (>135,000) • <100 students at one time (19+)	• LBS • PLAR Preparation	• Group 2 • Computer lab with desktop computer	November 28-29, 2011
Victor Male 19-25	• Suburban (<100,000) • 300+ students (16+)	PLAR Preparation	• Group 2 • Private office with laptop	November 28 and December 1, 2011

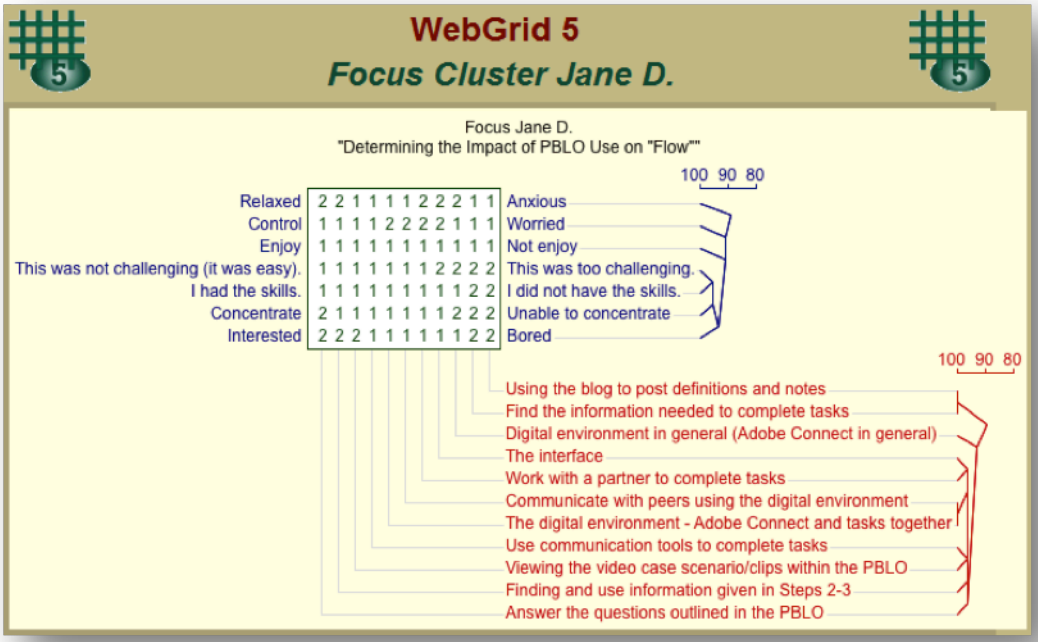
CHAPTER 4B - KEY FINDINGS

This portion of Chapter 4 describes results and findings for each participant related to the Repertory Grid analysis conducted and coded data sets created by the researcher. Specifically, twelve plots (three per participant) resulting from the cluster analysis are discussed – a Cluster Plot, a Pin Grid, and a Cross Plot. Again, for each learner, these results are compared to findings arising from coding other data sources (i.e. blog entries, when possible the post-Repertory Grid Interviews, and Adobe Connect Transcripts), as a means to corroborate (or not) the Repertory Grid analysis results as a means to highlight inconsistencies that may direct the researcher to a deeper understanding of each learner's experience. Finally, despite inability to code the OLE External Videos due to inconsistent learner behaviour, the videos are discussed to add further meaning regarding findings, when relevant, in order to improve validity of findings. In essence, the videos were used to complement other sources to further understand the nuances between what learners said and wrote regarding the OLE and the PBLO and their actions while using the technology. Further, a minimum of two other sources, in addition to the Cluster and Cross Plots, were available, ensuring triangulation across at least three sources (i.e. the Repertory Grid analysis results and two other coded sources), again to improve validity. Although it was intended that at least three additional sources were available for comparison to the Repertory Grid analysis results, this was not possible. Nonetheless, the focus of data creation and analysis was to highlight inconsistencies across sources, in terms of the existence of evidence of more than one state related to the "Flow" framework (i.e. anxiety, relaxation, and/or emotions related to a "Flow" state), in order to investigate learner actions, engagement, in response to these states. In other words, determination of certainty of "Flow" state is not possible. Rather, responses – in terms of ways of engaging – to states of anxiety and relaxation were documented as a means to determine whether participants converged to or away from a "Flow" state (Csikszentmihalyi, 1990, 1997). Ultimately, the form of engagement, specifically in terms of different parameters of the OLE and the structural components of the PBLO, differed for each learner. For this reason, key findings are presented separately.

JANE

Repertory Grid Analysis Results. Although the repertory grid analysis resulted in three plots for Jane, the Cluster and Cross Plots (Figures 4.1 And 4.2 respectively) provided the most information. The Pin Grid (Appendix 4-A), however, was difficult to interpret and was thus not used in directing further analysis and interpretation. In terms of the Cluster Plot, perceived challenge and perceived skill were most related for Jane. Group 1 members, including Jane, were asked to rate elements with respect to each construct on a scale of 1 to 5 whereby a rating of 1 indicated 100% experience of the positive state, as well as perception of having the skills and of a low challenge (see Chapter 3 for details regarding constructs and elements). A rating of three was neutral while a five referred to 100% experience of the negative state, as well as perception of not possessing the skills and high challenge level. With respect to all 11 elements, Jane rated constructs as 1 or 2, reporting that she was 100% relaxed and in control, that she 100% enjoyed the experience, did not find the experience challenging, was confident that she had the skills, was able to 100% concentrate, and was 100% interested (see Figure 4.1). This finding is inconsistent with the "Flow" framework. Given the reported imbalance between a perceived high level of skill and low challenge level, one would have expected boredom or apathy (i.e. related to anxiety) as opposed to the enjoyment and interest reported (Csikszentmihalyi, 1990, 1997). This is an indication that Jane's experience was different than that reported. Elements related to completing tasks and working with peers online were closely related for Jane. For example, "Finding the information needed to complete tasks" and "Using the blog to post definitions and notes" as well as "Communicate with peers using the digital environment" and "The digital environment – Adobe Connect + tasks" were 100% associated. Further, "The Interface" and "Work with a partner to complete tasks" as well as "Viewing the video case scenario within the PBLO" and "Use communication tools to complete tasks" were 95.4% associated. This indicates that Jane perceived the OLE, the PBLO – particularly the video case – and her partner key resources in completing the tasks introduced via the Adobe Connect interface.

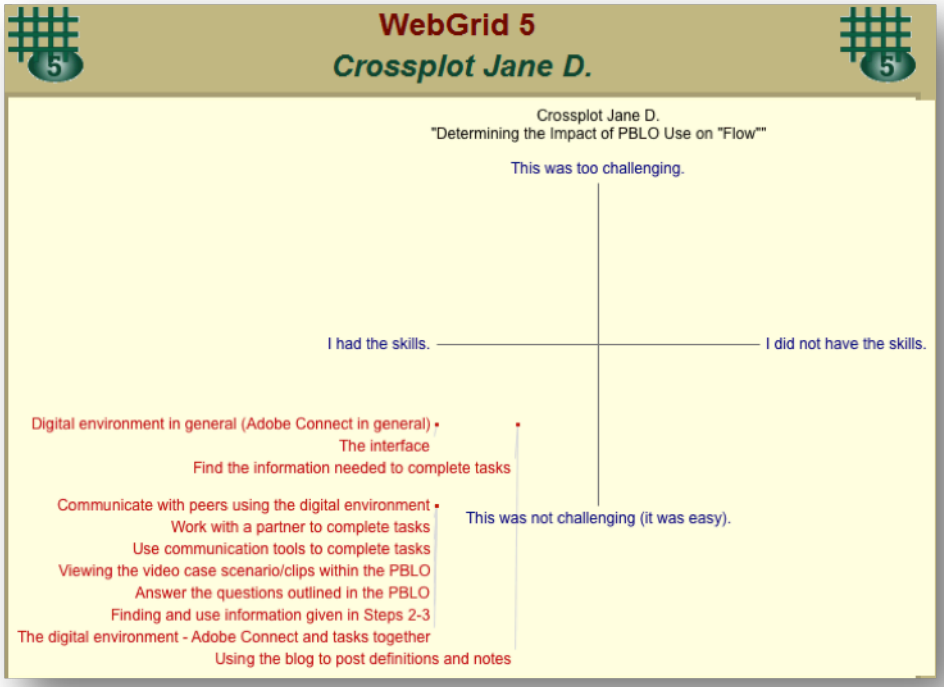
Figure 4.1: Jane's Cluster Plot (see also Appendix 4-B)



In terms of the Pin Grid (Appendix 4-A), Perceived Skill and Perceived Challenge also seem to be associated for Jane as indicated by the percentage variance accounted for by each factor (47.1% and 21.8%), respectively; however, it appears that there are other factors that have equal importance to Jane, trends explicit in the Cross Plot (Figure 4.2). For this reason, the researcher reviewed the Cross Plot for direction in investigating other data sources (i.e. Repertory Grid Interview, Blog Entries, AC Transcripts, and OLE External Videos). In light of the imbalance between perceived challenge and skill, it is likely that Jane experienced a state of relaxation while working with the PBLO and OLE, rather than a "Flow" state associated with a balance between perceived skill and challenge. Despite inconclusive results and inconsistencies highlighted, the researcher chose the most closely related factors (elements) as depicted in the Cluster Plot to focus coding and investigation of other data sources. It is pertinent to note that corroboration of the Repertory Grid analysis results was not possible as Jane's blog nor the Repertory Grid Interview provided sufficient information. This was due to error in questionnaire design

(i.e. blog) and the lack of post-repertory grid questioning (see Chapter 4B – Trustworthiness for further details).

Figure 4.2: Jane's Crossplot (see also Appendix 4-C)



Findings – Coded Sources. As depicted in the table in Appendix 4-M, valid sources of information regarding Jane's experience included her wiki/blog entry and the AC Transcripts. The Repertory Grid Interview focused mainly on asking Jane to rate each element and a brief conversation at the end regarding how she felt about the overall experience. "Work with partner to complete tasks" was the only element discussed due to time constraints, and the researcher simply asked why Jane "enjoyed" the experienced based on her rating (i.e. she led Jane to respond regarding the construct of "Enjoy-Not Enjoy" only)(see "Trustworthiness" for details regarding interviews).

For Jane, states of anxiety and expression of emotions related to a "Flow" state were documented across several elements. However, it is clear that Jane engaged in response to a state of relaxation regarding three elements: "Finding information needed to complete tasks," "View the video case scenario," and "Working with a partner" (see

Appendix 4-M). With respect to the former, Jane perceived finding information as a "perceived low challenge" (PLC) in comparison to her "perceived high skill" (PHS). For example, from her blog entry, relaxation – in the form of comfort – was associated with identification of resources within the digital environment (e.g. partner, teacher, and video case).

> "I feel comfortable with this digital experiences (sic), mainly because there is more interaction (sic) going on with my partner and teacher, the person always being there to talk to when I need help.

Jane also responded to a state of relaxation by taking control of the situation to ensure a more efficient process for task completion for her and her partner, John. This was evident as both learners began their work in completing the tasks (pre-PBLO).

> "Jane: So, tell me when you're done reading, and then I'll scroll down.
> John: Okay.
> Jane: Make it easier."

Again, although confirmation of a "Flow" state is not possible, Jane expressed related emotions as a result of the above-mentioned control, specifically with respect to organizing resources within the OLE. This was evident during the following exchanges between partners:

> "Jane: I just created the page. There. How does that look?
> John: Good.
> Jane: ***Awesome.***
> John: **Awesome is.**
> Jane: Woo for organization!"
> …
> "John: So, I just copy and paste my page rigth (sic) in there?
> Jane: Yeah. Under your little John pages thing. So that way we don't have to hit back later on."
> …
> "Jane: I'm just going to be a little neat freak here.
> John: Little neat freak.
> Jane: I like organizing stuff on the computer."

Responding to a state of relaxation, in the form of taking control over ones resources to ensure finding information necessary to complete tasks is an example of engagement on

Jane's part. Further, the emotions related to "Flow" that Jane expresses in response to such action are indicative that her response allowed her to converge on "Flow."

Similarly, convergence on a "Flow," is also evident in terms of "Viewing the video case scenario" as Jane experienced both relaxation and emotions related to "Flow" regarding this element (see Appendix 4-M). When writing about the video case scenario, Jane stated the following: "I was interested in the video scenarios because it's new, it's interesting and it was easy (sic)…" Further, she stated the following:

> "Having the videos help (sic) me and my partner were ***interesting*** and very informative, supplying me with information I didn't even know."

Also, while assisting her partner to answer the analysis questions associated with the video case scenarios, Jane expresses "Flow" as follows:

> John: Okay. Did I spell that right? Hydrogen. I don't think so.
> Jane: H-y-d-r-o-g-e-n.
> John: Yep, that's it.
> Jane: ***Awesome.***

Further, co-occurrence of relaxation and emotions related to "Flow" was also evident in terms of "working with a partner to complete tasks." Emotions related to "Flow" were reported via Jane's blog entry, Repertory Grid interview (Appendix 4-M), and Cluster Plot (see Figure 4.1). Alternatively, Jane's Cross Plot (Figure 4.2) reveals a state of relaxation. For example, in her blog and during the post-Repertory Grid discussion, Jane expressed emotions related to "Flow" as she revealed her ability to "concentrate", think, interact with the technology, and negotiate with her partner. There is no evidence of relaxation, however, from her blog or interview, making it difficult to decipher engagement in response to this state. Therefore, it is difficult to determine convergence to or divergence from a "Flow" state. Given the contradiction between sources, it is evident that Jane's words did not match her actions regarding her experience.

Engagement in an attempt to convergence on a "Flow" state was, however, evident as Jane both expressed anxiety and relaxation regarding the affordances of Adobe Connect. Initial anxiety was expressed via the AC Transcripts, despite Jane's report of relaxation as revealed via the Repertory Grid analysis. Specifically, the use of "host

status" and the File share features within Adobe Connect caused anxiety for Jane. "Host status" refers to a setting whereby all participants have control over the interface and is associated with the following elements: "Communicate with peers using the digital environment" and "Use communication tools to complete tasks". File share affords sharing of PDF documents within Adobe Connect. Use of this feature was necessary for "Finding and using information in Steps 2-3 of the PBLO." Since Jane was able to continue to engage in completing her tasks, it is likely that she solved such issues on her own and was able to move from a state of anxiety to relaxation. Again, Jane engaged.

Finally, regarding "The Interface/The Digital Environment in General (AC + tools + tasks combined)", Jane's blog corroborates the Cluster Plot results regarding emotions related to "Flow." For example, in her blog, Jane states

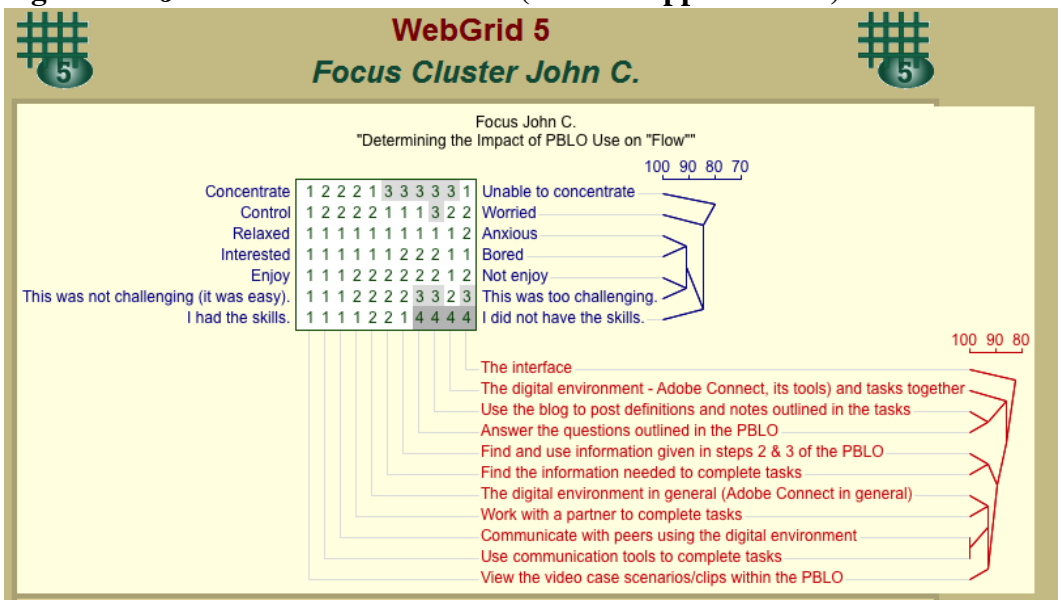
> "I ***enjoyed*** the digital classroom because it was easier to work with compared to an actual classroom…"

By classroom, Jane is referring to a traditional, face-to-face classroom, evidence of her awareness of the significance or at least difference between her previous educational experiences and the one introduced via this project. It is possible that Jane's emotions related to "Flow" regarding the digital environment in general are in response to her experience of relaxation with components of the environment suggesting engagement in an attempt to converge on "Flow." However, the researcher remains curious regarding the inconsistency between what Jane reported regarding the OLE in general and her predominant experience of relaxation. Again, her words do not match her experience.

JOHN

Repertory Grid Analysis Results. Similar to Jane's results, John's Repertory Grid analysis results depict inconsistencies with what one would expect regarding the "Flow" framework. According to John's Cluster Plot (Figure 4.3), and with respect to most closely related elements (i.e. "Use communication tools to complete tasks" and "Communicate with peers using the digital environment"), John revealed that he was somewhat able to concentrate, felt somewhat in control, was completely relaxed, completely interested, completely enjoyed the experience, found this part of the experience easy (not challenging), and perceived that he had the skills. This was indicated by his ratings of 1 and 2 for each construct, for each element based on the same scale of 1 to 5 used in Jane's interview (see "Jane" section above).

Figure 4.3: John's Focus Cluster Plot (see also Appendix 4-D)

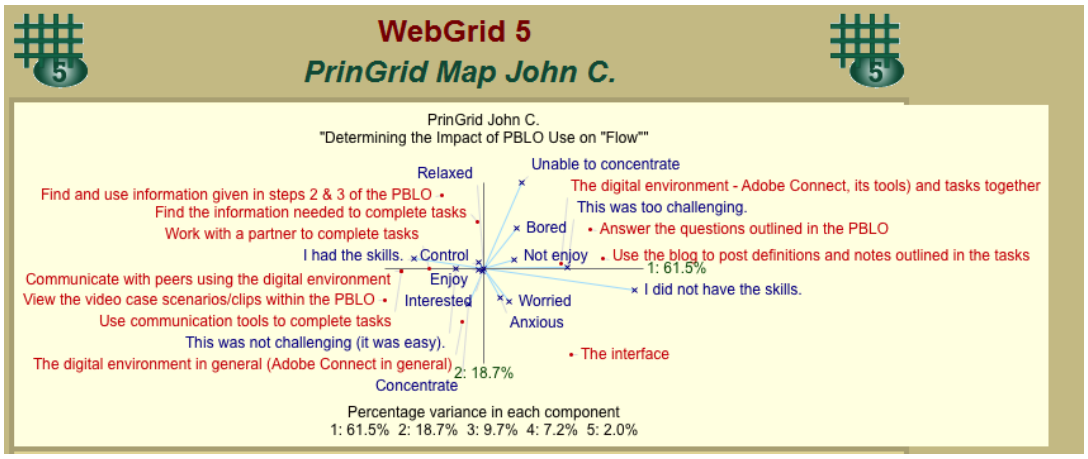


Given the imbalance of perceived skill and challenge (i.e. perceived low challenge (PLC) and perceived high skill (PHS)), one would expect John to experience states of anxiety, which was not the case. This conflict reveals that what John reported did not match his experience.

According to John's Pin Grid (Figure 4.4), his understanding of his experience becomes more transparent as two clusters depicting degree of association between

constructs and elements are evident. According to the Grid, perceived skill and challenge are depicted as the most important factors for John, as they account for 61.5% and 18.7% of the variance, respectively. In addition, one cluster displays the following elements and constructs together: "The digital environment – Adobe Connect, its tools and tasks together," "Answer the questions outlined in the PBLO," "Use the blog to post definitions and notes outlined in the tasks," "This was too challenging," "Did not enjoy," and "Bored." According to these results, John found working in the digital environment (i.e. Adobe Connect, its tools, and the tasks) and the blog too challenging with respect to his perceived skill level.

Figure 4.4: John's Pin Grid (see also Appendix 4-E)



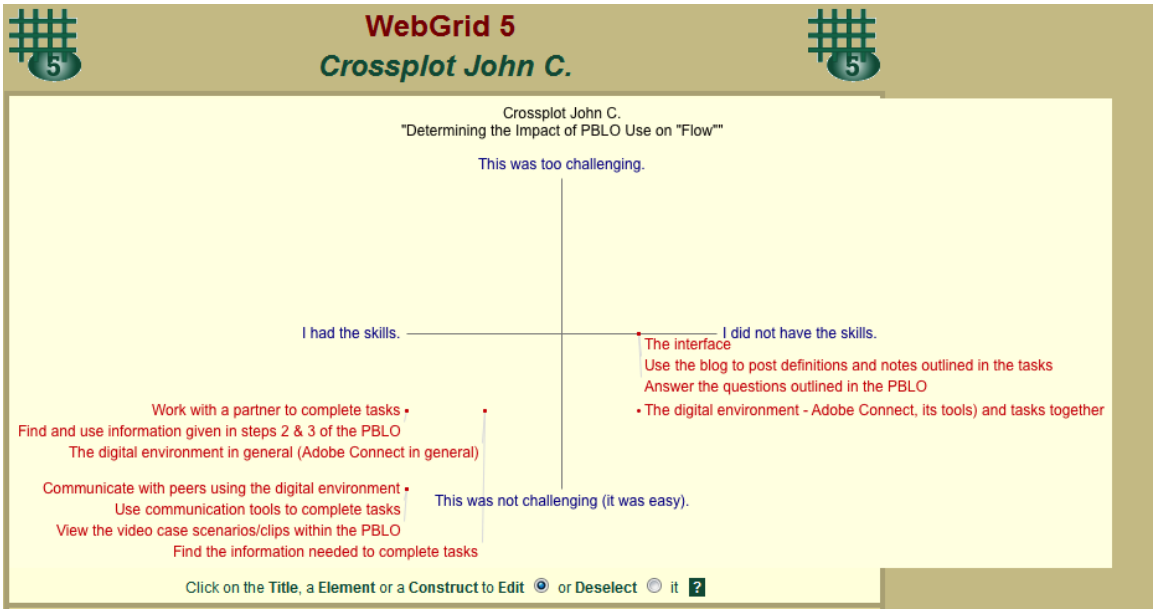
Further, he did not enjoy this part of his experience. A second cluster, groups the following elements and constructs together: "Communicate with peers using the digital environment," "Work with a partner to complete tasks," "I had the skills," "This was not challenging (it was easy)," "Control," "Enjoy," and "Interested." This is evidence that John felt relaxed when working with his partner and that he found this part of his experience both enjoyable and interesting. These findings are also evident in John's Crossplot (Figure 4.5).

According to the Cross Plot (see Figure 4.5), it is clear that John perceived he did not have the skills to work with the Interface, to use the blog to post definitions and notes outlined in the tasks, to answer the questions outlined in the PBLO, and to use the digital

environment (i.e. Adobe Connect, tools, and tasks combined). Despite not having the skills to accomplish the above, he did perceive that he had the skills to do the following:

- Work with a partner to complete tasks
- Find and use information given in steps 2/3 of the PBLO
- Use the digital environment in general (Adobe Connect in general)
- Communicate with peers using the digital environment
- Use communication tools to complete tasks
- View the video case scenarios/clips within the PBLO
- Find the information needed to complete tasks

Figure 4.5: John's Crossplot (see also Appendix 4-F)



The results, again, are inconsistent. If John did not have the skills to use the digital environment, to answer PBLO questions or tasks, let alone navigate the Interface, how could he have perceived he had the skills to accomplish the list of activities above? The following section outlines more of the story regarding these findings.

Findings – Coded Sources. As depicted in the table in Appendix 4-N, valid sources of information regarding John's experience included the AC Transcripts and the Repertory Grid Interview. The Repertory Grid Interview focused mainly on asking John to rate each element as well as brief discussions regarding reasoning behind the ratings regarding which John was forthcoming. Despite John's comments, information regarding all

elements was not possible, as the researcher did not conduct a formal post-Repertory Grid interview. Further, despite the intent on using John's blog posting as a source of information, John did not provide much information. First, as mentioned, the questionnaire was flawed, and John wrote very little in his answers to existing questions (see Chapter 4B – Trustworthiness for details regarding interviews). As such, dependence on the AC Transcripts and interview findings was paramount.

As was the case with Jane, there is evidence that John engaged in response to states associated with the "Flow" framework – anxiety and relaxation – as he converged upon a "Flow" state. As depicted in the table in Appendix 4-N, John's engagement is most explicit for elements with which both states of anxiety and relaxation are evident, in addition to emotions related to "Flow." "Work with partner to complete tasks" and "Answer the questions outlined in the PBLO (incl. Viewing video case scenario w/in PBLO)" are such two elements. When working with a partner, John's anxiety occurred when he perceived he had to negotiate a definition for chemistry (see Appendix 4-M). This was evident from the AC Transcript, as he stated the following: "Oh God. Now we gotta (sic) discuss our definition. So, we both have to come up with a definition." Further, anxiety was associated with using the technology to complete tasks, as was also evident in anxiety associated with the following elements: "Communicate with peers using the digital environment," "Use communication tools to complete tasks," and "Using the blog to post definitions and notes" (see Appendix 4-M).

John sought his partner's assistance both with the technology and in regards to chemistry content. A state of relaxation was experienced in response to this assistance (see Appendix 4-M). For example, when working together to post their definition in the blog, relaxation for John is evident both from the Repertory Grid Interview and AC Transcript. During his interview, John outlined that communication with his partner – using the tools available to him – made it easier to use the digital environment. This finding is validated by the AC Transcript as depicted in the following exchange between John and his partner, whereby Jane suggests a more efficient way to use search terms on the wiki:

> "John: Search, right, again?
> Jane: Yeah.
> John: So, I type in group. No capitals.

> Jane: It doesn't matter. I just copied it from the note in Adobe.
> John: Oh. That's ***easier***."

"That's easier" is an example of John's state of relaxation in response to his partner's support. The process of engaging his partner such that he moved from a state of anxiety to relaxation was accompanied by emotions related to a "Flow" state, indicating convergence on "Flow." John's experience of relaxation and emotion related to a "Flow" state are corroborated by the Pin Grid results (see Figure 4.4 above). Confirmation of such emotions is evident via John's blog: "I enjoyed working with others because it helped me figure out answers easyer (sic)." Further, during his Repertory Grid interview, John expressed much enthusiasm as he rated this element and stated: "I was 100% interested!" Enthusiasm was corroborated by the video of the interview whereby smile, laughed, and raised his voice while expressing his interest. Further, the AC Transcript reveals expressions of emotions related to "Flow" when John is either working with and/or has received assistance from his partner. For example, this is evident from the conversation presented below as John works with Jane to organize information in a Notepod in Adobe Connect.

> "John: Are you trying to make it all neat and tidy?
> Jane: I am.
> John: ***Perfect!*** What about tab?
> Jane: Tab for?
> John: Oh. To bring it over…to make it all neat and tidy.
> Jane: Come on… you can do it. There we go.
> John: It's ***perfect***."

On another occasion, Jane helps John, so he can return to the wiki:

> "Jane: Hold on. I'll send a link over.
> John: How will you do that?
> Jane: Like that.
> John: Oh. ***Perfect."***

In terms of "answering the questions outlined in the PBLO", which involved viewing video case scenario, John also experienced multiple states – anxiety and relaxation – as well as expressing emotions related to a "Flow" state (see Appendix 4-M). Anxiety was related to both difficulty in answering analysis questions and using the technology. John, again, engaged his partner in negotiating answers to the questions and

for assistance with the technology. As a result, he experienced a state of relaxation in the form of a sense of control. For example, John stated: "I was in control 100% because I was the one doing the questions…answering the questions." John also expressed a sense of control in terms of viewing the video case. During his Repertory Grid Interview, he stated the following: "…I was able to push play and pause. And mute…" Finally, emotions related to a "Flow" state, on the other hand, were expressed while not only viewing, but also identifying with the video case scenario. For example, while watching the video, John stated: "Oh, that'd be ***sick***. Oh gross. There we go. It's electrolysis." In this case, John used the term "sick" as a positive term as he reflected on using a hydrogen fueled vehicle. Further, during the Repertory Grid Interview, John expressed his interest in the video case as follows:

> "…That was ***interesting***…I got to learn how to make diesel fuel.
> It's not everyday you learn how to do that."

In essence, John experienced various states – anxiety, relaxation, and "Flow" – regarding the video case and analysis synthesis questions. Both relaxation and "Flow" corroborated the Repertory Grid analysis results; however, the evidence of anxiety from coded sources, was not evident again, highlighting an inconsistency between what is reported and experienced.

Further inconsistencies were noted, regarding the element "finding and using information given in Steps 2-3 of the PBLO," as both the Repertory Grid Interview and AC Transcript reveal anxiety - opposite to that revealed in the Pin Grid (Figure 4.4). For John, anxiety was associated with reading the documents in Step 2 (i.e. the amount of and language within the text) of the PBLO; however, taking notes using the Notepod caused a brief expression of anxiety. For example, in response to both comprehension and the amount of reading, John states the following:

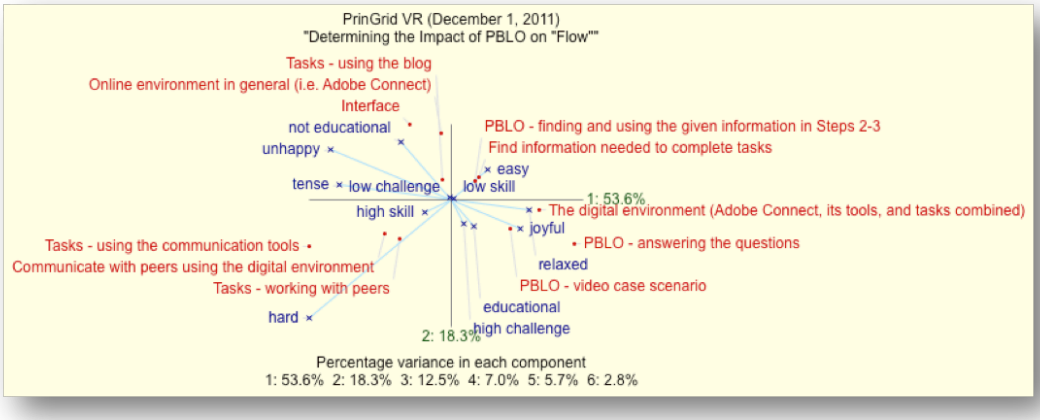
> "John: I don't even know half these words.
> Jane: Meteorological?
> John: Unequivocal? What the bleep?"
>
> ___
>
> "John: Oh. There's more.
> Jane: Yeah. There is.
> John: I thought for a minute that we got an easy one."

Further, while using the Notepod, John's states: "How did you do that line? Oh. Oh. Ah!" Again, reading and technology use tended to be issues for John, problems in response to which he engaged his partner for assistance

VICTOR

Repertory Grid Analysis Results. Although the Repertory Grid analysis resulted in three plots for Victor - the Pin Grid (see Figure 4.7), the Cluster Plot (Figure 4.8), and the Cross Plot (4.9) - the Pin Grid clearly reveals two distinct clusters that warrant further investigation. As such, this grid directed the researcher's focus in reporting key findings regarding other data sources. Constructs most related for Victor, as depicted by all three plots, were "low challenge – high challenge" and "low skill-high skill" (see Figures 4.7, 4.8, and 4.9). It is pertinent to note, however, that to Victor ratings related to perceived skill refer to whether the activity in question required "low skill" or "high skill." This clarification arose during the Repertory Grid interview as Victor revealed that ratings associated with perceived "low skill" meant that he perceived that he had the skills to complete an activity, and vice versa. Other related constructs included "not educational – educational" and "unhappy – joyful." As the meaning of the terms "not educational" and "educational" were not clear, this construct was disregarded from the analysis. "Unhappy" and "joyful" were considered as codes for further data analysis via coding. The first cluster evident via Victor's Pin Grid includes the following: "PBLO – finding and using information in Steps 2-3," and "Find information needed to complete tasks," "easy," and perceived "low skill" indicating that Victor perceived that finding information needed to complete tasks, specifically regarding Steps 2 and 3 of the PBLO, as easy indicating perceived he had the skills. Given this imbalance in perceived skill and challenge (i.e. a perceived low challenge (LPC) versus perceived high skill (PHS), one expected an experience of relaxation.

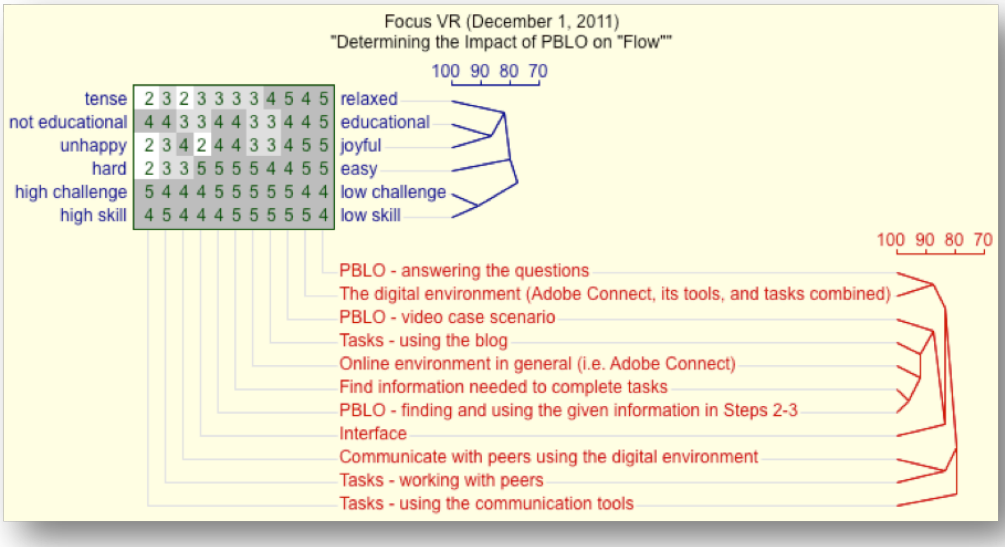
Figure 4.6: Victor's Pin Grid (see also Appendix 4-G)



However, as revealed in Victor's Cluster Plot (see Figure 4.8) he identified the same elements as a high challenge and perceived he did not have the skills. The rating scale was determined during construct elicitation, and for the construct "easy-hard" was as follows: 1 = easy; 2 = somewhat easy; 3 = neutral; 4=somewhat hard; 5=hard. For "low skill-high skill" the scale was as follows: 1=low challenge; 2=somewhat of a low challenge; 3=neutral; 4=somewhat of a high challenge; and 5= high challenge. Ratings of 4 and 5 depicted for the aforementioned elements, as depicted in the Cluster Plot would lead one to expect a state of anxiety. Therefore, further investigation of other data sources was necessary to further understand the inconsistency and Victor's experience. A second cluster evident in the Pin Grid (Figure 4.7), which corroborates the Cluster Plot (Figure 4.8), reveals that "The digital environment (Adobe Connect, its tools, and tasks combined) and "PBLO – video case scenario" were closely associated with "relaxed" and "joyful" respectively. Given this finding, one would expect either a state of relaxation (i.e. LPC versus HPS) or emotions related to a "Flow" state to arise (i.e. balance between perceived skill and challenge). The Cluster Plot confirms this finding as scores of 4 and 5 were reported for the "tense-relaxed" and "unhappy-joyful" constructs respectively (see Figure 4.8). The scale for the former the scale ranged from 1-5 and indicated the following: 1 = tense; 2 = somewhat tense; 3 = neutral; 4 = somewhat relaxed; and 5 = relaxed. For the latter construct, the scale indicated the following: 1 = unhappy; 2 = somewhat unhappy; 3 = neutral; 4 = somewhat happy; and 5 = happy. Thus the reported

ratings indicated that Victor was “somewhat relaxed” and “happy,” corroborating the Pin Grid.

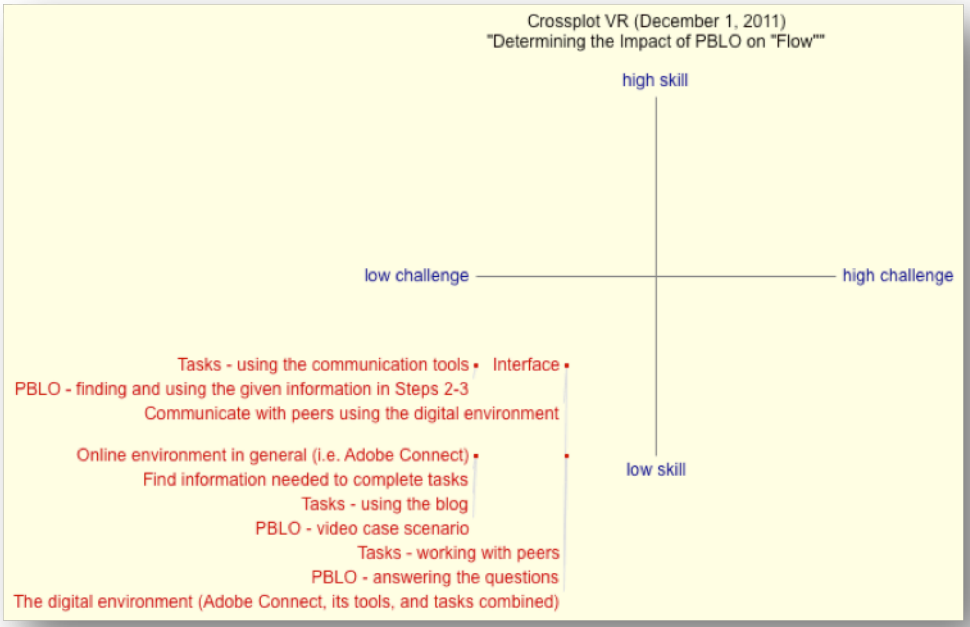
Figure 4.7: Victor’s Cluster Plot (see also Appendix 4-H)



According to Victor’s Cross Plot (Figure 4.9), all elements of the OLE were perceived as a low challenge and requiring low skills again indicating that Victor perceived that he had the skills given the challenge. One would expect, then, a state of relaxation to be revealed during all activities, which according to the Pin Grid was not the case. As such, the researcher sough further information from other sources to clarify the inconsistency identified via the Repertory Grid analysis.

Findings – Coded Sources. As depicted in the table in Appendix 4-O, valid sources of information regarding Victor’s experience included the AC Transcripts, Victor’s blog, and his Repertory Grid Interview. The Repertory Grid Interview differed slightly for Group 2 members, including Victor, as participants were asked not only to rate elicited constructs and elements but were asked about their reasoning for the ratings. This shift in methodology occurred to improve the validity of findings and to provide a better understanding of the Repertory Grid results. Again, due to questionnaire design, Victor’s blog did not provide information regarding all elements (see Appendix 4-O); however, he did provide a lot of information. Again, the OLE videos were used only when adding further information to findings from above mentioned sources.

Figure 4.8: Victor's Crossplot (see also Appendix 4-I)



As was the case with Group 1 participants, Victor engaged in response to states associated with the "Flow" framework – anxiety and relaxation – particularly for the elements flagged via the Repertory Grid analysis results: "Finding information needed to complete tasks" and "Find and use information given in Steps 2 and 3 of the PBLO" (see Appendix 4-O). Victor's responses were also accompanied by emotions related to "Flow," providing evidence that he attempted to converge upon a "Flow" state. Further, evidence of both states regarding these elements corroborates the original inconsistency revealed by the Repertory Grid analysis; however, reasons were highlighted from the above-mentioned sources.

First, although Victor revealed that "finding information needed to complete tasks" as "easy," he experienced anxiety regarding the using the technology – the Notepods in Adobe Connect, an affordance that was necessary for Steps 2 and 3 of the PBLO. Regardless, he was able to identify the Notepods as a resource and was able to continue to engage (see Appendix 4-O). Further, he also experienced relaxation regarding "finding information needed to complete tasks" as he revealed during his Repertory Grid that the information was "easy" to find. According to his blog, information was located where he had expected, and in response he was able to read and comprehend what was

asked of him (see Appendix 4-O). Emotions related to "Flow" were also highlighted for this element, although due to contradictory statements during his interview, the researcher could not be sure (see Appendix 4-O).

In addition, experiences of anxiety and relaxation regarding "finding and using information given in Steps 2 and 3 of the PBLO," were also clear. A state of anxiety was evident as Victor identified during his Repertory Grid interview that taking notes, the amount of reading, as well as determining what to do with newly introduced information (analyzing the situation) were obstacles (see Appendix 4-O. This was revealed during his Repertory Grid interview:

> "I stopped and took notes for certain things, and there was just a lot of reading involved. ***I was anxious*** just to answer the questions. So, the hardest part in that one was just taking notes..."

Further, as revealed by the AC Transcripts, Victor vigorously expressed anxiety on several different occasions and for several different reasons. This is evident in the following statements (contexts provided in parentheses):

> "I guess that's okay. But where the ***bleep*** is our test task thing. What the ***bleep*** did I touch?...They say computers are user friendly. My ***bleep***. Okay, so let's go back down here. "Understanding Canada's Climate Change". ***Bleep***, that was difficult." *(finding and using information – PBLO Step 2)*
>
> "***Bleep.*** I don't really feel like jotting down all of this. Lord. Is it lunchtime yet?" *(using information – PBLO Step 2)*
>
> "Reading. ***Bleep***." *(reading documents – PBLO Step 2)*
>
> "…Where the ***bleep*** are we though? Are we on "Alternative Fuels" next?" *(analyzing the situation – PBLO Step 3)*
>
> "Oh. ***This sucks***. Oh well. At least it's not that much to read." *(reading associated with PBLO Step 3)*
>
> "When the ***bleep*** did they add plasma?" *(content of information provided in PBLO Step 3)*

In response to his anxiety, Victor engaged in several ways in order to progress. First, he was able to analyze the situation and subsequently took control in facilitating the decisions making process for him and his partner. Second, he identified resources

necessary to read (i.e. via the Notepods). Third, he cooperated with his partner to divide up the reading. Finally, he read (sometimes aloud for his partner due to his partner's literacy issue) as a means for his partner to continue (see).

Victor also experience a state of relaxation in terms of Steps 2 and 3 of the PBLO, a state he attributed to ease in finding the answers to the questions and his perception that reading was the only activity he had to do (see Appendix 4-O). Evidence of this was provided as he stated the following during his Repertory Grid interview:

> "Everything's in your lap. It's right there in your lap. They've done everything but highlight the answers for you. So, you just gotta read it. You just gotta read it. Same with everything else. If you're not gonna read it, or at least read the answer [question] first and then skim through and find the answer, then you're kind of [bleep]. But everything is put in your lap. The answers are in the text. So, you just gotta read it. **S*o, it's pretty easy.***"

Again, Victor mentions the reading associated with this part of the PBLO and highlights this activity as "easy." This is contradictory to his expression of anxiety regarding the reading expressed in the AC Transcript (see above). However, it appears that Victor was not concerned about comprehending what he read but may have been bored regarding the amount and possibly the content of the text. This is supported as Victor expresses emotions related to "Flow" when he states the following about the reading associated with Steps 2-3 of the PBLO:

> "I did have a bit of ***fun*** reading about it, cause there were certain things I didn't know… I do ***enjoy*** learning about stuff I don't know about. So, the little bits and pieces that I didn't know, that it showed me, I ***enjoyed***."

It appears, that engagement as an attempt to converge on "Flow," was in response to the desire for "learning."

Finally, it is worth mention that anxiety, relaxation, and in some cases emotions related to "Flow" – were also evident for other elements: "Using the blog to post definition and notes," "The digital environment – AC+tools+tasks," and "Viewing the video case scenario (including the analysis questions)." Anxiety was mainly due to use of technology. For example, again, Victor expressed pre-existing anxiety regarding computers and blogging. Further, he had initial difficulty accessing the wiki and the video

case (Appendix 4-O). Also, he expressed some displeasure, as he perceived the video ending too abruptly. Regardless, Victor was either able to solve such issues on his own by playing with the technology and/or working with his partner. Finally, emotions regarding "Flow" were related to working with his partner in the digital environment as well as conducting research using additional resources – Wikipedia and Google – on topics of interest, prompted via viewing the video case scenario (Appendix 4-O).

> "And the video, at the very end, just kinda (sic) cut of into nowhere land… That one video just kinda (sic) started talking about fuel cells at the end then just cut off… We read, or we listened to something on the video. We got ***interested*** about it, so we just went off to Wikipedia and Google and went from there."

Co-occurrence of anxiety, relaxation, and emotions related to "Flow," as revealed from coded sources, adds more to Victor's story, specifically in terms of the inconsistencies first highlighted via the Repertory Grid analysis. It was evidence that he was able to respond to both anxiety and relaxation, and on some occasions, may have converged on a "Flow" state

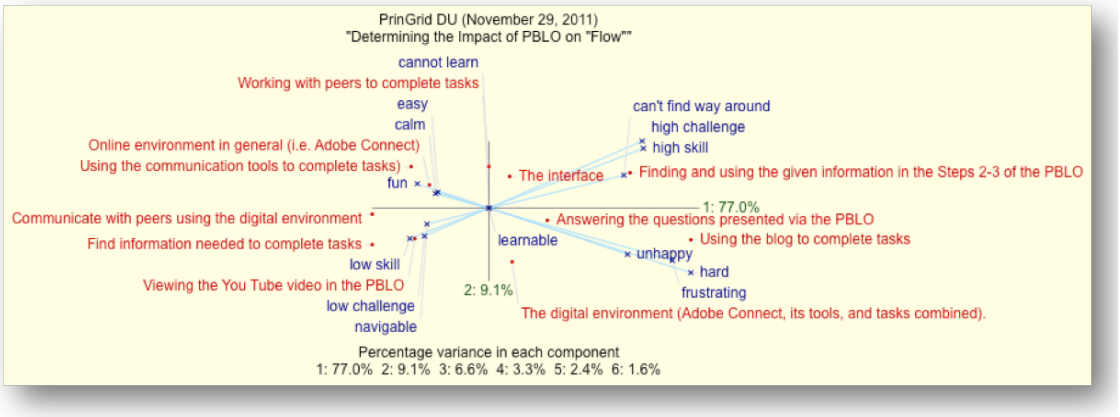
DAN

Repertory Grid Analysis Results. Although the factor cluster analysis resulted in three plots for Dan - the Pin Grid (see Figure 4.10), the Cluster Plot (Figure 4.11), and the Cross Plot (4.12) - his Pin Grid clearly reveals four distinct clusters that warrant further investigation. As such, this grid directed the researcher's focus in reporting key findings regarding other data sources.

According to Dan's Pin Grid (Figure 4.10), the element "Finding and using the given information in Steps 2-3 of the PBLO" is closely associated with the constructs "can't find way around," "high challenge," and "high skill." For Dan, "high skill" refers to the activity as requiring a high level of skill, indicating that he perceives he did not have the skill, a perspective that became apparent during the portion of the Repertory Grid Interview during which Dan explained his reasoning behind ratings of the elements. The Pin Grid also reveals a second cluster indicating that "Using the blog to complete tasks" is closely associated with the constructs "unhappy," "hard," and "frustrating." A

third cluster reveals that the elements "Online environment in general (i.e. Adobe Connect)" and "Using the communication tools to complete tasks" as closely associated with "fun," "easy," and "calm." Finally, a fourth cluster reveals that "Viewing the You Tube Video in the PBLO" as associated with "low skill" – meaning Dan perceived he had the skill, "low challenge," and "navigable."

Figure 4.9: Dan's Pin Grid (see also Appendix 4-J)



The importance of the above-mentioned elements to Dan's experience and his perception regarding perceived challenge and skill level regarding these elements are corroborated in the Cluster and Cross Plots (see Figures 4.11 and 4.12 respectively). Given these results, one would expect that Dan would experience anxiety when using the blog and while working with Steps 2-3 of the PBLO due to a perceived higher challenge given his skills. In contrast, one would expect that Dan experienced a state of relaxation while using the online environment and the communication tools to complete tasks, and during the video portion of the PBLO as Dan perceived his skill level higher than that of the perceived challenge.

Figure 4.10: Dan's Cluster Plot (see also Appendix 4-K)

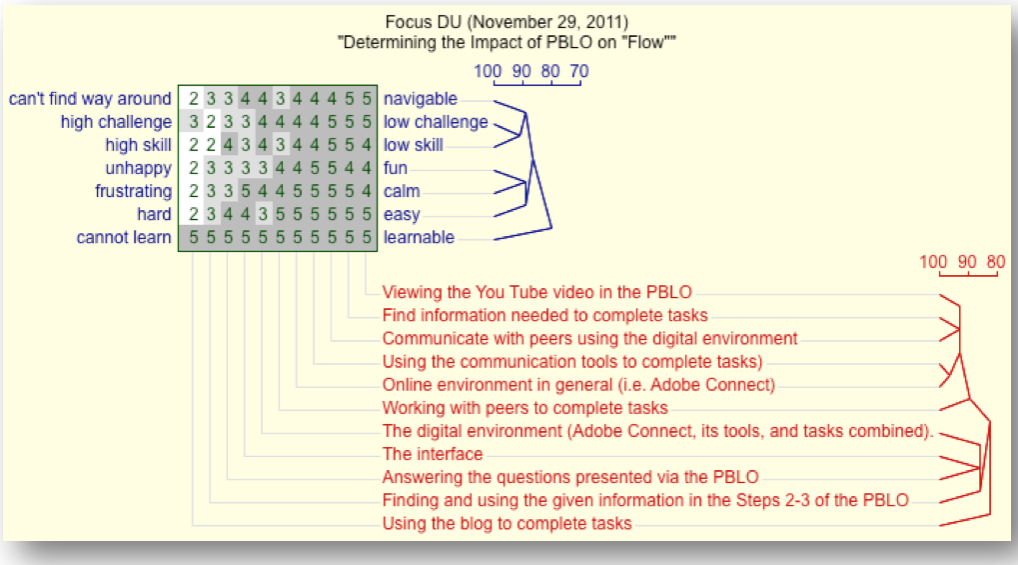
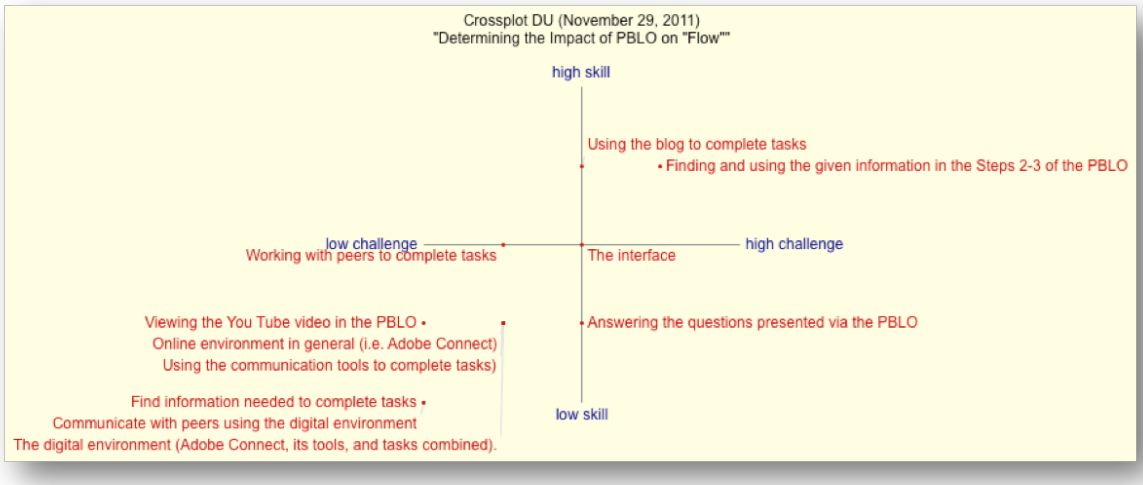


Figure 4.11: Dan's Cross Plot (see also Appendix 4-L)



To further understand Dan's experience, the researcher considered other sources to reveal more of his story. In doing so, she attempted not only to provide a better explanation as to whether anxiety, relaxation (or both) were evident, but to reveal

findings regarding Dan's associated activity, all with the goal of determining how Dan engaged to converge or diverge from a "Flow" state.

Findings – Coded Sources. With respect to "using the blog to complete tasks," Dan's Repertory Grid Interview – the only source coded for this element – corroborates the factor cluster analysis, as Dan experienced anxiety (Appendix 4-P). This was evident as Dan identified that he did not know about this particular wiki site (i.e. his identified problem) and that he could not navigate the wiki at first due to lack of direct instruction on how to do this. For example, during his interview, Dan states the following:

> "At the very beginning, I didn't know nothing (sic) about it. And, randomly clicking on stuff kind of navigated my way to somewhere where...like it had the edit button and a little plus beside it, and that's where you can blog and it'll actually go onto the website or onto so everybody can see it."

It is interesting, however, that despite his anxiety, Dan did not disengage. It appears that he played with the technology as a means to solve his problem, ensuring he could continue to act/engage in the experience. This is evident when he states the following, indicating that he would be able to work with the blog in the future:

> "…Like, I imagine today if I went on there, I'd be able to find my way around. It'd be pretty navigatable (sic)."

Further, despite Dan's initial anxiety, he does express willingness to try this activity again as he claims the following:

> "If you asked me to do it again, I'd probably do it again now that I know a little bit more about the setting - now that I know my way around. But, as for what I've known yesterday, it really irritated me."

Although one cannot claim that Dan achieved a "Flow" state while working with the blog, the evidence that solved his own problem of not being able to navigate the wiki site, in addition to his apparent willingness to try it again, given his newly gained skills/knowledge regarding the site, is evidence that Dan was able to act, to engage, in a

way that converged toward a "Flow" state. In other words, it is evident that Dan's actions prompted an increase in his perceived skill level increased given the challenge of navigating the wiki bringing him potentially closer to a "Flow" state.

In terms of "using the communication tools," Dan seemingly experienced a state of relaxation, as expected given the factor cluster results and as per the Repertory Grid Interview (Appendix 4-P, again, an opportunity for Dan to converge toward a "Flow" state. Although Dan did experience some anxiety regarding "communicating with peers using the digital environment" due to technical issues (i.e. audio and web cam not working), he did reveal during his Repertory Grid Interview that the communication tools were "straight forward" to use, once technical issues were dealt with. Further, he experienced a state of relaxation, as he perceived "several ways to communicate" including his "head set," the "chat," and "webcam." With regards to the communication tools, Dan identified one problem:

> "You gotta (sic) be able to, like, you know what I mean, find your way around the tools. You gotta (sic) be able to know what the tools do."

Again, Dan played with the technology and was able to increase his perceived skill such that he could use the communication tools. This is evident as he describes the actions he took to do this: "But all's it involved is asking some questions, clicking some buttons, and seeing what something does." It is interesting, however, that Dan revealed that he was attempting to solve the technical issues that were keeping him from communicating effectively with his partner. This is evident as he described what he considered doing: "But, you still have to go around and figure out why it's not working and try to help the problem." Ultimately, Dan and his partner decided to use the "chat" to communicate as revealed in the following:

> "It was leaning more towards navigable, but with the minor technical difficulties…Sometimes we had problems. Sometimes we had to type it in."

Again, despite the problems, Dan was able to continue to act, engage, with the environment by playing with the technology and coming to an alternative means through

which to communicate (i.e. use of an alternative communication tool). It may be that once Dan had figured out how to use the communication tools and had determined how to converse with his partner again, that he tried to solve the technical issues associated with them as a means to increase his challenge, given the increase in his perceived skill given the tools, ultimately allowing him to move closer to a "Flow" state.

In addition, as evident from both the Repertory Grid Interview and the AC Transcripts, while "finding and using the given information in Steps 2-3 of the PBLO" Dan appeared to experience anxiety (Appendix 4-P), further corroborating factor cluster analysis results. It is clear that anxiety related to this element was due to a literacy issue. Both during the interview and while working online, Dan mentioned privately in the chat, to the researcher, that he could not read very well. This is evident as he states during his interview that:

> "The reading part was challenging because I do have a problem with reading. The focus level when something gets read, when you have to read something that long you start losing focus. Like, I was losing interest in it, just because I don't like to read at all."

He goes on to discuss why reading is challenging:

> "It's because sometimes I forget what I just read, or what it was talking about, and then I'll have to get frustrated, and then I'll have to go back and read it again to understand it."

It is clear, length of text and comprehension were issues for Dan, which is not surprising as he was registered in an adult literacy program What is interesting, is despite this obstacle, he continued to engage in a way that allowed him to progress toward his identified goal (i.e. to answer one of the analysis questions associated with the PBLO). Dan revealed that he viewed other videos online as a means to find the answer he was looking for. This was revealed as the researcher analyzed Dan and his partner's activity to ensure the pair was keeping within the timelines given for the exercise.

> "I wasn't really researching, I was looking for the answer to the question that was asked on the paper, and I was searching other related You Tube videos on seeing if I could get that answer."

Also, another strategy was revealed from the AC Transcript. Dan agreed to let his partner

read text associated with Step 3 of the PBLO (i.e. the theoretical information), a cooperative effort. This is evident in the following exchange between Dan and Victor:

> "Victor: Alright. Want me just to read it out loud…make everything easy?
> Dan: Sure.""

It appears that Dan's solution to his "reading problem," included both independent and cooperative action both geared at decreasing his perceived challenge in an attempt to move toward the desired "Flow" state. He continued to engage as a means to progress toward his goal. Evidence of this is revealed when he states the following during his interview: "Just because I'm marking it as not fun, doesn't mean I wouldn't do it again."

Further interesting results arise regarding "viewing the You Tube video in the PBLO" as there is evidence that Dan may have experienced anxiety regarding this element (Appendix 4-P). This provides additional information to the expected relaxation given the factor cluster analysis results. As such, it seems that Dan may have experienced mixed emotional states regarding the video. During the Repertory Grid Interview, Dan revealed that he did not find the video "thrilling" and that he did not like "watching T.V." Given the result of emotional states of relaxation highlighted from the factor cluster analysis, it is possible that viewing the video case scenario was boring for Dan. It is worth noting, however, that Dan disclosed that identifying with the video was more challenging. For example, Dan outlined several problems that he attempted to solve while trying to progress toward his goal of answering the analysis questions. First, he stated that he had some difficulty comprehending the video content related to chemistry. This is evident as he outlined questions related to his thinking while viewing the video case: "What were they just talking about? How does that work?" Further, he revealed that unanswered questions remained – in addition to the analysis questions – after he watched the video:

> "…it was a little bit hard to, you know, focus on what the direction of those questions went. Like I could read it, don't get me wrong, but it was the more hard to find this sort of the answer that you wanted."

It is evident that another problem implied by Dan included not only finding answers to

his questions, but finding those that he perceived were in line with what the researcher wanted. Dan's solutions to his unanswered questions, as mentioned above, to view other videos as he felt the video case itself did not provide sufficient information for him to achieve his desired situation:

> "Well, the video that you had displayed on there was kind of not covering all of the questions, so I clicked a couple around it to try to like watch the video… I was looking at other videos to answer a certain question."

Again, although the researcher cannot confirm that Dan achieved a "Flow" state, and no matter the problems Dan identified, he was able to continue to engage given the situation within which he was situated. Evidence of this is revealed by his willingness to work with the video case again: "Would I do it again? Probably I'd do all that research again." Again, it seems that Dan was attempting to decrease his perceive challenge that the video did not provide sufficient information by viewing other videos – trying to find the information he perceived he needed to be able to answer his questions. Specifically, it seems he expanded his resource pool beyond the PBLO as a means to increase his knowledge regarding the situation, ultimately reducing the differential between his desired and current situation. It is clear, then, that Dan's actions were in the form of problem identification and solution creation via use of additional resources beyond the PBLO. By engaging in this way, it appears that Dan was attempting to achieve a "Flow" state.

It is not surprising, then, that Dan's actions also resulted in expression of emotions related to a "Flow" state as he fluctuated between the implied states of relaxation and anxiety associated with different aspects of "viewing the You Tube video in the PBLO" (i.e. viewing the video and identifying with it). This was evident during his interview as Dan revealed that he liked the information provided in the video:

> "It's somewhat fun cause it's fun to sit there and get information about chemistry. Watching the video...learn something that I never knew about before. That's the fun part of it… The information was awesome…"

Regardless, of whether a "Flow" state was achieved, however, Dan continued to engage with the video case scenario – the PBLO – and beyond, and ultimately was able to progress toward achieving his goal.

Regarding the "online environment in general (i.e. Adobe Connect)," Dan's Repertory Grid Interview revealed an experience of relaxation in addition to the expected state of anxiety revealed from the cluster analysis (Appendix 4-P), again confirming that Dan was acting in ways to bring him closer to a "Flow" state. For example, Dan found the online environment in general easy to navigate, corroborating the factor cluster findings of a possible state of relaxation. This finding was associated with Adobe Connect. However, he did mention anxiety related to his inability to navigate the blog, which he also considered part of the online environment. Again, as mentioned, Dan analyzed the situation and tested the technology in order to navigate the environment. He likened his strategy to a real-life experience:

> "[It] doesn't take a rocket scientist to find out your navigating around the thing what you can use, what's there, tools you need to be using for sure…That's how I learned how to drive a car. Just try."

This finding confirms that in general, Dan was able to act – to engage – no matter the problems he identified. He was able to create solutions, and as a result he was able to converge upon a "Flow" state as he continuously fluctuated between states of anxiety and relaxation. Dan's experience is summed up well in his own words as he commented on the online environment in general:

> "Because the fun parts about it was because it was a new experience, I learned some stuff, I met a cool guy."
>
> "The unhappy thing about it...I took into consideration the reading, the not sufficient enough time to complete a task, and the blogging."

TRUSTWORTHINESS

As mentioned, and remaining within the paradigm of case study research, the researcher attempted to validity of findings, through corroboration of findings by triangulating her data (i.e. validating findings across three sources for each participant) – two of either the blogs, Adobe Connect session transcripts and/or the Repertory Grid interview transcripts (Creswell, 1998; Denscombe, 2010; Guba, 1981). Internal validity was compromised due to error in questionnaire design; hence the researcher was unable to obtain the specific information she sought for analysis (Creswell, 1998). This was due in part because the researcher did not ask questions regarding all of the components of the online learning environment (e.g. the blog), nor were the existing questions clear enough for learners such that explicit responses regarding each OLE parameter and each component of the PBLO. As such, questionnaire design could have been better. In addition, it was the intent of the researcher to corroborate findings across several sources, including the OLE External videos; however, this was not possible. Rather, learner behaviour lacked the consistency for this to occur. Hence, each source was reviewed to determining reasons behind learner experience. However, the coded sources were corroborated with (or not) Repertory Grid analysis results, providing some sense of validity.

Further, the way in which the Repertory Grid interviews were conducted also affected internal validity of findings. First, the researcher did not conduct post-Repertory Grid interviews with Group 1 participants making it difficult to fully understand their ratings with respect to constructs and elements. Methodology was changed for Group 2 participants to improve validity. However, the researcher's language may have affected how learners answered, ultimately implying for some that there was a "correct answer." This may have led learners to report to the researcher what they perceived she wanted to hear. Again, interview technique leaves room for improvement for this researcher.

Despite the challenges in achieving a solid sense of internal validity, the researcher sought trends in findings across a minimum of three participants as a means to ensure external validity for this case. As such, despite potential use for the field of adult literacy in Ontario, the findings are valid for this case only – in regards to adult literacy learners, preparing for a science PLAR assessment – at the schools involved in this study.

CHAPTER 5 - INTERPRETATION

Chapter 5 offers a discussion of the observed participant engagement to extend understanding of findings presented in Chapter 4. Specifically, the Chapter relates engagement observed in terms of the "Flow" framework (i.e. anxiety and relaxation) to Online Learning Environment (OLE) Parameters; 2) PBLO Structure; and 3) Social Practice. To conclude, a discussion regarding researcher impact is warranted, as the design of the PBLO and OLE were not separate from preconceived notions, due to external constraints beyond her control. First, a brief review of the intent of the study is warranted.

In review, the researcher initiated this investigation in response to a problem identified while using teacher-centered, content focused curriculum in preparing learners for the science PLAR assessment in her LBS Program – a lack of engagement. Her goal was to determine, in the context of a Literacy & Basic Skills (LBS)/Prior Learning Assessment & Recognition (PLAR) Preparation Program, whether a learner and process-centered approach would be more effective in engaging learners. More specifically, the purpose of this qualitative case study was to investigate whether the a Problem Based Learning Object (PBLO) introduced to learners in conjunction with a social, constructivist online learning environment (OLE), would engage adult literacy learners as a means to provide access to school science by offering a realistic context. Essentially, the researcher sought understanding of a Problem Based Learning (PBL) online approach in this context.

As a first attempt at implementing a PBL online approach, a PBLO and OLE were designed (see Chapter 3 for details of the design). The intent of the design was to elicit learner engagement in the form of "legitimate peripheral participation" (LPP) within a "community of practice" (CoP) as a means to provide a situated learning experience, ultimately rendering abstract concepts more concrete and accessible (Lave and Wenger, 1991). In doing so, the researcher attempted to address the lack of engagement observed via the use of traditional methods where abstract concepts remained inaccessible to learners due to their lack of connection to real-life and/or realistic contexts (Brown, Collins, & Duguid, 1989; Herrington, Oliver, Herrington, and Sparrow, 2000). Csikszentmihalyi's (1990, 1997) "Flow" framework provided a model

through which learner emotion could be documented, emotion that was subsequently connected to learner action (ways of engaging). It was through this connection that an understanding of whether PBLO and OLE design provided the necessary conditions for engagement. Despite a lack of ability to conclude whether study participants experienced a "Flow" state, all participants experienced anxiety and relaxation at different points throughout their work with the PBLO and OLE (see Chapter 4). Further, all four learners were able to act – to engage – in response to these states, and continued to do so as a means to continually converge on "Flow" or in attempts to achieve a state of balance between perceived skill and perceived challenge (see Chapter 4) (Csikszentmihalyi, 1990, 1997). In essence, all four learners continued to engage such that they fluctuated between states of anxiety and relaxation as their perceived skill and/or challenge levels changed over the course of working with the PBLO and other elements regarding the OLE.

ENGAGING WITH THE ONLINE LEARNING ENVIRONMENT (OLE)

As stated in Chapter 2, the parameters of the OLE include the following: constructivist, cognitive, and social. The researcher's intent was to create the conditions necessary for a social, constructivist environment – a design that had the potential of becoming a cognitive partner or "Mindtool" – one in which learners were in control, were enabled to come to their own conclusions regarding the situation within which they were situated as a result of collective engagement in seeking, identifying and defining relevant problems, as well as creating solutions (Jonassen, 1995, 1996). It was intended that the OLE would provide conditions through which learners could form their own mental models regarding the situation, not only independently, but collectively via negotiation of meaning – through the process of making "conjectures" and having them refuted by peers (and or the researcher) (Jonassen, 1996; Piaget, 1969; Popper, 1964). Finally, it was intended that learners be able to represent negotiated meaning (Popper, 1972). In this way, the OLE – including the PBLO – was intended to foster critical thinking and self-directedness by turning the focus from a teacher-directed and content focus to a learner-centered and process focus.

Although the researcher did not assess whether learners constructed new meaning (i.e. learned something new) – as assessment of learning was beyond the scope of this

study – it was evident that all four learners engaged and continued to engage in the OLE. Sources of anxiety and relaxation highlighted, regarding the OLE in general, were related to ability to use the technology – technological competence. Specifically, all learners engaged in response to either states of anxiety or relaxation regarding OLE tool and software use. A key problem identified regarded the wiki. As a result of identification of opportunities for engagement, all learners were able to solve issues regarding the wiki either independently or cooperatively. For example, learners cooperated as one member of each group was tasked with posting definitions in the wiki (i.e. a common goal), despite having negotiated content of the postings. Independent activity is reminiscent of "benign community neglect" that occurs as learners "configure their own learning relations with other apprentices" (Lave & Wenger, 1991, p. 93). Cooperative activity – or the division of labour to achieve a common goal – in this respect may also be evidence of learners trying to access a culture of practice: "legitimate access for apprentices depends on the characteristics of the division of labor in the social milieu in which the community of practice is located" (Lave & Wenger, 1991, p. 92). "Host status" in Adobe Connect was also the source of anxiety for all learners as they became aware that they needed to collaborate and negotiate the terms of technology use. All learners, however, were able to continue to engage in response.

The wiki, on the other hand, posed more of a challenge for the majority of learners and learners decided to both play with the technology and work together cooperatively to solve problems related to the wiki. Engagement in the form of "playing with the technology" is a result of the OLE design. The intent was to offer a "problem-solving space" whereby learners could think for themselves, using the technology, to explore their own needs and interests (Jonassen, 1996). None of the study participants had used Adobe Connect or the wiki prior to this study, providing the ideal space for an "exploration environment that [exploited] the interest and curiosity of the learner" (Jonassen, 1996, p. 240). Further, the purpose of this design was to "encourage [learners] to debug [their] knowledge rather than apply principles attained during direct instruction" (ibid). It was this curiosity with regards to the tools that the researcher was hoping to ignite through design of the OLE. Essentially, the researcher intended to create conditions necessary for use of the technology as a cognitive partner or "Mindtool" as participants

were given control to explore in order to come to an understanding regarding the affordances of the tools (e.g. the wiki) as a space for documentation of both independent and negotiated meaning (Jonassen, 1996). Specifically, it was intended that the wiki stored participants' initial definitions of chemistry thus offsetting the cognitive load enabling them to continue to negotiate meaning regarding other tasks – including the PBLO –enabling them to co-edit consensual definitions at the end of the exercise (see Chapter 3 for tasks embedded in Adobe Connect). In other words, it was intended that the wiki provide the opportunity to develop "epistemological competence" (Desjardins, Lacasse, and Belair, 2001). Measurement of competence development, however, was beyond the scope of this study, albeit of interest.

In terms of cooperation regarding the wiki, one participant from each group depended on his partner to continue to engage. For Group 1, this may have been a result of the researcher directing the learner that had learned how to navigate the OLE more readily (including the wiki) to work with her partner (see Researcher Impact below). For Group 2 participants, learners cooperated to post in the wiki, assigning the task to the partner who was more comfortable with the technology. Participants interacted regarding the tools available to them; however, they did not necessarily negotiate their meaning. Rather, they exchanged information regarding the affordances of tools implicitly agreeing that associated comprehension of the tools was necessary in progressing with the tasks. Further, it is possible that without the presence of peers, these learners would not have been able to complete the tasks using the wiki, within the given time frame. For example, two of the learners reported that despite their ability to continue to engage with the wiki, it either took too much time (i.e. half of the class) to learn how to navigate the wiki or that their skills regarding the blog needed improvement.

On the one hand, dominant learners who were able to learn about the tools more quickly took on the role of a more knowledgeable other (MKO), allowing partners to accomplish together what was not possible independently – to expand their zones of proximal develop (ZPD) with regards to the technology (Vygotsky, 1978). In addition, Lave & Wenger (1991) purport that rapid and effective exchange of information is characteristic of legitimate participation – or engagement – within a CoP. It is indicative of learners structuring their resources such that identification of opportunities for

engagement is possible. By enabling social interaction, the OLE design incorporated conditions through which social construction of new meaning regarding the technology was possible. Further, the movement from ability to solve problems independently regarding less complex tasks regarding technology (i.e. "host status") to dependence on peers – more advanced "apprentices" – regarding more complex tasks (i.e. using the wiki) is indicative of further division of labour or structuring of resources (including each other) in such a way that opportunities for engagement became apparent. Again, this is an example of learners attempting to access the culture of the CoP. Lave & Wenger (1991), highlighting that as "apprentices" configure relations within a CoP, "there may be loose couplings between relations among learners on the one hand and often hierarchical relations between learners and old-timers on the other hand" (p. 93). Dependence on partners is an example of formation of such a hierarchy as more "advanced apprentices" become not only legitimate peripheral participants (LPP), those with access to the community but those whose participation increases as they begin to "[absorb] and [be absorbed] in the 'culture of practice'" and further as they engage in such a way that "[makes] the culture of practice theirs" (p. 95). In other words, as more dominant learners took on the role of MKO, and as learners depended on their partners for assistance, all began to define the culture of their CoP in terms of practice – who the "more advanced apprentices" were; how they engaged; who the "newcomers" were; and how they acted (Lave & Wenger, 1991). The hierarchical nature of the community that began to develop within each group persevered throughout learners' work together (see discussions below regarding PBLO and Social Practice).

A key finding then, regarding the OLE in general regards learner technological competence. It appears that the lack of ability to use the technology, particularly the wiki, for two of the learners (one from each group) led to a focus on "learning about the technology" (i.e. how to use the technology) as opposed to using the OLE (i.e. Adobe Connect – its affordances and the tasks) and the PBLO as a means to "learning with the technology" or use of the technology as a cognitive partner or "Mindtool" (Jonassen, 1995, 1996). The obstacle presented by "learning about the technology" may have rendered the remainder of the work with the OLE – including the PBLO – less "transparent" for these learners, resulting in an inability for them to perceive the

significance of the OLE and PBLO in creating mental models regarding the situation within which they had been situated (Lave & Wenger, 1991; Piaget, 1952).

Further, dependence on peers was crucial for learners who maintained that the wiki was a major obstacle. As such, learners who were able to learn about the technology more rapidly, took on roles as MKOs – or mentors – ultimately defining the hierarchical culture of the communities that formed (Lave & Wenger, 1991; Vygotsky, 1978). One might even say that a culture of dependence – rather than the intended independence – arose. The dependence, however, shifted from dependence on the researcher to dependence on peers, one that forced learners to interact with each other as they completed the tasks, including navigating the PBLO.

ENGAGING WITH THE PROBLEM BASED LEARNING OBJECT (PBLO)

As mentioned in Chapter 2, PBLOs "are specifically designed to motivate or to initiate a process rather than to deliver actual curriculum content" (vanOostveen et al., 2010, p. 6). They engage learners in seeking, identifying, and defining problems, actions anchored within a realistic context (or situation), all prompting discussion and collaborative solution creation (Desjardins and vanOostveen, 2008; vanOostveen, 2011; vanOostveen et al., 2010). The intent of the design in this study was to foster discourse through problem creation and solution. The researcher introduced a context, including embedded content, as a strategy to initiate discussion and problem solving. Despite the embedded content, it was intended that the process, as opposed to content, was the focus. This approach to PBL, although somewhat different than vanOostveen, Desjardins, and Bullock's (2010) PBLO model, remains in line with the PBL approach as defined by Woods (1996) (see Chapter 2). Furthermore, as learners had not used PBLOs before the study, it was intended that learners would come to an understanding of how to use a PBLO. This was intended as the researcher sought to understand how PBLOs could be introduced to learners with the goal of continued use beyond the study.

Interpretation of findings followed the logic of the PBLO structure discussed in Chapter 2: the video case, the analysis/synthesis structure, and contextualized problems arising as learners work through the tool. The video case was designed as a means to introduce learners to a real-life context – one within which to engage in thinking about the situation presented, one to render the abstract more concrete (Brown, Collins, & Duguid, 1989; CTGV, 1990, 1992). Further, the video case was designed to ensure that learners were not simply presented with "information to be absorbed" (vanOostveen et al., 2010). It was designed as a means through which learners could identify with the situation, so they could begin to develop mental models regarding the context/situation presented (Piaget, 1969). In addition, the analysis and synthesis questions were included to prompt learners to further think about and discuss the situation presented both by the video case, further situating them within the context presented (vanOostveen et al., 2010). Finally, information introduced via 'pages' 2 and 3 of the PBLO – contextual and

subsequent theoretical information – was provided to, again, further situate learners within the context and to provide an alternative perspective to that presented via the video case and 'page' 2 of the PBLO. The theoretical perspective presented in 'page' 3 was intended to foster reflection regarding existing mental models as a means to allow learners the opportunity to either "assimilate" the information into existing "schema" or to alter their cognitive structure to "accommodate" new information (Piaget, 1952). In other words, these 'pages' of the PBLO were intended to engage learners further in problem solving, as a means to provide conditions necessary for construction of new meaning – for learning something new. The idea was that if learners had the opportunity to think about and discuss the context, framed by the video case, questions, contextual and theoretical information inherent to PBLO structure, they would be able to identify opportunities for engagement, as well as related learning opportunities (Lave & Wenger, 1991; Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). In this way, PBLO structure was designed to instigate discourse characteristic of "social practice" (Lave & Wenger, 1991) (see "Engaging in Social Practice" below).

In response to the video case, analysis, and synthesis questions. In general, all learners engaged in response to states of anxiety and relaxation experienced while working with the PBLO. Specifically, all learners were able to view and identify with the video case scenario and identified major goals as answering the analysis and synthesis questions. The majority of learners experienced a state of relaxation – they felt a sense of control – in response to the video case, as indicated by the fact that learners returned to the video several times as they worked through the PBLO, as they attempted to answer the analysis and synthesis questions. As such, they identified with the video case as a resource, as an opportunity for engagement, as intended.

On the other hand, Dan, from Group 2, experienced a state of anxiety related to the video case scenario, a state related to an inability to access the information introduced via the video, a result that was unexpected. Dan self-identified his inability to comprehend the language used in the video as a problem, a problem subsequently identified by John, from Group 1. Hence, for both learners, the language remained

inaccessible, perhaps affecting their ability to see the significance of the video case, which may have inhibited their ability to identify the significance of the PBLO in completing tasks, as intended. In response, John engaged his partner in assisting him to comprehend the video, again, emphasizing the culture of dependence that developed for this group from the beginning. Dan, however, responded in a unique way. Unable to form a mental model regarding the context, he discussed the video case with his partner, a discussion that took on the form of storytelling or "talking within" a practice (Lave & Wenger, 1991, p. 107-108). According to Lave & Wenger (1991), learning to talk is key in becoming a LPP and involves both talk "about" and "within" a practice (ibid). Furthermore, engagement within a CoP is "supported by conversations and stories about problematic and especially difficult cases" (p. 108). This learner participated in a conversation with Victor, his partner, and began telling personal stories regarding his own vehicle, prompting the arousal of other related stories from Victor. Ultimately, these learners were "talking within" their practice. It is possible that this conversation was the means through which learners were able to solve the problem of lack of comprehension of the video case scenario, in Dan's case, in order to continue to engage.

As a result of the conversation between Dan and Victor, learners decided that the video was insufficient in providing them with the information they needed to answer the analysis and additional personal questions that arose from their discussion, an unintended finding. As a result, they both left the OLE to conduct their own research using You Tube, Google, and Wikipedia. Despite viewing other sources, both learners in this group were unable to find the information necessary to address their problems, suggesting that they were unable at that point able to develop a mental model of what it was they were to do. It is possible that literacy issues – regarding technological competence (for both learners) as well as barriers regarding the language (for Dan) – were so great for these learners that despite recognizing the Internet as a source of information, they lacked capacity to use its tools. This indicates that these participants had identified finding the information needed to assist them in developing mental models regarding what to do with the PBLO as a priority, as opposed to actually moving forward with the rest of the PBLO. This type of engagement is an example "improvised practice" arising from a "learning curriculum" – a curriculum that evolves out of the actions of members of a CoP –

permitting the evolution for opportunities to engage (Lave & Wenger, 1991). These learners needed to figure out what to do with the PBLO before they could use it. Essentially, the significance of the PBLO in completing their tasks lacked transparency as they identified other opportunities for engagement as more pressing (Lave & Wenger, 1991).

Regardless of the development of a "learning curriculum," which was intended, the researcher intervened. Upon realizing that these learners were experiencing difficulty finding information via the Internet and that they had not accessed the contextual and theoretical information provided via the PBLO, to remain within the timeframe of the project, the researcher redirected learners back to the PBLO. Again, this interference was to ensure learners were able to come to an understanding of how to use the PBLO in completing tasks as well as the constraint of addressing specific curriculum (see "Researcher Impact" below). Upon return to the PBLO, Dan and Victor continued to discuss the analysis and synthesis questions in light of the information introduced via the PBLO. However, researcher interference hindered their curiosity as was evident in that both learners in Group 2 expressed frustration and felt rushed. Further, this interference essentially implied that there was 'a correct way' in which a PBLO should be used leading to further anxiety as they worked through the remainder of the PBLO. It is pertinent to note that despite the intent that participants work through all four pages of the PBLO, in an attempt to foster understanding of the tool's significance in completing tasks presented via the OLE, it was unintended that promotion of a "correct way" of using the PBLO arise. It is possible that this unintended consequence is a result of embedding content within the PBLO, as the focus on curriculum content became the reason why learners were redirected back to the PBLO. The question remains: what could have happened if Group 2 members were permitted to spend the allotted time researching on their own, based on interest and need? According to Lave & Wenger (1991), when teachers interfere or curriculum becomes the focus, even if a "learning curriculum" arises, it does not necessarily reflect that of the CoP, but rather is shaped by external constraints, ultimately negatively affecting development of engagement in the form of "legitimate peripheral participation." The researcher suspects this was the case for Dan and Victor. The "learning curriculum" that arose was in line with the researcher's intent

(i.e. content and competence development). Allowing Dan and Victor to continue with their own research would have lead to a more authentic "learning curriculum," one that was both relevant and addressed their needs, one that afforded further opportunities for engagement rather than crushing their curiosity.

Contextualized Problems. In terms of the contextual and theoretical information introduced to learner via 'pages' 2 and 3 of the PBLO, all learners were able to engage in response to continual fluctuation between states of anxiety and relaxation. John and Jane viewed the video case, each other, and other contextual and theoretical information provided via the PBLO as sufficient to address problems arising from the analysis and synthesis question structure. They were able work together such that they continued to engage and did so as one learner, again, depended on his partner to lead the discussion regarding the analysis and synthesis questions, deciding what to do, including which problems were relevant to address. Again, this hierarchical relationship between learners formed as they configured their relations within their CoP (Lave & Wenger, 1991). It is possible that engagement for John may have been hindered by this relationship (Lave & Wenger, 1991). However, he was still able to participate in discourse, and it appeared that his partner was able to "manipulate" the situation in a way that John was still able to engage. Either way, they continued to act together. Similarly, Dan and Victor were able to continue to engage.

Despite the ability to continue to engage, the amount of reading and the language used in the text introduced during this portion of the PBLO was problematic for John and Dan. John revealed his difficulty with reading while the other, Dan, highlighted his difficulty with the language. In response, learners cooperated with their partners to divide up the reading, discussed the concepts with their partners, and worked together to interpret how the content was useful given their goal of answering the analysis and synthesis questions. Group 2 members, again, left the OLE in an attempt to find information they thought necessary to find answers to the analysis and synthesis questions. In essence, a division of labour, "talking about" and "talking within" the practice, as well as structuring resources in a way that prompted further engagement occurred (Lave & Wenger, 1991). As a result, a "learning curriculum" – revealing the

need to address the ability to read and comprehend scientific jargon; communicate thoughts regarding scientific concepts in writing; and use technological tools to find and use information – unfolded as learners worked through this portion of the PBLO.

The more dominant members of each group experienced emergence of a different "learning curriculum" – opportunities related to taking on the role of a MKO. For example, as learners progressed through the latter pages of the PBLO, they led negotiations regarding next steps, read aloud, volunteered to take notes, and to post answers in the wiki on behalf of their partners, all in an attempt to reduce the challenges their partners were experiencing. In doing so, they ensured that their partners could continue to engage. In essence, their motivations for engagement took on a different flavour, that of manipulating the situation – not only with respect to the affordances of the OLE and PBLO – but in terms of their relations with their partners, in order to complete the tasks, as intended.

It is evident that the PBLO design did indeed allow – for the majority – learners to identify with the context introduced via the PBLO, were able to identify problems and create solutions related to embedded problems within the PBLO as intended. Through discourse with each other, dependence on each other for assistance, whether remaining with the boundaries of the OLE and PBLO or beyond, opportunities for engagement were identified and learners were able to act in response to states of anxiety and relaxation. The lack of transparency for some learners, regarding the language introduced via different components of the PBLO was a barrier for John and Dan. As a result, different "learning curriculum" developed. First, Dan and Victor decided that they needed to understand the language of the PBLO in order to decide how to act in response and moved beyond the OLE to be able to attempt to accomplish this. Although unsuccessful in finding the information they needed, due to technological competence issues and lack of time, this type of negotiated and self-directed engagement was intended by the PBLO design. Further, dominant members of both groups identified that they needed to take on the role of a MKO in order to assist their partners in achieving common goals of completing the analysis and synthesis questions, and the tasks. In this way, all participants identified opportunities to engage. Despite the intent of the researcher to avoid teacher-directed and content driven activity in regards to the PBLO, it was evident

that her preconceived agenda was present. As indicated, her own desire to ensure learners understood how to use a PBLO, as well as covered the content provided via the PBLO, made it very difficult to maintain focus on learner needs and processes versus teacher needs and processes.

ENGAGING IN SOCIAL PRACTICE

In general, the intent of PBLO use was to engage learners in "social practice", to foster "legitimate peripheral participants" (LPPs) within a "community of practice" (CoP) as a means to provide a situated learning experience (Lave & Wenger, 1991). "Legitimacy" refers to a sense of control learners gain over resources in practice, resulting in a sense of belonging or membership. Fostering opportunities for legitimacy within a CoP depends on structuring of resources with the "social milieu in which the community of practice is located" – in this case the OLE, of which the PBLO is an essential component (p. 92). Characteristics of structuring resources in this way include identification of opportunities for engagement (i.e. "strong goals for learning"), the unfolding of curriculum, a development of hierarchical relations among peers, and the rapid, effective spread of knowledge among members (Lave & Wenger, 1991). Peripherality refers to the degree of participation or engagement within a CoP - "growing participation" within the community once access is achieved (Lave & Wenger, 1991). Specifically, the intent of using a PBLO in conjunction with the OLE was to foster "social negotiation of meaning" of what it meant to be a part of this CoP – whether that intended by the researcher (i.e. community of a group of learners preparing for a science PLAR assessment within the context of PBL online) or a collectively, learner defined culture of practice – as learners worked together (Jonassen, 1996; Lave & Wenger, 1991). The intent was that a CoP would form as learners completed intended actions such as: reading and comprehending text and diagrams; viewing and identifying with the video case scenario; and identifying and creating solutions to problems.

Corroborating evidence of social interaction revealed thus far, whereby learners depended on and mentored each other, negotiated next steps, and engaged in discourse as they navigated the OLE and worked through the PBLO, the majority of learners experienced a state of relaxation regarding working together online. Further, all learners

were able to respond as follows: via identifying resources for each other (e.g. affordances of the OLE; each other; the researcher), using communication tools to communicate, initiating and participating in discourse regarding problems and goals, and negotiating next steps and answers to questions. As such, all learners were able to structure their resources such that opportunities for engagement (or "strong goals for learning") were identified. All learners recognized that they were to complete tasks given via Adobe Connect, including working with the wiki and the PBLO. Further, learners identified the analysis and synthesis questions given in the PBLO as key to completing the tasks. Despite dependence on partners, all learners were still able to structure their resources in a way that allowed them to continue to engage.

Key evidence that learners structured resources in a way that allowed for identification of opportunities for engagement – hence legitimate participation – included the "unfolding of curriculum," the evolution of hierarchical relations amongst group members, rapid and effective spread of knowledge among peers, as well as "talking within practice" or storytelling. According to Lave & Wenger (1991), "practice of the community creates the potential 'curriculum' in the broadest sense – that which may be learned by newcomers with legitimate peripheral access" (p. 93). As mentioned, as learners engaged with activities both regarding the OLE and the PBLO, a "learning curriculum" arose, a curriculum that would not have existed without the interaction between group members. First, a curriculum regarding the need to develop technological competence that allowed learners to fully use the technology – specifically the wiki and later Internet tools such as You Tube, Google, and Wikipedia – was identified. Second, a curriculum identifying the need to come to comprehend the language introduced via the PBLO arose. Without discourse, learners may not have been able to identify their own needs, suggesting that this was truly a "learning curriculum" (Lave & Wenger, 1991).

Having said this, it has been stated that the research also had several curriculum and goals that she had identified for this project as well. Hence a "teaching curriculum" was also present – one that is constructed for "newcomers" (Lave & Wenger, 1991). The prevalence of the perceived need to ensure learners developed competencies necessary for learning with technology and that they understood how to use a PBLO is an example of such a curriculum. According to Lave & Wenger (1991) such a curriculum…

> "…supplies – and thereby limits – structuring resources for learning, the meaning of what is learned (and control of access to it, both in its peripheral forms and its subsequently more complex and intensified, though possibly more fragmented, forms) is mediated through an instructor's participation, by an external view of what knowing is about" (p. 97).

As such, the prevalence of the researcher's previously conceived notions and agenda might have hampered cooperation and collaboration, hence the ability for learners to identify opportunities for engagement (for learning). Further, the implication that there was a "right way" to work with the OLE and PBLO may have fostered the aforementioned culture of dependence.

However, evidence of legitimacy was evident in the evolution of hierarchical relationships between group members. Lave & Wenger (1991), again, highlighting that as "apprentices" configure relations within a CoP, "there may be loose couplings between relations among learners on the one hand and often hierarchical relations between learners and old-timers on the other hand." In terms of both the wiki and the language introduced via the PBLO, one participant from each group depended on his partner to be able to continue to engage. The movement from ability to solve problems (or reach goals) independently regarding less complex tasks regarding technology (i.e. host status) to dependence on peers – more advanced "apprentices" – regarding more complex tasks (i.e. comprehending the content introduced via the PBLO and using the blog) is indicative of further division of labour such that structuring of resources (including each other) in such a way that opportunities for engagement become apparent. Dependence on peers in this way is an example of formation of such a hierarchy as more "advanced apprentices" (as opposed to "old timers") become not only LPPs, those with access to the community but those whose participation increases as they begin to "[absorb] and [be absorbed] in the 'culture of practice'" and further as they engage in such a way that "[makes] the culture of practice theirs" (p. 95). Despite initial difficulty regarding technology use associated with the OLE, study participants were able to engage as legitimate participants due to development of such relations within the CoP.

Yet another indication of legitimate participation included the occurrence of rapid, effective spread of knowledge among group members. Specifically, with regards to

learning about the technology, learners exchanged information to ensure that both members of each group could move forward with the tasks. This took less than an hour with Group 1 and 15 minutes with Group 2. This kind of exchange regarding using the wiki as well as using other affordances of Adobe Connect (e.g. File share) continued throughout the exercise as learners identified problems related to technology as key in advancing toward their goals.

Finally, as mentioned, further evidence of legitimate and peripheral participation was revealed as Dan and Victor began not only to "talk about" their practice but were able to "talk within" their practice. The use of storytelling during their conversation regarding the video case scenario is evidence that learners were attempting to support each other as they engaged within the CoP. It is possible that this was the beginning of peripheral engagement regarding the PBLO as learners were truly working together. This was corroborated as both Dan and Victor stated in their interview and blog that despite challenges regarding using the technology, if asked, they would engage in this experience again. Further, they revealed that if asked to use the technology as second time, they felt they would be more confident. John and Jane, on the other hand, although legitimate participants based on their ability to structure resources and the development of hierarchical relations, did not engage in such discourse suggesting that they may have not reached the level of peripherality of the other group. In other words, they were able to access and develop a mental model of the community, and may have even come to understand its culture; however, they may have not developed a sense that the culture of practice became their own. This is possible due to the unintended prevalence of the researcher's agenda.

In light of these findings, it is apparent that all participants were likely legitimate participants as they were able to structure their resources in a way that they could identify opportunities for engagement (for learning) (Lave & Wenger, 1991). However, evidence regarding peripherality is scant. Peripheral participation may have been evident in terms of learners' ability to continue to engage using the technology – they were able to improve their skills as a result of interactions with their partners. Peripherality, however, seems to be most visible from the conversations between Dan and Victor. Since Dan and

Victor comprised the second group to use the PBLO, they may have benefited from fewer interventions of the researcher, as she also began to learn when not to engage.

RESEARCHER IMPACT

Due diligence regarding the project is not possible without discussing the actions of the researcher. The researcher's intent was to intervene only when needed, to minimize her presence online so as to leave the control and decision making to the participants. Initially, all learners depended on the researcher to assist with technological issues, to inquire about how to use the wiki, to ensure their wiki posts were presented in accordance with the standards of the researcher (i.e. that they "were doing it right"), and to clarify tasks and questions. In response, the researcher directed learners on how to use the technology and scaffolded with regards to wiki posts and questions. Initial dependence on the researcher resulted in a lack of cooperation and collaboration among peers, questions regarding "how the blogs should look", and desired input regarding "how answers should appear." To alleviate this dependence, and with the intent of emphasizing that learners were in control and were to come to their own decisions and negotiate, the researcher directed learners to do the following: 1) to work together to ensure cooperation or collaboration on tasks (this included scaffolding learners to ensure they remained "together" on a task); 2) to review the written instructions regarding the tasks provided via the Notepod in Adobe Connect (including those regarding the expectations regarding the wiki/blog and how to access the PBLO); and 3) continue with next steps in the PBLO to ensure learners remained within the given timeframe.

The researcher directed learners more than she had originally intended creating more of a focus on teaching than she had hoped. The prevalence of a behaviourist model was clear both from the perspective of the participants and the researcher. First, participants were obviously used to depending on a teacher for guidance, which may be attributed to past educational experiences. Second, the researcher was under the constraints of curriculum and the complexities of action research. As mentioned in Chapter 2, in more traditional models of online learning circumstances, teaching rather than learning is the focus, and the teacher's role is to provide "content expertise through a

variety of forms of direct instruction" (Anderson, 2008, p. 345). The content in this case, and in terms of the OLE in general, implied a "right way" – that intended by the researcher – to address the tasks, to post in the blog, to use the PBLO, and to work together. This form of teaching presence – that of expert from the behaviourist perspective versus that of a guide or coach from a constructivist perspective – may have intensified participant inability to come to his/her own conclusions regarding the situation or to develop a sense of ownership over the culture of practice, ultimately fostering a culture of dependence (Jonassen, 1995; Lave & Wenger, 1991). The fact that the researcher directed learners regarding the form in which their wiki postings should take, to work with each other (i.e. dominant learners were coached to work with their partners) to avoid dependence on the researcher, to return to the PBLO in response to learners leaving the OLE, and to move on to remain within timelines is evidence of the researcher's agenda, an unintended "teacher directed" model and prevalence of a behaviourist perspective. As a result, it is most likely that more dominant group members adopted the notion of a "right way" or correct practice within the community, a culture that they inadvertently demonstrated for their peers. As a result, the communities that began to emerge within each group took on a culture of dependence, opposite of what the researcher had intended.

Although this level of researcher interference was not the original intent during the design of the OLE and the study, it was difficult to avoid for several reasons. First, the researcher was in a position whereby delivering a secondary school science curriculum was unavoidable as she was in a position of preparing learners for a pre-set, government created, standardized assessment. It was evident that implementation of a mandated curriculum was the focus as the content of the preparation materials provided by the institution was identical to that of the assessment. Further, the researcher anticipated implementation of a second curriculum framework – that of a second governing body – for which she was mandated to "implement." Third, and more in-line with the original intent of the project, the researcher sought to understand development of competencies necessary to learn with technology (i.e. technological, informational, social, and epistemological) - to use technology as a cognitive partner – in an attempt to offer an experience that went beyond delivery of information to be absorbed (Desjardins

and vanOostveen, 2008; vanOostveen et al., 2010). Her response was to attempt a PBL online approach as to providing a more engaging experience. This attempt, in light of competing government and personal agendas, became more difficult and complex than originally thought.

Further, beyond curriculum and desired learning outcomes, the realities of action research – conducting and being a part of the research simultaneously – offered its own set of complexities. First, the space within which the study was conducted was a simulated distance education scenario. Despite the researcher's attempts at minimizing her effect, her presence in the room and/or building within which learners were working made it easier for direct communication with the researcher beyond the OLE. Desjardins and vanOostveen (2008) found a similar issue during their research with the Collaborative Online Learning Environment (COLE).

According to Lave & Wenger (1991), identifying opportunities for engagement is characteristic of identifying opportunities for learning. Hence, it follows then that engagement observed in response to the OLE may have conformed to the original intent, as learners were able to continue to identify problems that they felt necessary to address. In essence, learners in general were able to think about their situation with regards to the OLE in general and to make conclusions about it, ultimately allowing them to engage (Jonassen, 1995). However, the form in which the teaching presence revealed itself during the exercise impacted learners in an unintended way. The agendas affecting this researcher's practice, in addition to her physical presence, may have affected the development of peripheral participation – particularly for John and Jane - enabling a culture of dependence rather than the intended culture of independence.

ADDRESSING THE GAP

Although the researcher was able to come to a better understanding of the goal of PBL online and the intent of PBLOs, the effect of a set curriculum and preconceived notions regarding her personal practice – ultimately the effect of government legislation and institutional policy – remains strong. As such, despite the evidence of legitimacy, peripherality was not prevalent in this study. It is premature, then, based on the findings of this study to state whether learners were legitimate peripheral participants (LPPs)

within a CoP. At best, one can say that the learners were beginning to relate to each other in such a manner that they were able to access their perspective CoPs. Based on these findings, this researcher feels that much work is to be done in adopting a PBL online approach as a means to foster "social practice" for this group of learners, participating in the LBS/PLAR program at the school board in question. The unintended teacher-centric, content-focused approach remains, despite the efforts to focus on the learning.

CHAPTER 6 - CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

As mentioned, the PBLO designed for this study was intended to offer an alternative to a traditional method of preparing participants for the science PLAR assessment. Further, it offered the conditions necessary to give control to learners to identify their own opportunities for engagement, while still addressing content necessary in preparation for a standardized government assessment. It was intended to introduce learners to content related to the secondary school curriculum via a realistic context, while simultaneously enabling learners to identify their own learning needs through discourse and problem solving. Ultimately, the design was intended to create the conditions for "social practice," conditions for learning. Although it is not possible to conclude that participants of this study engaged in "social practice," review of main conclusions, study limitations, and recommendations for future research is warranted, all topics of this Chapter.

Conclusions. In general, participants engaged in response to states arising during work with the PBLO and OLE. Further, cooperation and collaboration was crucial for the majority of learners to continue to engage. Participants were able to communicate online, and through discourse, self-identified problems, those both related to PLAR preparation content as well as their own – barriers associated with technological and informational competence. Further, learners were able to structure their resources (including each other) in a way that allowed them overcome obstacles and identify opportunities to engage. This was specifically evident in the hierarchical relations that formed amongst group members. In this way, a sense of legitimacy within communities of practice was evident. Regarding more dominant learners in each group, peripheral participation was also evident, specifically with regards to development of increased ability to use the technology over time. Alternatively, peripherality was less prominent for other participants due to dependence on partners, suggesting peripherality as an emergent quality of the communities. As such, it is possible that "social practice" within a CoP began to evolve over the three-hour study but had not fully developed.

Limitations. The findings of this study were not only then limited in context – to this case – but by time. Since the study took place over such a short period of time, it is suspected that learner experience was impacted. Specifically, the shortage of time impacted the researcher in terms of the way she engaged online (i.e. her concern with observation of learner engagement with the PBLO and OLE and to ensure specific curriculum was covered). Further, this researcher's approach to data collection (i.e. a research-directed approach) may have also affected the pedagogy leading to a focus on curriculum during facilitation of this attempt at PBL online. As such, evidence of the impact of a "teaching curriculum" or preconceived agenda – became apparent. It is possible that the ways in which the researcher communicated with learners and asked questions, as well as her explicit directives, not only indicated that was there a time constraint but implied a "right way" to engage, a "correct way" to use the PBLO. As a result, an unintended more teacher-directed, content focused – a more traditional model of online learning – resulted, accompanied by evidence of a culture of dependence.

The observed shift away from a learner, process focus may not be, however, due to the OLE and PBLO design. Rather, the perceived need to implement curriculum – institutional constraints with which all action researchers must contend with – prevailed. For this researcher, two curricula– secondary school science and adult literacy – were mandated by two separate governing bodies. Further compounding the situation was the fact that learners were preparing for a standardized assessment, a high-stakes test. Due to increasing pressure of governing bodies on administration to maintain eligibility for funding, as well as the learner timelines, implementation of curriculum was expected to occur within a certain time frame. Essentially, the constraints under which the researcher conducted this study and her resulting actions became the factors that impacted whether the PBLO was used as a cognitive partner (i.e. a constructivist model). Ultimately, researcher actions – in response to forces beyond her control - affected whether the learners and learning remained the focus and ultimately whether a constructivist, PBL model fostering independence was possible.

Finally, although the development of a "learning curriculum" – one that highlighted learner needs to improve technological and informational competence – the study did not address epistemological competence necessary to use technology as an

cognitive partner. The intent of implementing PBL online via the use of PBLOs is to engage learners in "social practice" as a means to prompt construction of new meaning regarding the context within which one has been situated through reflecting on one's cognitive processes (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). In doing so, learners become autonomous in determining gaps in understanding, ultimately motivating them to continue to learn. In essence, learners learn how to learn. In providing the context (i.e. via the use of PBLOs) necessary for this type of critical reflection, it becomes possible for learners to be able to apply their thinking across multiple contexts. This study did not assess learners' ability to reflect on their own cognitive processes, a consideration for future research, particularly in the context of preparing for PLAR. Cognitive process, versus content, needs to remain the focus.

Recommendations. Based on the findings and limitations highlighted from this study, there are many questions that arise. Since the PBLO and OLE designed engaged learners in this study but insufficient time was available to observe the practice over a longer period of time, it was difficult to know how a mature CoP for this group could look. Further, since participants in this study identified obstacles related to technological and informational competencies – questions arise as to the timing of introducing learners to PBLOs. What was also clear, in addition to explicit curricula under consideration, was the hidden agenda of the researcher, which resulted in the maintenance of a traditional model while the researcher struggled between relinquishing control and implementing mandated curriculum. Specifically, in order to understand PBLO use, the researcher was influenced by a perceived need to ensure learners viewed the entire PBLO, implying that there is a "correct way" to use a PBLO. This is not the case.

It is recommended, then, that a longitudinal study be conducted, either with the school board in question or one that uses a similar model of PLAR Preparation. Such a study could involve several students across one LBS/PLAR Preparation program – preferably not in the same location – with the intent of not only gaining more insight into what a CoP for this group of learners may look like and how it "reproduces" itself over time, learner needs that arise (i.e. a "learning curriculum"), roles of the players (i.e. learners, practitioners, and administration), as well as the opportunity to incorporate

assessment of epistemological competence development from PBLO use (Desjardins and vanOostveen, 2008; Lave & Wenger, 1991; vanOostveen et al., 2010).

To address the original intent of PBLOs to prompt growth in epistemological competence – to prompt reflection on cognitive processes – assessment of thinking must be considered in any future investigations. This consideration could be incorporated into the pedagogy via use of semantic networks (concept maps) (Jonassen, 1996). Essentially, learners could be prompted to create concept maps using freeware such a CMap providing a representation of perceived meaning regarding the presented context after initial experience with a PBLO. Further, after discussion with peers and a PBL facilitator regarding PBLO use, learners could be prompted to reflect on their thinking by adding to their concept maps. This process would result in a pre and post-PBLO use, as well as a pre and post-discussion, representation of each learner's meaning regarding their thinking, with the context as the "anchor." Finally, learners could be prompted to individually reflect on how their thinking changes over time, as a result of PBLO use and related discourse, by comparing their concept maps. In other words, learners could be asked to reflect on their own cognitive processes by comparing their thinking pre and post-PBLO use and pre and post-discussion. Finally, a representation of the reflection would be warranted to allow learners to potentially construct meaning regarding their own cognitive processes by entering Popper's "Third World" (Popper, 1972). This representation of meaning could be utilized to assess any growth in epistemological competence that may (or may not) have occurred via experience with a PBLO.

In order for further investigation to include the epistemological affordances of PBLO use, any methodology adopted requires a similar focus to ensure that the methodology corresponds to the pedagogy – to reduce researcher impact as was evident in this study. An accommodated methodology can prompt participants to reflect on their cognitive processes; however, rather than focus on the context presented via the PBLO, a new context – that of cognitive processes and constructed meaning regarding perceived experience with the PBLO – warrants consideration. In other words, rather than "thinking about thinking" and constructed meaning regarding a context such as "alternate fuels," learners can be prompted to think about their thinking and learning regarding the

experience of using a PBLO. Either way, the methodology needs to correspond to the pedagogy.

To broaden the scope of the study in terms of the number of participants, the researcher needs to consider a more timely and effective means through which to gather information. This is an opportunity to consider methodology that reflects the social aspect of the pedagogy proposed. One solution involves conducting Repertory Grid Interviews with groups of learners. Further, conducting the interviews using the same technology (e.g. Adobe Connect) can allow for the method to correspond to the online pedagogy, and the group format would emphasis the "community" rather than the researcher/teacher. Interviews conducted online would also allow for participation across LBS programs and sectors. Essentially, engaging in research and with a PBLO has potential for growth of epistemological competence and associated construction of new meaning, regardless of curriculum content. If learning is the goal, focus on cognitive process, no matter the context, is essential.

Opportunities for Further Research. Questions related to timing in adopting PBL online in an LBS/PLAR Preparation context include the following:

- Given that learners in this study self-identified obstacles highlighting difficulties related technological and informational competence, when is it – if at all – relevant to introduce a PBLO to adult literacy learners preparing for PLAR? How can this be assessed?
    - Is there a role for the General Technology Competency and Use (GTCU) questionnaire (http://gtcu.eilab.ca/)? (Desjardins, vanOostveen, Blayone, and Childs, 2013).
- Once a PBLO is introduced, what would occur if the teacher/researcher removed him/herself from the OLE giving full control of the experience to the learners?
- What would be the reproduction cycle of the CoP?
- How could the reproduction cycle of the CoP – if at all – inform PBLO use within an LBS/PLAR preparation context (i.e. how would it inform the model of PBL online that is adopted)?
- What roles would both learners and practitioners/researchers take on?
- What roles would administrators take on?
- What could be said regarding curriculum arising, if any, out of this type of a situated learning experience (i.e. would it have any parallels with those that are mandated)?

Answers to these questions may provide information regarding the timing associated in adopting a PBL online approach within the context of LBS/PLAR preparation, allowing development of proof of concept necessary to fully implement PBL online using PBLOs. The question remains: How does one come to adopt a PBL approach? Further, how can the benefits, in terms of maintaining the focus of LBS/PLAR Preparation programming on learners and learning, of this type of PBL online approach be fully comprehended by practitioners in the field?

Further research, from this perspective, involves engaging administration and practitioners in discourse regarding PBL online. Existing literature suggests that situating practitioners within a context using a PBLO embedded in a collaborative online environment (COLE) may be one way (Desjardins and vanOostveen, 2008; vanOostveen et al., 2010). However, it is recommended that in this case, practitioners be given creative control over their environment, that they create PBLOs as they are learning about PBL online (vanOostveen, unpublished). Possible questions that arise include the following:

Set 1 – Engaging LBS/PLAR Program Administrators and Practitioners in PBL Online via use of PBLOs

- Is there an interest amongst LBS and PLAR Practitioners in Ontario school boards to adopt a PBL online approach?
- What are the barriers to adoption of PBL online – if any?
- How could both administrators and practitioners become engaged in the use of a PBL online approach?
- What is the role of PBLO theory in addressing these questions?

Set 2 – Determining Professional Development Needs

- Do practitioners have the technological, informational, social, and epistemological competence to come to understand the significance of PBLOs in terms of maintaining learning as a focus for programming? How can this be assessed?
    - Is there a role for the General Technology Competency and Use (GTCU) questionnaire (http://gtcu.eilab.ca/)? (Desjardins, vanOostveen, Blayone, and Childs, 2013).
- What professional development training would be necessary for LBS/PLAR practitioners to introduce the PBL online approach, in addition to PBLO design and use, in their own program?
- What is the role of PBLO theory in addressing PD needs?

- In light of the major changes to LBS over the past years, when should PBL online/PBLOs be introduced to practitioners (i.e. in order not to "scare" them off)?
- How would one introduce PBLOs in the form of PD? What is the best way to do PD?
- What model of PBL online would be most effective for this community of practice?

Finally, in a time when LBS practitioners are encouraged to develop new competency-based programming, more recently with a focus on essential skills training and "problem solving within technology rich environment" (OECD, 2013), and as post-secondary institutions are urged to improve to access to both diploma and degree programming, further research regarding this study may overlap with the concept of "disruptive innovation" – developing new programming for those who may not have ever considered further training or education as an option (Christensen, 2014). New program development could be a means through which PBL, PBL online, and hence PBLOs could be introduced to the LBS field - via either school board, community, or post-secondary sectors – in a way that warrants innovative learning environments and associated professional development that not only meet the requirements of governing bodies and institutions (i.e. targets and funding) but those of practitioners and learners.

In conclusion, despite little evidence of "social practice," this case study revealed that communities of practice may have begun to form in response to PBLO use. It is evident, then, that the PBLO and OLE design afforded opportunities for engagement. Despite this, the constraints of curriculum – and resulting researcher intervention – prevailed ultimately affecting the ways in which learners engaged. Questions remain if this approach can actually take on a learning focus, given institutional constraints. It is recommended that a longitudinal study be conducted to gain further insight regarding the "reproduction rate" of communities of practice such as those in this study. In addition, further research regarding the possibilities for adopting PBL online via PBLO use across a broader context, for learners, practitioners, and administrators of LBS programs across community based, school board, and post-secondary sectors in Ontario.

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APPENDIX 3-A: Research Information & Consent Form

RESEARCH INFORMATION & CONSENT FORM*
(Faculty of Education Undergrad and Graduate Students)

The Effect of Problem Based Learning Objects (PBLOs) on "Flow": A Case Study of Adult Learners, Secondary School Science, and PLAR

Dear Potential Study Volunteers:

You are invited to participate in a research study with the purpose of determining the effect of a virtual classroom (Adobe Connect) on "FLOW" – concentration, interest, and enjoyment – in adult learners participating in the science part of Prior Learning Assessment and Recognition (PLAR). Adobe Connect is an online "classroom" that provides the opportunity to complete a set of "activities" with other learners online. The goal of the "activities" is to find and solve problems by working through problem based learning objects (PBLOs). PBLOs are part of the "activities" and ask learners to watch video clips outlining scenarios, answer questions, and read informational text (Desjardins & vanOostveen 2008).

Adobe Connect has been chosen for this study as it is a "classroom" that can provide a student with a "FLOW" experience – an enjoyable and interesting experience that allows a student to focus and engage in learning (Csikszentmihalyi 1990, 1997). Adobe Connect can be engaging as it provides the "activities" (including the PBLOs) that offer collaborative, online, and problem based learning – learning types that have been documented to engage both secondary school science and adult learners (Ally 2008; Anderson 2008; Annetta et al. 2009; Bartholomew et al. 2004; Bencze 2001; Desjardins et al. 2001; Desjardins & vanOostveen 2008; Jonassen 1995, 1996; Lave and Wenger 1991; Pickens & Eick 2009; Hodson 2009; Peters & Slotta 2009; Savin-Baden, 2007; Slotta & Peters 2008; vanOostveen, Desjardins, & Bullock 2010). Since Adobe Connect offers the "activities" and associated PBLOs that may lead to engagement in learning, it has been chosen to examine the effect of the PBLOs on concentration, interest, and enjoyment of students preparing for the science PLAR assessment.

Participants in this study will be asked to do the following:

1) Attend a 2.5-hour orientation session, allowing learners to "play" with the features of Adobe Connect. This session will occur during ***regularly scheduled class hours*** **(Day 1).**
2) Attend a second 2.5-hour session, working with classmates, to complete the Chemistry Unit of the science PLAR preparation using Adobe Connect. This will involve working through a series of tasks, including the PBLOs, to complete the Chemistry Unit. This session will also require you to blog about your experience in working with the virtual classroom **(Day 2).**
3) Attend a third 2.5-hour session to complete an online survey and to participate in an interview discussion with Judith Amesbury (Principal Investigator), outlining further detail regarding experiences with Adobe Connect. This session will occur during ***regularly scheduled class hours*** **(Day 3).**
4) Attend a fourth session of no more than 1 hour to participate in a follow-up interview with the Principal Investigator **(Day 4).** ***This session will occur during regularly scheduled class hours.***

Data Collection

With your consent, I (Principal Investigator) hope to collect feedback from you with respect to studying science through this online "classroom", particularly the PBLOs. Your participation in the project will help me assess the effectiveness of the PBLOs and their impact on engagement in adults preparing for the science PLAR assessment. Specifically, I would like to document your experiences through collection of a variety of materials. These materials include:

1. Recordings (video, audio and software) of your interactions with and conversations about the "activities", problem-based learning objects (PBLOs), and Adobe Connect in general. These recordings will be taken throughout the four day study.
2. Blog postings of individual and group definitions, notes, and descriptions of experience in using the Adobe Connect and the PBLOs. (Day 2)
3. Survey (Day 3)
4. Individual interviews (your responses will be documented in tables called "grids") (Day 3 & 4)

NOTE: The data collected for this study will not affect your progress or standing within the Literacy Basic Skills (LBS)/PLAR Program. Data collection will occur during regularly scheduled PLAR preparation classes. This study has been reviewed and received ethics approval from the UOIT Research Ethics Board (Application #: 10-095). Questions pertaining to the Research Ethics Board or to the rights of participants can be addressed by the UOIT Ethics and Compliance Officer (905.721.8668 x3693 or compliance@uoit.ca).

There is minimal risk involved with your participation in this project, as only one unit (of four) of the science PLAR preparation will be conducted through the use of this online environment; the remaining three units will be executed in the regular face-to-face format, with usual guidance from your Instructor. The benefits from participating in this study will be for future PLAR candidates studying science. The results from this research will expand current understandings within the Literacy Basic Skills (LBS) and PLAR communities through the development of: i) a problem-based learning model for the support of adults preparing for PLAR online, and (ii) an exploration of the effects of video-based case studies on engagement in this context. Information regarding the project is available upon request from the Principal Investigator (see the contact information below). In addition, notices about project conference presentations and project progress reports will be available at the end of the study via the Principal Investigator.

Responsibilities of the Principal Investigator and Study Volunteers

The Principal Investigator is: Judith Amesbury
(Supervisors are: Dr. Roland vanOostveen and Dr. Francois Desjardins)

1. Right of Refusal. You have the right to refuse to participate in the research described above and may, no reasons given, withdraw at any time. To withdraw from the study, you need to contact Kathleen Glover at (705) 740-2609 or kathleen_glover@kprdsb.ca (Trinity Church) or Mavis Stapleton (705) 745-9833 or mavis_stapleton@kprdsb.ca (PCIS). However, all data collected regarding Adobe Connect will remain part of the data set indefinitely. Participation or non-participation in the project will not affect your standing in the Program. You will have the right to examine data and conclusions and refuse their use in academic publications upon request. In order to invoke these rights please contact the Principal Investigator.

2. *Anonymity*. Anonymity will be preserved outside of this study, as much as possible. All identifying information will be stripped from any data used and reported, however since much of the data collection techniques used here will include video recording, it is impossible to ensure that you will not be recognized. As far as possible, however all other identifying information will be removed from the recordings. By participating in this study you are consenting to keep the content of your participation, as well as identities of other participants, confidential outside of this study.

4. The Principal Investigator invites you to contact her at any time regarding any aspect of the project. Relevant contact information for her is given in the box on the previous page.

5. All data collected, except video/audio-recordings, will be protected by standard security protocols at the EI Lab at UOIT, including SSL security with password protection. Any miniDV (AV) tapes used will be stored in a locked drawer in the office of the principal investigator.

6. *Secondary Use of Data*. The data collected regarding your use of the video case study and the reflections on it may be used by this research team (Principal Investigator – Judith Amesbury, Supervisors – Dr.

Francois Desjardins and Dr. Roland vanOostveen) for comparison purposes with data collected from other studies dealing with PBLOs in other contexts; however, the videos will not be distributed outside UOIT.

CONSENT TO ACCESS LEARNER TRANSCRIPT AND LBS FILE

This study involves learners who are eligible for the science portion of PLAR. In order to assess eligibility, the Principal Investigator (Judith Amesbury) must have access to your latest secondary school transcript (or the document that was submitted to the Campus Program Leader upon registration) as well as results from the Literacy Basic Skills (LBS) Assessment that you wrote on the first day of participation in the LBS/PLAR Program. The Principal Investigator may also require examination of LBS class work completed to date.

By signing this agreement, you are giving the Principal Investigator permission to access this information to confirm your eligibility for this study.

I, the undersigned, agree to have my transcript and LBS Assessment (and/or class work) reviewed to assess eligibility for this study.

_____
(Printed Name of Student)

_____
(Signature of Student)

_____
(Date

CONTACT INFORMATION

Judith Amesbury, Principal Investigator Graduate Student, UOIT (705) 745-9833 Ext. 28	Dr. Francois Desjardins, Supervisor Associate Dean, UOIT (905) 721-8668 Ext. 2198	Dr. Roland vanOostveen, Supervisor Director, B.Ed. Programs, UOIT (905) 721-8668 Ext. 2657

CONSENT TO PARTICIPATE

I, the undersigned, agree to participate in this project and to the conditions stated above:

_____
(Printed Name of Student)

_____
(Signature of Student)

_____
(Date)

APPENDIX 3-B – PBLO Template

Page #1
Title: Matter

Clip (Alternative Fuels) * Note -[0:00-2:48; portrays small scale hydrogen fuel and biodiesel production processes]

Static Line:
This video portrays examples of alternative fuels.

Questions:
1. What waste product of the car is the man drinking, what does it look like, and what is it made of?
2. What is the fuel of this car, what does it look like, what are the sources of this fuel, and how is it produced?
3. What is biodiesel made of?
4.What are the characteristics of biodiesel, its ingredients, and its waste products? (biodiesel; clear, golden liquid; methanol, vegetable oil, lye (NAOH); clear liquid, opaque, viscous liquid, solid)

Transcription:

Imagine a car that's got electric motors in every wheel, an onboard source to generate electricity, no mechanical linkages whatsoever, and a fuel more prominent than any element in the universe – with drinkable water as an exhaust. "Ah, très bien!"

Fantasy ? No. It's a hydrogen car, and it's right around the corner.

Hydrogen is the most abundant element in the universe. About 92% of the universe is made up of hydrogen. We have abundant sources in the form of water, and in the form of hydrocarbons that are under the ground, as well as in the form of grasses and trees above ground.

Water is made up of 2 hydrogens and 1 oxygen – H_2O – and in order to separate the two, we need to perform electrolysis. What this process does is it takes that molecule and splits it down the middle to its component parts: hydrogen and the oxygen. The hydrogen is separated and then captured as a gas, but how does this elusive fuel work in cars?

To get the full use of hydrogen, you need a fuel cell car. A fuel cell is essentially the reverse of an electrolysis process. That way, you combine hydrogen and oxygen and generate electricity. If you have hydrogen fuel stored in fuel tanks, much like we do today with gasoline, but hydrogen instead, and you take air in – like we do from the atmosphere – you will generate water and electricity in the fuel cell. The water goes out the tail pipe into the atmosphere, and the electricity goes to an electric motor, which turns the wheels around.

Another Option

The process of making biodiesel is so easy, you can make it using materials you can buy at the grocery store. The three ingredients you'll need are methanol, sodium hydroxide, and any type of vegetable oil. I use a glass container, add 1 cup of methanol,

then add ½ tsp. of lye. Use an airtight lid and swirl or stir until the lye is completely dissolved.

Next, use 4 cups of vegetable oil, heat the oil to about 140 degree Farenheit. Use the funnel to pour the heated oil into a 2 L plastic bottle. Then, add the lye mixture. Tightly close the lid, and vigorously shake for about 20 seconds. After a while, a dark layer of glycerin forms beneath the lighter layer of biodiesel fuel. Over the next couple of days, the biodiesel becomes clear as all the glycerin settles.

Biodiesel fuel will work in any modern diesel engine, without any modification. It has substantially reduced carbon emissions, and will better lubricate and extend the life of engines over petrol based diesel fuel.

Page #2
Title: [Why the Need for Alternative Fuels?]
Static Line
Hydrogen and biodiesel fuel are alternatives to petroleum based fuels. Hydrogen fuel is beneficial as hydrogen is abundant and is found anywhere from the stars in space to water to animals and plants. Also, hydrogen fuel produces water as a waste product, so there are no harmful emissions. Hydrogen fuel requires a fuel cell to power a vehicle. Biodiesel fuel, on the other hand, is made of vegetable oil, methanol, and lye (sodium hydroxide, NAOH). It is beneficial as it is easily produced, produces little emissions, and it runs in unaltered diesel engines. Although these present some options for alternative fuels, the question remains: why do we need to produce alternative fuels?

Document #1 – Canada's Role in Climate Change (see Appendix 3-C)
Document #2 – Understanding Climate Change (see Appendix 3-C)
Document #3 – Low-carbon Economy (see Appendix 3-C)
Document #4 – 20/20 Planner (see Appendix 3-C)
(Source: http://www.davidsuzuki.org/what-you-can-do/reduce-your-carbon-footprint/go-carbon-neutral/)

Page #3
Title: [Alternative Fuels as Matter]

Although biodiesel and hydrogen fuel can be described in terms of benefits in reducing carbon emissions, these fuels are also examples of matter.
Matter is anything that occupies space and has mass. Matter consists of four states: gas, liquid, solid, and plasma. All matter can be described by physical and chemical properties. Physical properties describe a substance using one's senses or a measurement to help identify it. Chemical properties describe how a substance reacts with another substance when it is forming a new substance.
For example, water (H_2O) used to produce hydrogen fuel is a clear liquid, has a boiling point of 100 degrees Celsius, a melting point of 0 degrees Celsius, and is considered a universal solvent as many substances dissolve in water. The hydrogen fuel itself is a colourless, odourless gas (H_2), which is extremely flammable (combustible) as it reacts vigorously with oxygen (O_2). Furthermore, biodiesel is an opaque, transparent golden liquid; however, its components have different properties. Methanol is a clear liquid, and

lye (sodium hydroxide, NaOH) is a solid. Sodium hydroxide is somewhat soluble as it dissolves in methanol when stirred.
The Particle Theory of Matter states that:
1) All matter is made up of tiny particles
2) All particles of one substance are the same
3) Different substances are made of different particles
4) The particles are always moving
5) The more energy the particles have, the faster they move
6) There are attractive forces between particles

Based on this theory, matter has been grouped or classified into two groups - pure substances and mixtures. In pure substances all the particles that make up the substance are the same. For example, the water (H_2O) used to produce hydrogen fuel, and the H_2 fuel itself are both pure substances as they contain only water and hydrogen particles respectively. Biodiesel, on the other hand, is a mixture of three different substances, as mentioned above. This is evident when the glycerin separates from the biodiesel solution over time.

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Page #4
Title: [Taking Action]
Clip (Alternative Fuels) * Note -[video portrays hydrogen cell and biodiesel fuel alternatives to petroleum]

APPENDIX 3-C: Contextual Information ('page 2' of the PBLO)

Document #1: Canada's Role in Global Climate Change

Climate change is a global problem with global consequences. In 2006, warmer-than-average temperatures were recorded across the world for the 30th consecutive year. Increasing average temperatures are melting glaciers and polar ice caps and raising sea levels, putting coastal areas at greater risk of flooding. Mounting evidence indicates that these changes are not the result of the natural variability of climate.

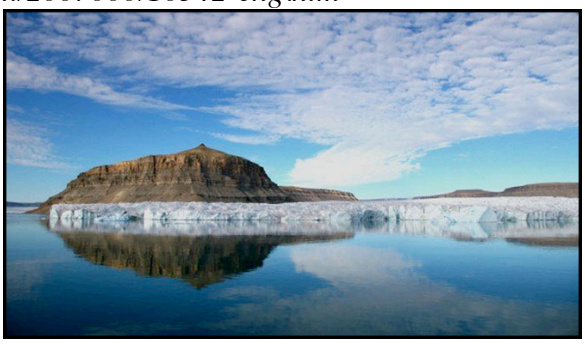
The IPCC, established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), released its fourth assessment report in 2007. It declared that "warming of the climate's system is unequivocal" and that there is a "very high confidence" that human activity since 1750 has played a significant role in overloading the atmosphere with carbon dioxide (CO_2).

One of the greatest concerns associated with climate change is the anticipated increase in the frequency of extreme weather events. The ice storm that struck eastern Canada in 1998 illustrates the magnitude of the potential impact of these events. In addition to extreme weather events, other changes associated with climate change are more gradual.

Lakes and rivers generally freeze later and thaw earlier than they used to, resulting in difficulties building and maintaining the ice roads that are vital for many northern communities. Over the past 10 years, the network of ice roads in Manitoba has gone from 50 to 60 days of usage to as low as 20 days in some years. A series of mild winters in the central interior of the province of British Columbia has supported the spread of the mountain pine beetle, a very serious forest pest, resulting in the death of pine trees across millions of hectares of forests.

Canada has about 0.5% of the world's population, but contributes about 2% of the total global greenhouse gas (GHG) emissions. This puts Canadians among the highest per capita emitters, largely as a result of the size of the country, the low density of the population, the high energy demands imposed by the climate, our resource-based economy, and the volume of goods we export. In 2005, slightly more than 23 tonnes of GHGs were emitted for each person in the country: this represents an 8% per capita increase since 1990.

Taken from:
http://www.statcan.gc.ca/pub/16-201-x/2007000/10542-eng.htm



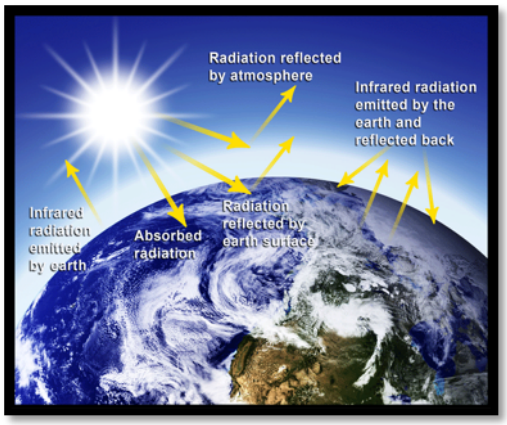
Document #2 - Understanding Climate Change

The greenhouse effect

The earth's atmosphere is like a blanket that keeps the planet warm. The greenhouse effect is a heat-trapping process that occurs naturally in the atmosphere. Without the greenhouse effect, the average temperature of the earth would be a frigid -19°C instead of the balmy 14°C that we currently enjoy.

The greenhouse effect is illustrated in Figure 1. Incoming energy from the sun penetrates the atmosphere to warm the earth. The planet then radiates heat back out toward space. Some of the outgoing heat is absorbed by greenhouse gases (GHGs) in the atmosphere and re-emitted back to earth, keeping the planet warm.

Figure 1:



Greenhouse gas emissions

Consideration of greenhouse gas emission data is central to any examination of climate change. The work we do, the purchases we make and the leisure activities we enjoy all result in GHG emissions. Knowing the amount of GHGs emitted as a result of human activity is important.

Canada's 2007 National Inventory Report prepared by Environment Canada, is the most comprehensive and up to date information source on GHG emissions in Canada, presenting emissions estimates for the years 1990 to 2005. It follows the approaches and practice of the Intergovernmental Panel on Climate Change (IPCC) used by all countries to identify, quantify and reduce uncertainty of GHG estimates as much as they possibly can.

The concepts of supply and demand provide different ways of looking at the same issue. The data in the National Inventory, following the categories prescribed by the United Nations Framework Convention on Climate Change, provide the supply perspective. These data show how many emissions are produced and by whom.

Greenhouse gas emissions, 1990 to 2005

Canada's 2007 National Inventory Report documents estimates of human-induced emissions and removals of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs).

The inventory classifies emissions into the following six categories:

1. energy production and consumption
2. industrial processes

3. solvent and other product use
4. agriculture
5. waste
6. land use, land-use change and forestry activities.

Emissions and demand

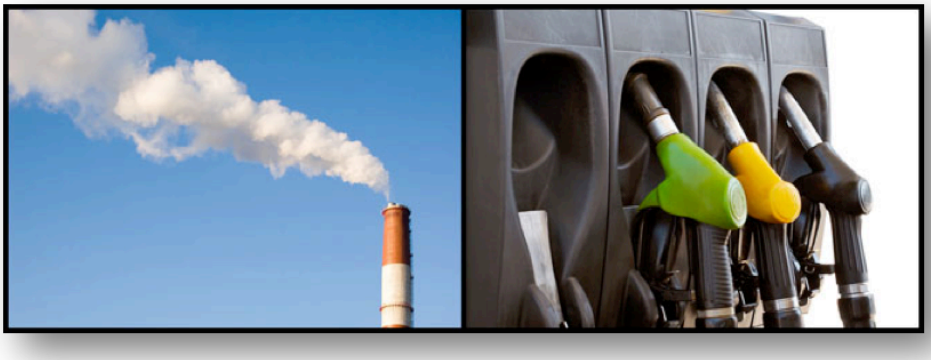
Typically, emissions are reported from the supply perspective, showing what emissions are produced and by whom. While this supply perspective is valuable, it is also useful to look at emissions from the perspective of the demand for products and services.

When businesses meet the demand for goods and services, GHG emissions are an unfortunate by-product of the production processes that ensue. From the final demand perspective (Text box "Final demand"), GHGs emitted by industry are attributed to the end-user of the industrial goods and services rather than to industries themselves. This can provide insights into emissions that are otherwise not apparent.

Canada is a trading nation, producing a significant volume of exports. The proportion of industrial GHG emissions associated with the production of goods and services for export increased from 1990 to 2003. In 2003, exports accounted for 45% of industrial emissions of GHGs, up from 37% in 1990. Over the same period, GHG emissions required to satisfy domestic demands increased by 10% in spite of a population that increased by 14.4%. This means that 76% of the increase in domestic industrial emissions from 1990 to 2003 was due to the production of goods and services for export.

What is behind this increase in GHG emissions from the production of goods and services for export? The largest source of this growth was the production of fossil fuels, including coal, crude oil and natural gas, for export. In both 1990 and 2003, the production of these fuels for export resulted in more GHG emissions than the production of any other exported commodity. Over the period, as worldwide demand for fuels surged, GHG emissions from the production of exported fuels jumped 146%, and the contribution of this sector increased from 16.5% to 26.6% of all exports.

Taken From:
http://www.statcan.gc.ca/pub/16-201-x/2007000/10542-eng.htm



Document #3 - The Low-Carbon Economy

A Low-Carbon Economy (LCE) or Low-Fossil-Fuel Economy (LFFE) is an economy which has a minimal output of greenhouse gas (GHG) emissions into the biosphere, but specifically refers to the greenhouse gas carbon dioxide. Recently, most of scientific and public opinion has come to the conclusion there is such an accumulation of GHGs (especially CO_2) in the atmosphere due to anthropogenic causes, and that the climate is changing. The over-concentrations of these gases is producing global warming that affects long-term climate, with negative impacts on humanity in the foreseeable future. Globally implemented LCE's therefore, are proposed as a means to avoid catastrophic climate change, and as a precursor to the more advanced, zero-carbon society and renewable-energy economy.

LCE or LFFE's are possible through use of renewable energy and/or improving energy efficiency to displace fossil fuels, meeting global energy demand while reducing carbon dioxide emissions. Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (naturally replenished). Energy efficiency gains refer to the goal of efforts to reduce the amount of energy required to provide products and services. There are various motivations to improve energy efficiency. Reducing energy use reduces energy costs and may result in a financial cost saving to consumers if the energy savings offset any additional costs of implementing an energy efficient technology. Reducing energy use is also seen as a key solution to the problem of reducing greenhouse gas emissions.

Several examples of energy efficiency can be seen in the transportation industry. Options for better efficiency – including the use of renewable energy – are as follows:

- Increased focus on fuel efficient vehicle shapes and configurations, with more vehicle electrification, particularly through plug-in hybrids.
- More alternative and flex-fuel vehicles (based on local conditions and availability)
- Driver training for more fuel efficiency
- Low carbon-biofuels (biodiesel, bioeethanol, biobutanol)
- Petroleum fuel surcharges will be a more significant part of consumer costs
- Less international trade of physical objects, despite more overall trade (as measured by value of goods)
- Greater use of marine and electric rail transport, less use of air and truck transport
- Increased bicycle and public transport usage, less reliance on private motor vehicles.
- More pipeline capacity for common fluid commodities such as water, ethanol, butanol, natural gas, petroleum, and hydrogen (in addition to gasoline and diesel).

Taken from:
http://en.wikipedia.org/wiki/Low-carbon_economy
http://en.wikipedia.org/wiki/Efficient_energy_use

Document #4 – The 20/20 Planner

The 20/20 Planner: A Practical Guide to Reduce Energy Use by 20% at home and on the road

APPENDIX 3-D: Tasks Embedded in Adobe Connect

Please complete the following tasks in the following sequence.

Task 1: Individual Statement of Definition
Reflect on your current knowledge of chemistry. Come up with a first definition of "chemistry." Post your initial definition in the blog (see link below). Each person should have one blog post for this task. Give your posting the title "My Definition of Chemistry" along with your name.

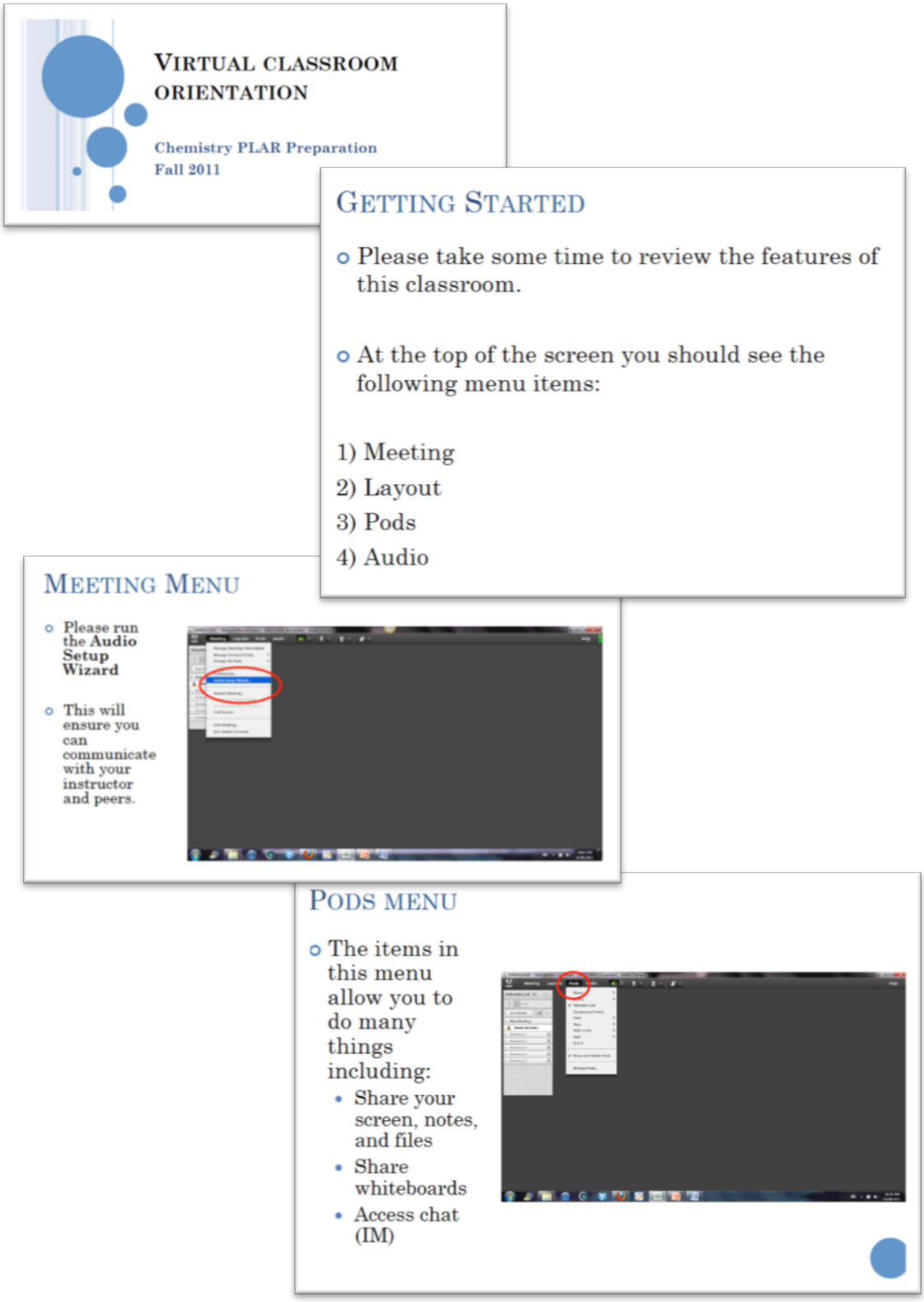
Task 2: Consensual Statement of Definition
With a partner, use the Communication Tools (e.g. instant messaging/chat, video conferencing, collaborative whiteboard, and/or shared note pod) to discuss your initial definitions and come to an agreement on a group definition of "chemistry." Post your group definition in the blog. Give your blog posting the title: "Group Definition of Chemistry"

Task 3: Video Clip Analysis, Synthesis and Evaluation
With your partner, view and discuss (using the Communication Tools) a variety of video clips under the Chemistry set. Be sure to discuss all of the questions thoroughly, in addition to reading/viewing all of the additional materials provided. Use the blog to record any notes/thoughts you may need for Task 3. You should have only 1 posting for this section of video clips. Give your discussion notes the title: "Chemistry Notes."

Task 4: Consensual Definition Revision
Using the original group definition of "chemistry," as well as ideas and notes generated through group discussion in Task 3, negotiate and decide on a final definition of chemistry. Post this final definition in the blog. Give your group blog posting the title: "Chemistry is…"

Tasks 5: Blog about Your Experience
As a final task, please blog about your experience using this online classroom to complete the chemistry unit. Post your comments in either the page titled "My Experience-Participant 1" or "My Experience-Participant 2" depending on which blog login information you received from your teacher.

APPENDIX 3-E: Orientation Session Power Point Sample



APPENDIX 3-F: Wiki Questionnaire

1. How did you feel about the tasks, video scenarios, and digital environment you worked with during this unit?

2. Were you able to concentrate while completing tasks, watching the video scenarios, and in this digital environment? Why or why not?

3. Were you interested in the tasks, video scenarios, and this digital environment? Why or why not?

4. Did you enjoy the tasks, video scenarios, and this digital environment? Why or why not?

5. Did working with others affect your concentration, interest, or level of enjoyment? How?

6. Have your views toward science changed after working in this environment? How?

APPENDIX 3-G: Repertory Grid Interview Template for Group 1

Repertory Grid Interview

Please rate the following 11 statements using each set of ratings below. You should have recorded 7 ratings – based on a scale of 1 to 5 - for each statement.

		I had the skills – I did not have the skills	This was not challenging – This was too challenging	Relaxed – Anxious	Concentrate – Unable to concentrate	Control – Worried	Interested – Bored	Enjoy – Not Enjoy
1	The digital/online environment in general (Adobe Connect in general)							
2	The interface (what you see on the monitor when working in Adobe Connect)							
3	Find the information needed to complete tasks							
4	Communicate with peers using the digital environment							
5	The tasks – working with a partner							

APPENDIX 3-G: Repertory Grid Interview Template for Group 1 (continued)

		I had the skills – I did not have the skills	This was not challenging – This was too challenging	Relaxed – Anxious	Concentrate – Unable to concentrate	Control – Worried	Interested – Bored	Enjoy – Not Enjoy
6	The tasks – using the communication tools (e.g. instant messaging, video conferencing, file share, interactive/collaborative whiteboard)							
7	The tasks – using the blog to post definitions and notes							
8	The PBLOs – viewing the video case scenarios							
9	The PBLOs – answering the questions							
10	The PBLOs – finding and using the given information in Steps 2-3							
11	The digital environment (Adobe Connect and its tools) and tasks together							

APPENDIX 3-H: Rating Scales for Each Construct for Group 1

I had the skills – I did not have the skills

1. I had the skills
2. I somewhat had the skills
3. I neither had nor did not have the skills
4. I had some of the skills but need to improve
5. I did not have the skills

This was not challenging – This was too challenging

1. This was not challenging (easy)
2. This was somewhat challenging
3. I did not find this too challenging or too easy
4. This was challenging
5. The challenge was to difficult

Relaxed – Anxious

1. This allowed me to relax
2. This was somewhat relaxing
3. I was not relaxed, nor anxious
4. I was somewhat anxious
5. This made me anxious

Concentrate – Unable to concentrate

1. This allowed me to concentrate
2. This allowed me to somewhat concentrate
3. I could concentrate at times but not at other times
4. I had a difficult time concentrating
5. I could not concentrate

Control – Worried

1. I felt 100% in control
2. I felt somewhat in control
3. I felt in control some of the time and worried other times
4. I was worried most of the time
5. I was worried all of the time

APPENDIX 3-H: Rating Scales for Each Construct for Group 1 (continued)

Interested – Bored

1. I was 100% interested
2. I was somewhat interested
3. I was neither interested nor bored
4. I was somewhat bored
5. I was 100% bored

Enjoy – Not Enjoy

1. I 100% enjoyed
2. I somewhat enjoyed
3. I neither found this enjoyable or not enjoyable
4. I somewhat did not enjoy
5. I 100% did not enjoy

APPENDIX 3-I: Repertory Grid Interview Template for Group 2

	Online environment in general (Adobe Connect in general)	The interface	Find information needed to complete tasks	Communicate with peers using the digital environment	Tasks – working with peers	Tasks – using the communication tools	Tasks – using the blog	PBLO–video case scenarios	PBLO –answering the questions	PBLO– finding and using the given information in Steps 2-3	The digital environment (Adobe Connect and its tools) and tasks together	
Low challenge												High challenge
Low skill												High skill

APPENDIX 3-J: The Code Book

A: EMOTIONS RELATED TO THE FLOW FRAMEWORK		
Vocabulary (written or from transcript)		
	Description	**Example(s)**
Anxiety (PHC/PLS)	This code represents emotions and states that are experienced when perceived challenge is greater than perceived skills. Include the following related terms or states: anxious; bored; can't find way around; frustrating; hard; not enjoy; tense; unable to concentrate; unhappy; worried	"I found it about a two three because it was a little bit hard to, you know, focus on what the direction of those questions went. Like I could read it, don't get me wrong, but it was the more hard to find this sort of the answer that you wanted." "Oh. This sucks." "At this point, I don't know where we are."
Relaxation (PLC/PHS)	This category represents emotions related to the state of relaxation (i.e. when perceived challenge is low vs. perceived skill). Include the following related terms or states: calm; relaxed; navigable; control; easy.	"I think I've decided we write them in Adobe and them put them on our notes." "To view the video, obviously it's not a challenge at all. Like you click a link. I didn't even have to use the link and I still managed to get the video, you know what I mean."
Flow (PC = PS)	This category represents the emotions related to experiencing a "Flow" state (i.e. when perceived challenge and perceived skill are in balance). Include the following related terms and states: concentrate; enjoy; fun; happy; interested; joyful	"That was interesting." "I was interested in the video scenarios because it's new, it's interesting and it was easy besides the small [malfunctions], little and easily forgotten about when the class started." "Sweet. I can spell."

APPENDIX 3-J: The Code Book (continued)

B: LEARNER ACTIONS		
	Description	**Example**
Read and Comprehend Text & Diagrams	This represents references to and occurrences where learners are reading and trying to understand text and diagrams while using the PBLO. Exclude: Emotional statements/states related to reading such as anxiety, relaxation, and Flow.	"Really, the only reason I see in reading all this is to understand the whole concept of why we need the alternative fuels and how we were both born well before the 90s, when all this bleep happened, so we should know about it." "V.R.: Ugh. Wow, we got a lot to read. Alright. Um. Are you reading that? Or, are you reading Understanding Climate Change? D.U.: Greenhouse effect. V.R.: I'm trying to see if we can somehow cheat here and skip ahead to these questions. Bleep. No we can't. We have to read all this bleep to understand it. I don't know if I want to do this all day."
View and identify with video case	This refers to occurrences and references to viewing the video case scenario portion of the PBLO and indication of relating to it (i.e. finding it relevant). Include: Any reference to the occurrence of viewing and/or relating to the video case scenario. Exclude: Emotional responses to the video case scenario.	"JC: Oh, that'd be sick. (comments while watching the video) Oh gross. There we go. It's electrolysis. (Laughter) Okay." "JC: Okay. So. I don't know. I don't have an answer for how it's produced. I'm going to rewatch the video, I think." "JD: Yeah, I was thinking. Cause it says in the video that it doesn't affect the engine as harshly as normal."

APPENDIX 3-J: The Code Book (continued)

B: LEARNER ACTIONS		
Analyze situation	This refers to statements/occurrences whereby learners demonstrate or indicate they are thinking/reflecting about the situation within which they find themselves situated (i.e. are trying to figure something out regarding the PBLO) Include: All occurrences whereby learners are trying to figure out what it is they need to do.	"Alright, well let's go back to our task thing for a second, and it'll tell us what the bleep we have to do. And, find out what we actually have to do." "JC: Okay. So, I guess these are the questions we have to answer? JD: Yep. (sigh) JC: Okay. JC (reading questions and answering aloud): What waste product of the car is the man drinking? What does it look like? What is it made of? Water. JD: I don't think you're supposed to say the answers out loud. (laughing) JC: Oh. Okay. Well that was a gimme. So, we write this in Adobe, right? JD: I don't know. JC (asking researcher who was in the room): Um, the answers from Alternative Fuels, we write them in Adobe, right? R: You decide (from outside the Online Learning Environment). JD: What do we do? JC: We decide. JD: Oh. Neeeurr…"
ID & Define Problems	This refers to learners' identifying/stating actions that need to be addressed in order to reach a desired situation. This can also relate to identification of skill gaps or other obstacles keeping a learner from reaching desired situation.	"What do we do?" "I lose interest in things when I have to read" "Close this somehow. What the? Feel free to click something to get me back to where I was." "JC: But I'm trying to figure out what are the sources of

	Include: All occurrences/statements that indicate that learners have identified that there is a gap between their current situation and their desired situation.	this fuel, and how is it produced? So I guess I should watch the video again."
Knowledge (sub-node of ID & Define Problems)	Refers to what learners currently understand about a situation. Associated with the action of identifying and defining a problem (i.e P = ((D-C)/K+R)Role). **Include:** statements regarding/references to/occurrences whereby learners are using what they currently understand in relation to a currently identified problem. **Exclude:** All references to/occurrences ID & Define Problems.	"Really, the only reason I see in reading all this is to understand the whole concept of why we need the alternative fuels and how we were both born well before the 90s, when all this bleep happened, so we should know about it." "V.R.: I only remember the three. Gas, liquid, and solid? When did they add plasma? D.U.: No doubt. V.R.: When the bleep did they add plasma? D.U.: What's plasma? V.R.: I don't know. Judith is gone. I don't ever remember them adding plasma. This must be new."
Resources (sub-node of ID & Define Problems)	Refers to information that learners perceive as available to them in solving a problem. Related to defining a problem (i.e. P = ((D-C)/K+R)Role). Refers to statements regarding/references to/occurrences whereby learners are accessing resources (e.g. video case scenario, reading, You Tube, Google, Wikipedia) they perceive are available to them.	"V.R.: I Googled and used Wikipedia." "I was searching other related You Tube videos on seeing if I could get that answer."

APPENDIX 3-J: The Code Book (continued)

B: LEARNER ACTIONS		
Create Solutions	Refers to statements/occurrences where learners are looking for or creating solutions to perceived problems together. Include: Any reference to/occurrence/statement that reveals seeking or creating solutions. Exclude: Independent solution creation.	"I'm trying to see if we can somehow cheat here and skip ahead to these questions. Bleep. No we can't. We have to read all this bleep to understand it." "JC: I think I've decided we write them in Adobe and them put them on our notes. JD: So, just make a new note, and just copy and paste? JC: Yeah, I think so. We'll write down the answers to Analysis questions."
Collaboration	Refers to any occurrences/statement revealing negotiation and decision-making has occurred together, resulting in a group cognition artefact (e.g. a group definition of chemistry; agreed upon next steps). Include: All references/occurrences related to negotiation and joint decision making.	"I thought we were just going to read it and then discuss it after, but I guess we can take notes together." "JC (saying what he's typing out loud): So, what is the fuel of this car. Water. It is clear…Do you agree with that? JD: Yep."

APPENDIX 3-J: The Code Book (continued)

B: LEARNER ACTIONS		
Cooperation	Refers to the division of tasks by a group whereby learners separate to complete part of the task and then the group reconvenes to discuss. Include: All references to division of labour in order to complete a task. Exclude: References to collaboration (i.e. negotiation/joint decision making).	"V.R.: You done reading the bottom half here? D.U.: Give me one second…I'm done when you are. V.R.: Uh, I'm still dot jotting. I'm just at "where Canada has blank"
Independent Action	Refers to any indication of a learner preferring to work alone or having worked alone. Exclude: Any evidence of collaborative or cooperative action.	"If we both take separate notes, we could just compare after, but it doesn't really matter to me." "I was trying to read." "Um. I'm going to watch a bit of the video again." "I'm going to try and get better answer"

APPENDIX 3-K: Coding Procedure

1. Import data source into Internal Sources folder of NVivo 10 (for Mac). Free trial available at: http://www.qsrinternational.com/products_free-trial-software.aspx
2. From the Create tab, click Node.
3. Add in Nodes, which are the codes (see Codebook).
4. Navigate back to the data source document. Click on the Nodes folder on the left hand side to ensure that your codes are showing.

5. To code, do the following:

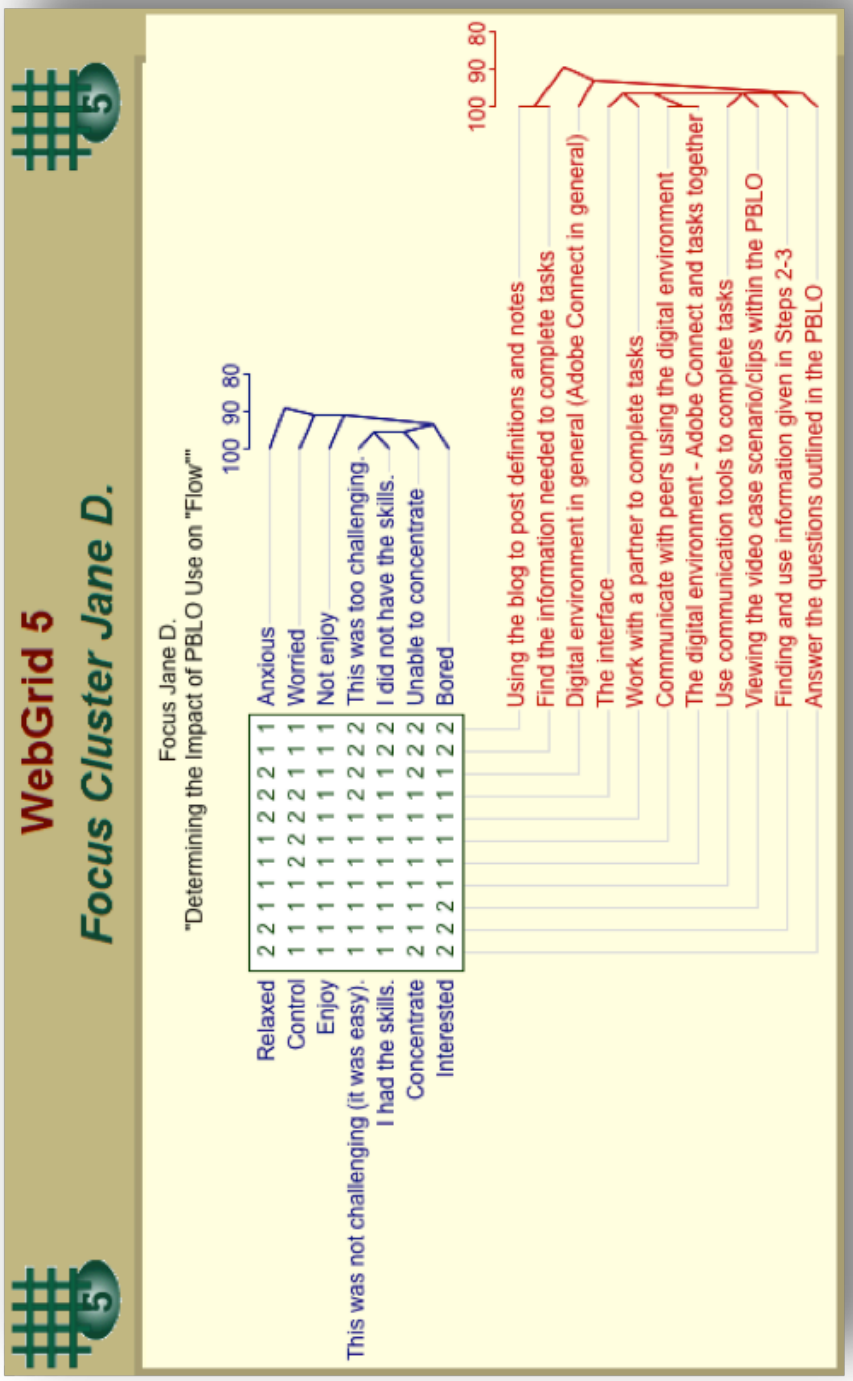
    a. Start with focusing on the first Node (code), and scan the document for relevant text pertaining to that code. Once relevant text is located, highlight it and drag it into the Node of focus. Scan the rest of the document adding all relevant text to that Node.
    b. Move to the next Node, and complete the same process as above but focusing only on the new Node/code.
    c. Continue this process until you have coded the document text once per Node/code.

6. Click on View – Coding Stripes – All Coded. This reveals the text that has been coded, as well as which codes are assigned to each passage of text.

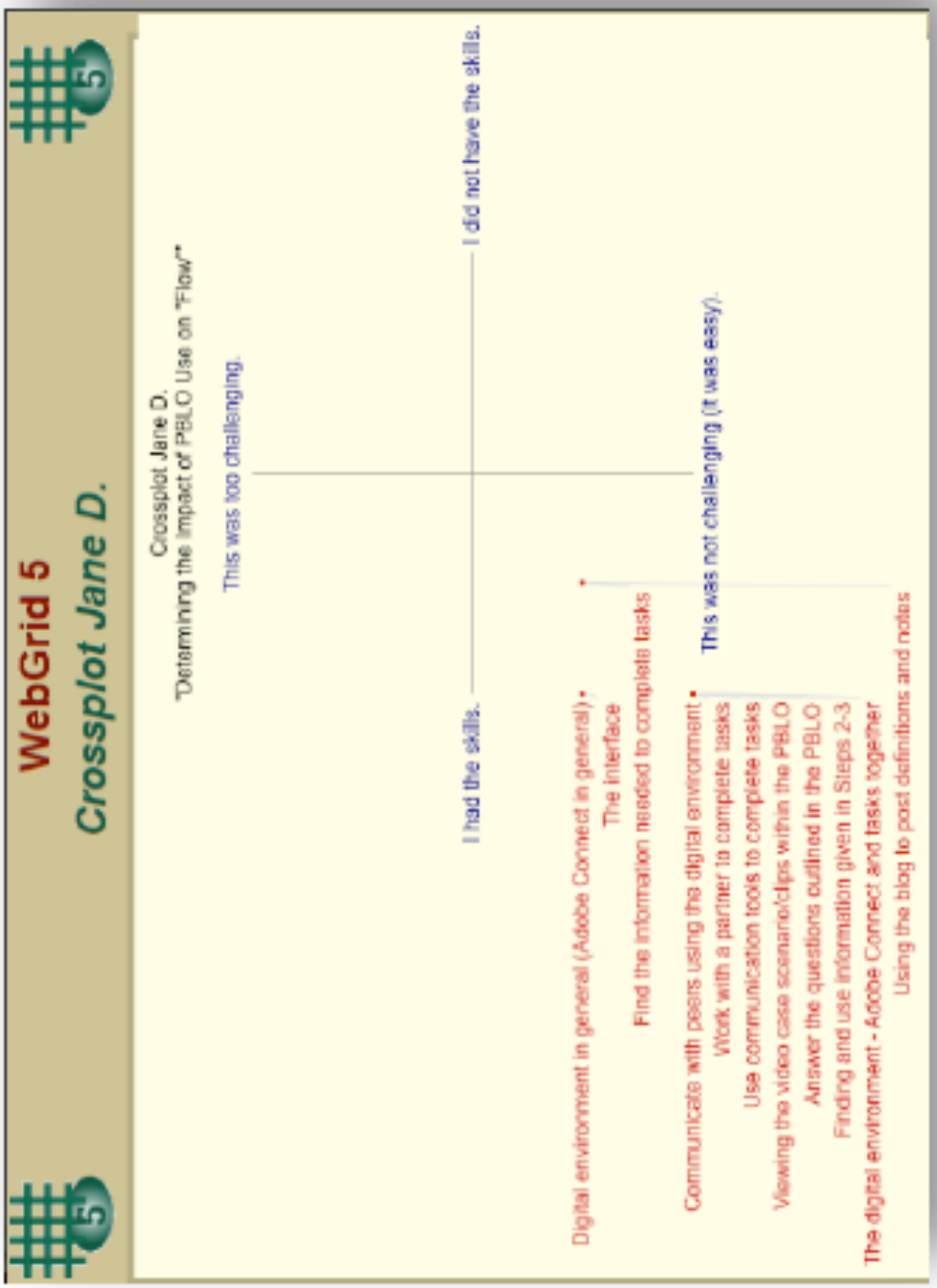
7. Double check each passage coded with the Code Book to ensure that coding has occurred as per the definition given in the Code Book. Edit as necessary.

APPENDIX 4-A: Jane's Pin Grid

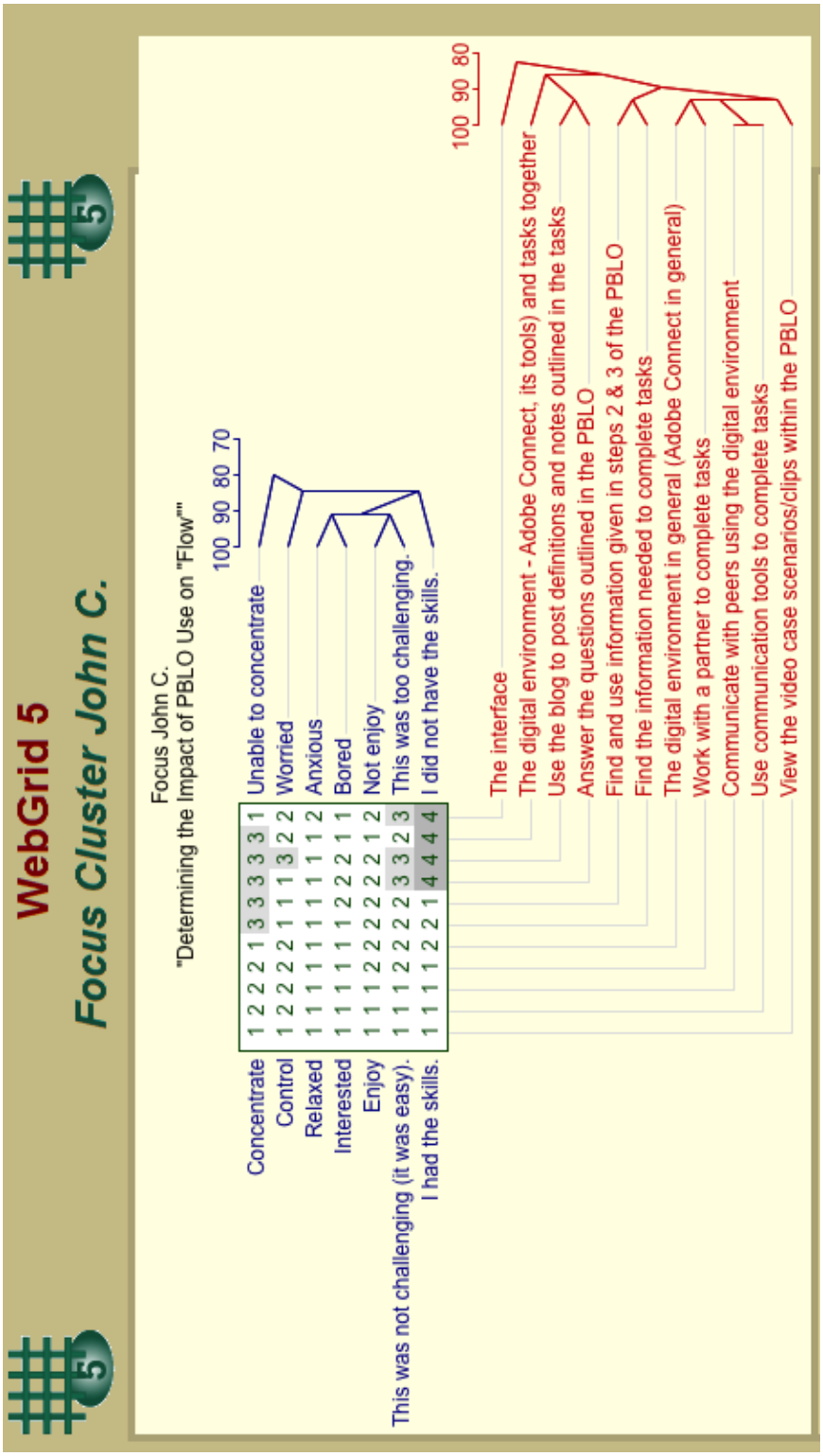
APPENDIX 4-B: Jane's Cluster Plot



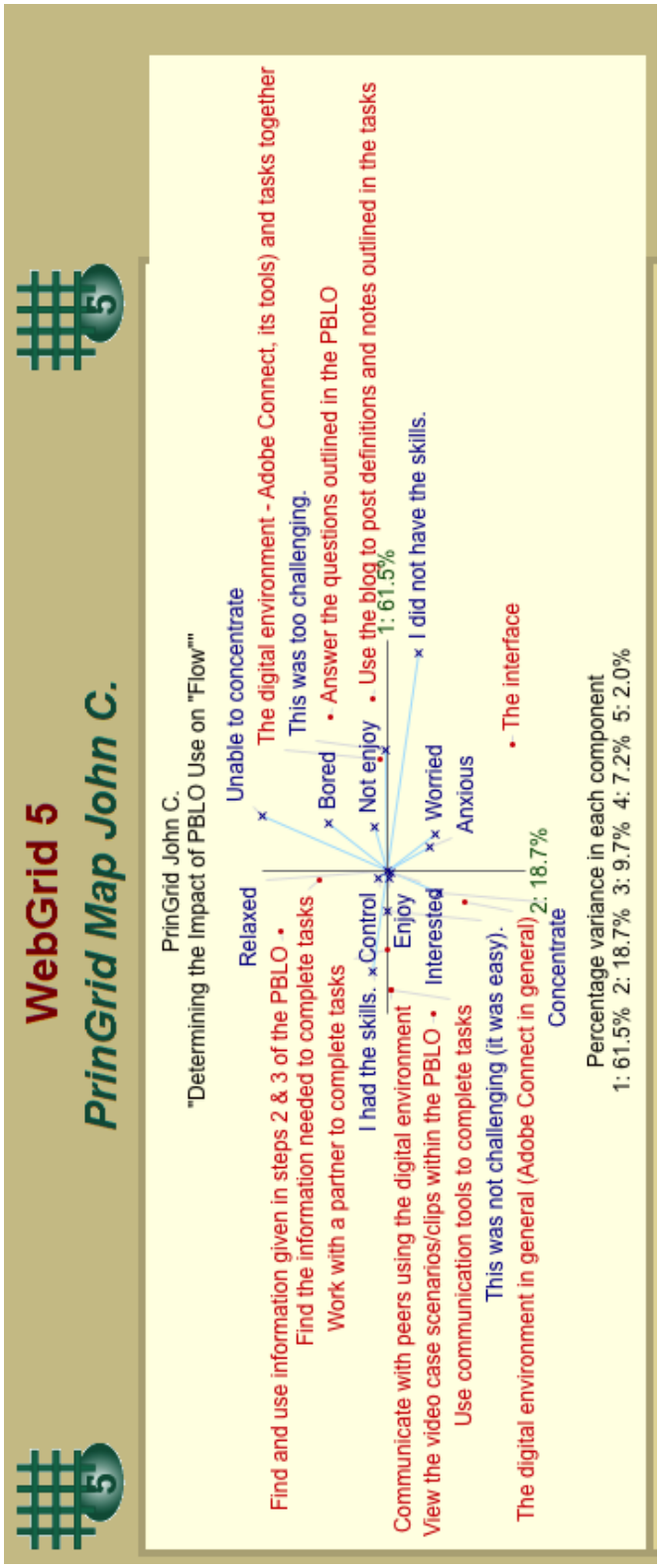
APPENDIX 4-C: Jane's Crossplot



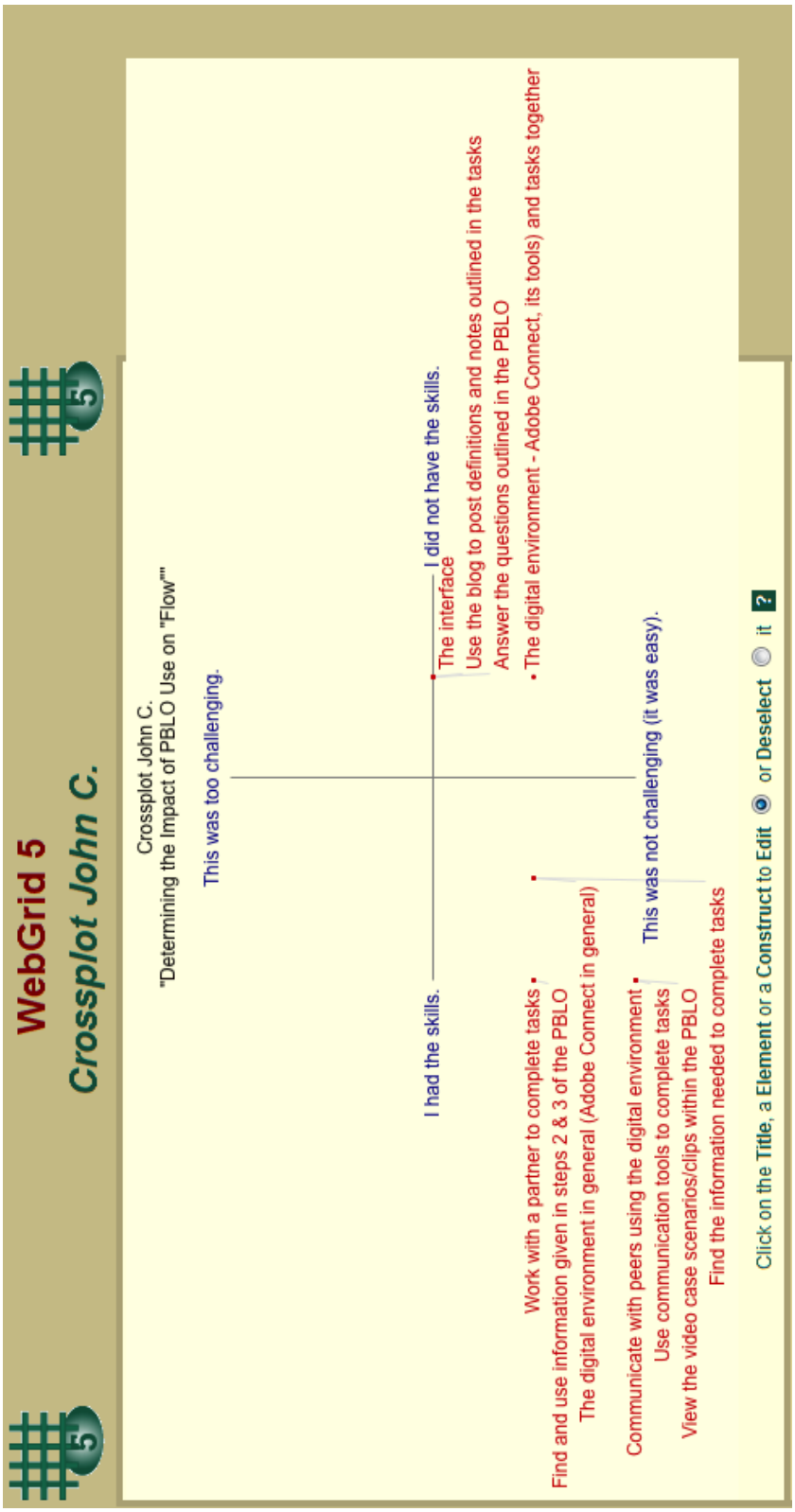
APPENDIX 4-D: John's Cluster Plot



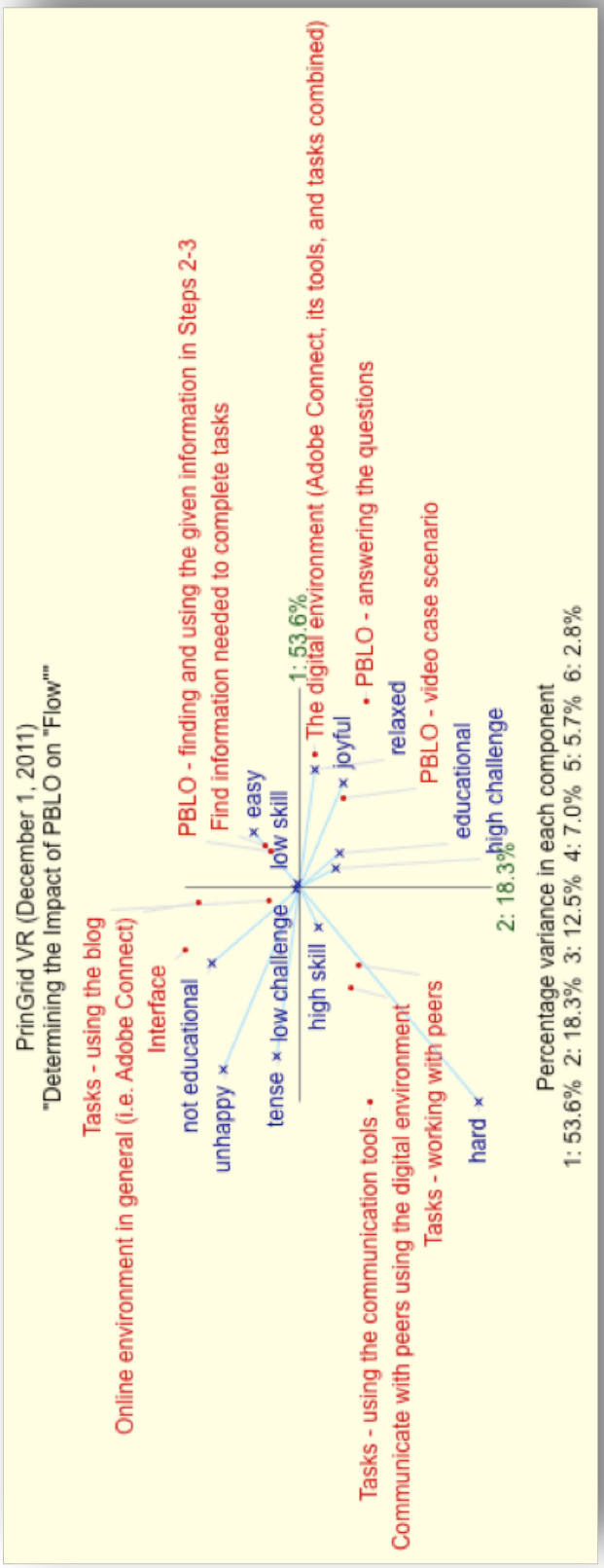
APPENDIX 4-E: John's Pin Grid



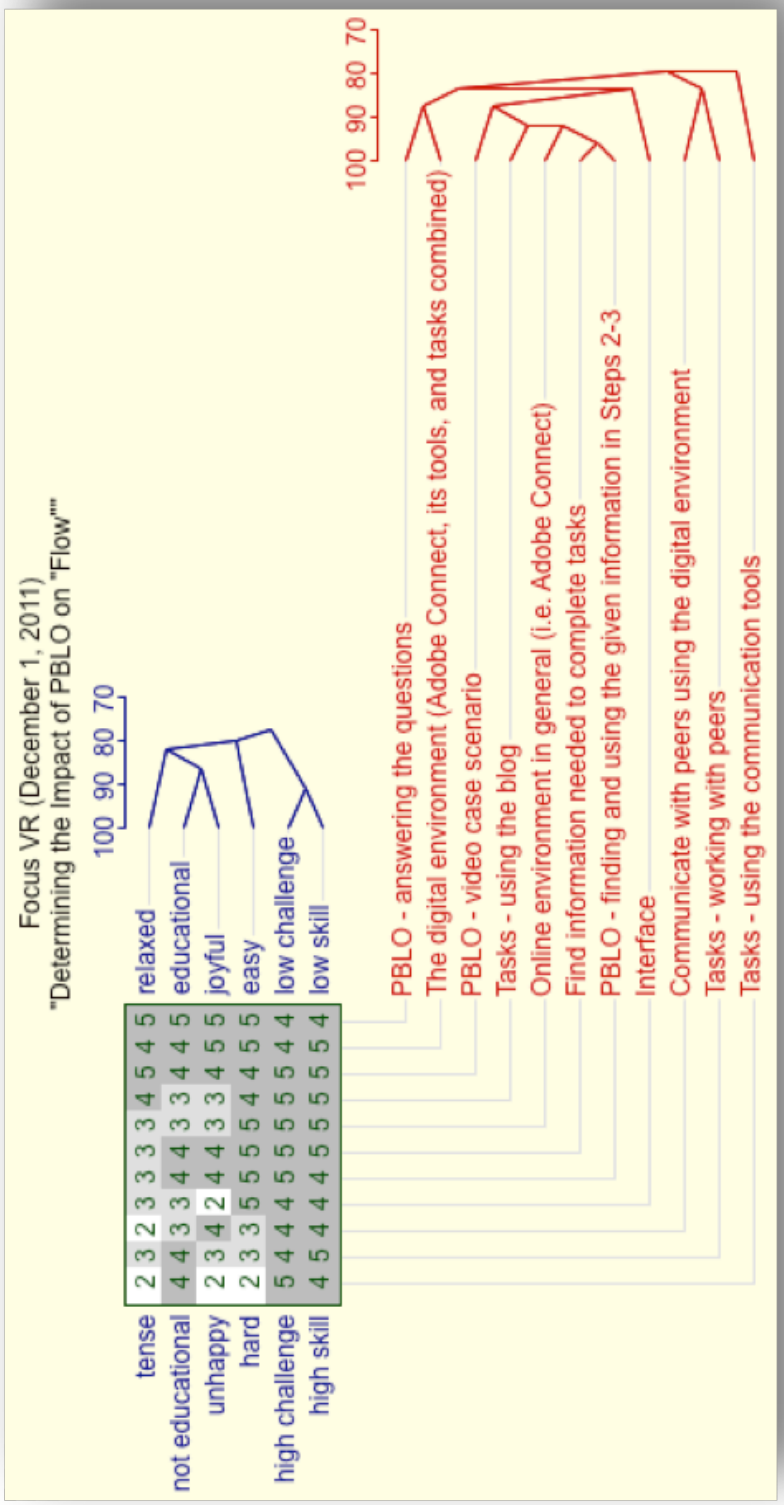
APPENDIX 4-F: John's Crossplot



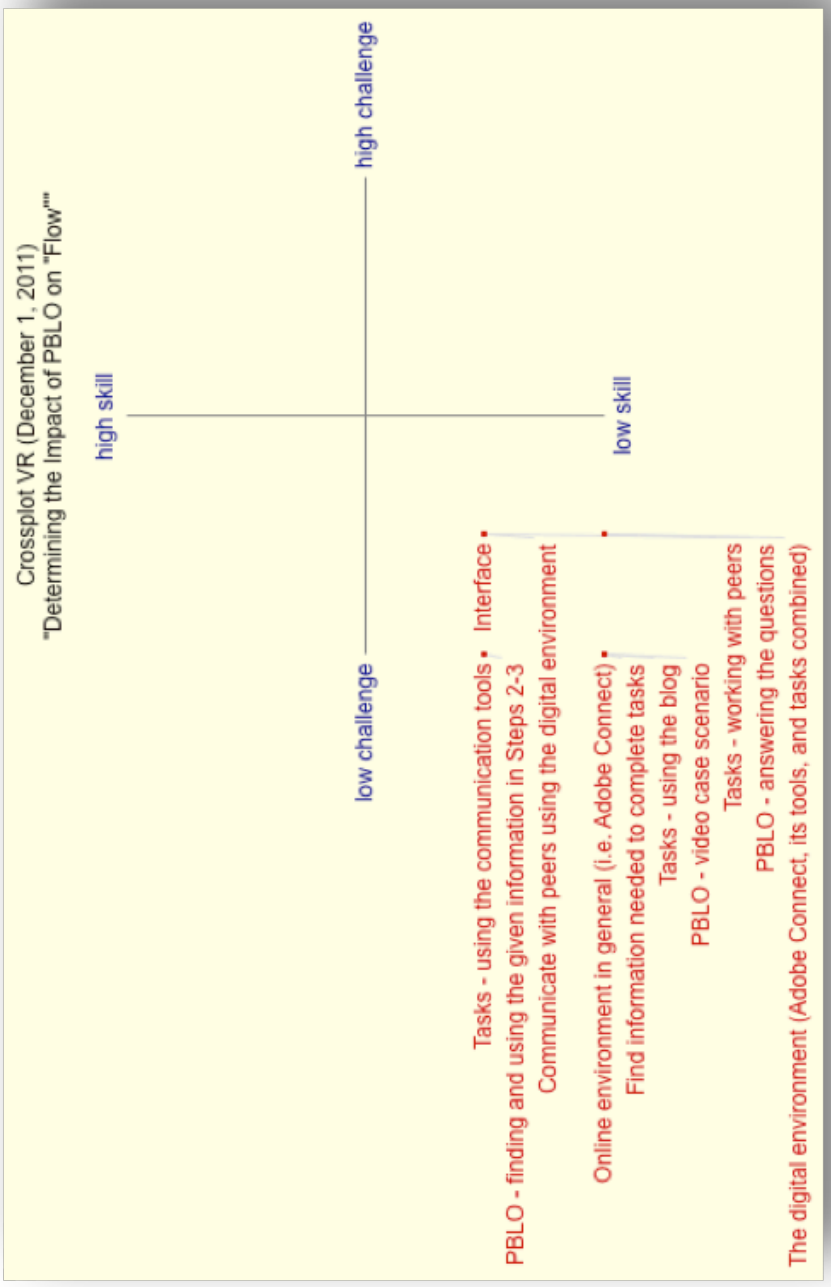
APPENDIX 4-G: Victor's Pin Grid



APPENDIX 4-H: Victor's Cluster Plot

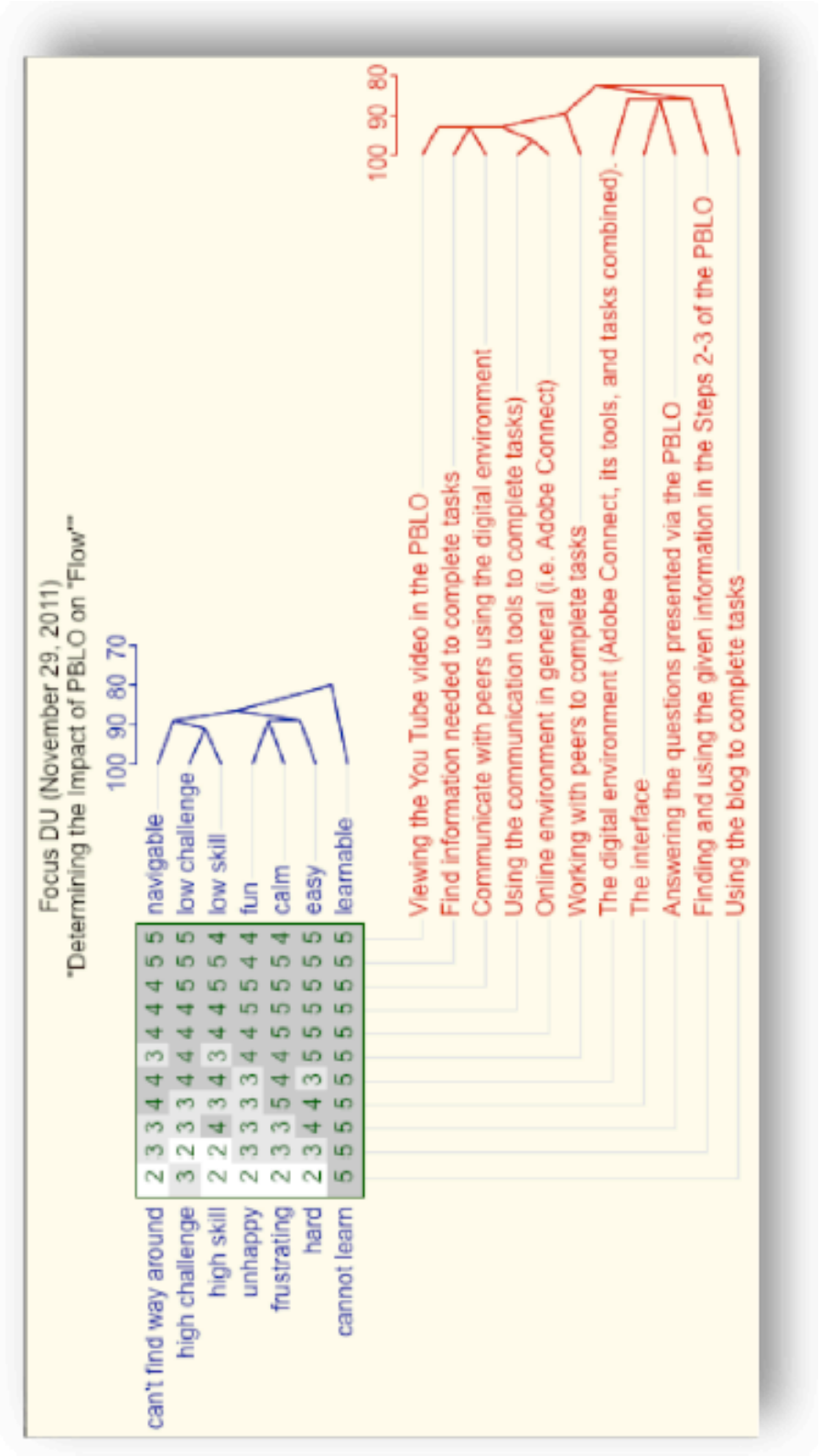


APPENDIX 4-I: Victor's Crossplot



APPENDIX 4-J: Dan's Pin Grid

APPENDIX 4-K: Dan's Cluster Plot



APPENDIX 4-L: Dan's Crossplot

APPENDIX 4-M: Findings Across Coded Data Sources for Jane

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions Related to Flow (PC=PS)	Reasons/ Notes	Action Taken
• Finding information needed to complete tasks	Blog		✓		Had other people to work with when needed	Identified resources – researcher and partner
	AC Transcripts		✓	✓	*Relaxation*: related to taking on role of "making it easier for her and partner" *Flow*: -Associated with finding info needed to complete tasks, organizing information, and posting answers in the blog	*Problem:* -Assist John in identifying affordances of technology -Identify resources for John -Need to come up with definition of chemistry (consensual) *Solution:* -Takes control in working w John to progress toward goal -Identifies resources available for her partner (e.g. affordances of the wiki and Adobe Connect; researcher) -Scaffolds to assist John w tasks
	Rep Grid Interview	N/A	N/A	N/A	N/A	N/A
• Using the blog to post definitions and notes	AC Transcripts	✓			Related to task, not using the blog	*Problem:* Task 5 *Solution:* Answers researcher's questions in blog.
	Rep Grid Interview	N/A	N/A	N/A	N/A	N/A
	OLE External Video	✓			Sarcastic tone "Oh that sounds fun."	
• Communicate with peers using the digital environment • Use communication tools to complete tasks	Blog					
	AC Transcripts	✓			Host status	*Problem:* control of screen *Solution:* Does not mention it again but is able to move on
	Rep Grid Interview	N/A	N/A	N/A	N/A	N/A

APPENDIX 4-M: Key Findings Across Coded Data Sources for Jane (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Flow (PC=PS)	Reasons/ Notes	Action Taken
• Work with partner to complete tasks	Blog			✓	*Flow:* -Working with a partner helped her concentrate and stay on task	*Problem:* to complete tasks *Solution:* discuss ideas with partner (collaborate)
	AC Transcripts	N/A	N/A	N/A	No emotions related to "Flow" framework evident	N/A
	Rep Grid Interview			✓	*Flow:* -Associated with deciding to negotiate and talk with her partner (vs. doing the work herself). - Ability to interact with the program, including her partner.	
• The Interface • The Digital environment-AC+tools+tasks	Blog			✓	*Flow:* -Enjoyed the digital environment because it provided individual support needed, making it easier. -Also, the digital environment "cleared up a few questions" Jane had.	
	Rep Grid Interview	N/A	N/A	N/A	N/A	N/A
• Viewing the video case scenario within the PBLO (incl. analysis questions)	Blog		✓	✓	*Relaxation:* It was easy *Flow:* -Video case scenario was new, interesting, and easy	Viewed video several times to find info needed
	AC Transcripts			✓	-Occurred while collaborating with partner to take notes/answer analysis questions as a means to progress toward completing task 3 (after rewatching video)	*Problem:* To complete Task 3 (to find answers to analysis/synthesis questions) *Solution:* Identified video as a resource/source of info (i.e. watched video more than once)
	RepGrid Interview	N/A	N/A	N/A	N/A	N/A

APPENDIX 4-M: Key Findings Across Coded Data Sources for Jane (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Flow (PC=PS)	Reasons/ Notes	Action Taken
• Find and use information given in Steps 2-3 of PBLO	AC Transcripts	✓			*Anxiety:* -File Share feature in AC to access docs necessary for PBLO Step 2 of the PBLO	*Problem:* Need to find documents to read, in order to complete task 3 *Solution:* Played with technology (evident as she is able to find the document and read it)
	OLE External Video				Laughs while trying to find document; difficult to tell if she was actually "anxious;" may actually indicate comfort with her strategy to overcome problem	Same as above
	Blog	N/A	N/A	N/A	N/A	N/A
	RepGrid Interview	N/A	N/A	N/A	N/A	N/A

APPENDIX 4-N: Findings Across Coded Data Sources for John

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions related to Flow (PC=PS)	Reasons/ Notes	Action(s) Taken
• Finding information needed to complete tasks	Rep Grid Interview		✓		*Relaxation:* B/c he was "relaxed the whole time" while working in the OLE/PBLO	*Problem:* None revealed *Solution:* None revealed
• Using the blog to post definitions and notes	AC Transcripts	✓			*Anxiety:* - Because John had difficulty navigating finding and navigating the wiki -Because of the nature of the tasks related to posting definitions of chemistry (i.e. having to negotiate content of post)	*Problems:* -Technology related to the wiki -Comprehension of the questions in the tasks -Perceived lack of knowledge of chemistry -Having to negotiate with partner *Solutions:* -Works with partner and researcher to navigate blog -Depends on partner to create solutions
	Rep Grid Interview	✓			*Anxiety:* not overly familiar with blogging before.	
• Communicate with peers using the digital environment • Use communication tools to complete tasks	AC Transcripts	✓			*Anxiety:* Initially due to host status	Problem: Needs to act to keep the screen the way he wants it. Solution: evident that he solves the problem on his own as he then moves on to use the wiki
	Rep Grid Interview		✓		*Relaxation:* b/c it made it easier to use digital environment	*Problem*: Using the digital environment *Solution*: collaborating with partner

APPENDIX 4-N: Findings Across Coded Data Sources for John (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions related to Flow (PC=PS)	Reasons/ Notes	Action(s) Taken
• Work with partner to complete tasks	Blog			✓	*Flow*: b/c working with partner helped him figure out the answers more easily	*Problem*: To find answers *Solution*: Work with partner
	AC Transcripts	✓	✓	✓	*Anxiety*: arises when John perceives he has to collaborate/negotiate chemistry definitions -Due to using tech *Relaxation*: occurs when partner helps (i.e. when challenge is reduced) *Flow*: occurred also when working with partner	*Problem*: -Perceived need to negotiate with partner (consensual definition of chemistry) -Using tech *Solution*: -Cooperates with; looks to her for direction/assistance
	Rep Grid Interview			✓	*Flow*: enjoyed working with partner	N/A
• The Digital environment-AC+tools+tasks	Rep Grid Interview	N/A	N/A	N/A	No mentioned of emotions related to framework. Researcher error.	
	AC Transcripts	✓			Observed anxiety related to the following: - Host status - Navigating environment (i.e. finding and using webcam, Notepod, navigating Adobe Connect) - Working with blog - Negotiate definition of chemistry (collaboration) - Analysis question associated with video case scenario - Regarding amount of reading to do in PBLO2-3, as well as the vocabulary.	

APPENDIX 4-N: Findings Across Coded Data Sources for John (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions related to Flow (PC=PS)	Reasons/ Notes	Action(s) Taken
• Answer the questions outlined in the PBLO (incl. Viewing video case scenario w/in PBLO)	AC Transcripts	✓		✓	Anxiety: -Related to difficulty in answering analysis questions -Typing in Notepod	*Problem*: -Answer analysis/synthesis questions -Using the technology *Solution:* -Collaborates with partner to negotiate answer -Able to solve tech issue on own
	RepGrid Interview		✓	✓	*Relaxation:* b/c he felt in control (associated with viewing the video) *Flow:* interest in context (associated with identifying with the video) *Video = two parts (viewing & identifying with)*	Problem: To understand the video, both as a resource to control and for content Solution: use tools allowing him to control video
• Find and use information given in Steps 2-3 of PBLO	RepGrid Interview	✓			*Anxiety*: -Said he found it boring,	N/A
	AC Transcripts	✓			*Anxiety*: -Reading (i.e. amount of reading and vocabulary) -Using Notepod while taking notes	Problem: -Vocabulary -Amount of reading -Tech issues Solution: -Read aloud -Cooperated with partner

APPENDIX 4-O: Key Findings Across Coded Data Sources for Victor

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions Related to Flow (PC=PS)	Reasons/ Notes	Actions Taken
• Finding information needed to complete tasks	Rep Grid Interview	✓	✓	✓	*Relaxation:* Easy to find info. *Flow:* B/c it was easy to find information; later contradicts stating he was neutral regarding this element *Anxiety*: Related to finding the source of info (i.e. Notepods)	*Problem:* Need to find information *Solution:* Although he didn't talk about it, the Notepods were identified as a resource needed to help him find needed information.
	Blog		✓		*Relaxation:* -Tasks were easy to read and understand; -questions well thought out; answers (i.e. information where expected)	*Problem:* -To answer questions highlighted in tasks (find info) (implied) -To prepare for science test *Solution:* -Read
• Using the blog to post definitions and notes	Rep Grid Interview	✓	✓		*Anxiety:* Found it boring. *Relaxation:* Blog easy to use.	N/A – comments regarding blog regarded "education-not educational"
	Blog	✓			*Anxiety:* Initial anxiety expressed b/c blogging was new to Victor	*Problem:* -Pre-existing anxiety regarding using computers -Lack of experience with blogs *Solution:* Persevered with tasks
	AC Transcripts	✓			*Anxiety:* B/c of initial difficulty accessing the blog to post notes	*Problem:* Need to post notes (as per tasks) Solution: Cooperated with partner; accessed on his own

APPENDIX 4-O: Key Findings Across Coded Data Sources for Victor (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions Related to Flow (PC=PS)	Reasons/ Notes	Actions Taken
• The digital environment- AC+tools+tasks	Rep Grid Interview		✓	✓	*Relaxation:* -It was relatively easy by the end *Flow:* -Fun associated with working with partner	*Problems:* -Learning how to use the environment (i.e. where everything is/tools -Technical glitches -Complete tasks *Solutions:* -Play with the technology -Read -Discourse with partner
	Blog	✓	✓		*Anxiety:* -Host status -Pre-existing anxiety regarding using computers *Relaxation:* User friendly -Answers were where expected	*Problem:* -Lack of full control of screen -Intimidated by computers *Solution:* -Played with technology -Worked with his partner
• Viewing the video case scenario within the PBLO (incl. analysis questions)	RepGrid Interview		✓	✓	*Relaxation:* Easy b/c all information provided for you; all information Victor had seen before; no thinking required. *Flow:* Likes videos; finds joy in answering questions; prompted further research via Wikipedia and Google on topic of interest identified via video case	*Problem:* -Need to pay more attention to video and read text to answer synthesis questions -Video case "cut off" (i.e. didn't provide the info perceived as necessary to answer questions) *Solution:* -Re-watched video Based on interest left OLE to do further research (i.e. used Wikipedia and Google
	AC Transcripts	✓			*Anxiety:* Difficulty getting video to load. (tech issues)	Problem: Technology Solution: Was able to continue
	OLE External Video				*Anxiety:* Getting video to load (see AC Transcript above)	Problem: Technology Solution: Was able to continue
	Blog	N/A	N/A	N/A	Victor did not comment.	

APPENDIX 4-O: Key Findings Across Coded Data Sources for Victor (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Emotions Related to Flow (PC=PS)	Reasons/ Notes	Actions Taken
• Find and use information given in Steps 2-3 of PBLO	AC Transcripts	✓			*Anxiety:* Tech issues; taking notes; defining next steps; amount of reading; introduction to new information	Problems: -Take notes on text (Step 2 of PBLO) -How to use new information (i.e. given in Step 3 of PBLO) -Answer synthesis questions and complete task 4 -Host status *Solutions:* -Analyzed situation and took control in making decisions on how to proceed -Identified resources necessary to read -Cooperated with partner to divide up the reading -Read (sometimes for his partner)
	RepGrid Interview	✓✓ ✓	✓✓✓ ✓✓✓	✓	*Relaxation:* Info. Is easy to find answers are provided -Only have to read to find information. *Anxiety:* Difficulty figuring out what to do with information. -Didn't like taking notes. *Flow:* B/c he learned something new	*Problem:* -To answer questions (finding resources; figuring out what to do with them) *Solution:* -Read -Took notes

APPENDIX 4-P: Key Findings Across Coded Data Sources for Dan

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Expression of Emotion Related to "Flow (PC=PS)	Reasons/Notes	Solution/ Action Taken
• Find information needed to complete tasks	Rep Grid Interview	✓	✓		*Relaxation:* Tasks were easy *Anxiety:* -Boring b/c took too long -Lack of time to complete tasks was frustrating	*Problem*: Reading required *Solution*: *see PBLO Steps 2-3 below* *Problem*: More time needed *Solution*: Responded to facilitator's direction regarding timelines
	Blog	✓			*Anxiety:* Tasks in general were challenging	Problem: challenge level *Solution: see blog and PBLO2-3 below*
• Using the blog to complete tasks	Rep Grid Interview	✓			*Anxiety:* Took Dan half the class to figure out; couldn't navigate at first	*Problem*: -Lack of knowledge of the wiki/blog -Couldn't find way around at first *Solution*: Played with the technology to familiarize himself with the wiki
	Blog	N/A	N/A	N/A	N/A	N/A
• Communicate with peers using the digital environment	Rep Grid Interview	✓	✓		*Anxiety:* Audio nor video were working *Relaxation:* several ways to communicate (i.e. head set; chat; webcam); once tech issues were dealt with, tools were straight forward	*Problem*: Communication tools didn't work at first *Solution*: Tried to get the tools working again *Independent
	Blog	N/A	N/A	N/A	N/A	
• Tasks – Using the communication tools	Rep Grid Interview		✓		*Relaxation*: Straight forward, despite tech glitches	*See Communicate w partner using the digital environment above*
	AC Transcripts	N/A	N/A	N/A	N/A	N/A
	Blog	N/A	N/A	N/A	N/A	N/A

APPENDIX 4-P: Key Findings Across Coded Data Sources for Dan (continued)

Elements of Importance	Sources	Anxiety (PHC/PLS)	Relaxation (PLC/PHS)	Expression of Emotion Related to "Flow (PC=PS)	Reasons/Notes	Solution/ Action Taken
• Online environment in general (i.e. Adobe Connect)	Rep Grid Interview		✓	✓	*Relaxation*: Easy to navigate. *Flow*: b/c it was new and had opportunity to work on same goal, same website, with same person.	*Problem:* Needed to navigate the environment; sometimes couldn't find what he needed (related to the blog) *Solution:* Need to look around/ Analyze the situation/try
	AC Transcripts	N/A	N/A	N/A	N/A	N/A
• Viewing the You Tube video in the PBLO	RepGrid Interview	✓		✓	*Anxiety:* -Viewing the video was boring - "not thrilling"; Dan doesn't like watching T.V. -Identifying with video was more challenging (i.e. *Flow:* Dan found the fun part of the video the information he received from it.	*Problems:* -Understand what was said in video (i.e. chemistry content) -Answer questions that remained after Dan had watched the video -Finding answers the teacher wanted *In response to anxiety:* viewed other videos to try and find answer
	AC Transcripts			✓	Relates to context of video (i.e. states he wants one of the cars).	
• Finding and using the given information in Steps 2-3 of the PBLO	RepGrid Interview	✓			*Anxiety*: -Frustrating as Dan has "a problem with reading"	*Problem:* -Length of text Understanding what has been read *Solution:* -Dan views other videos to find answers -Reread text
	AC Transcripts	✓			*Anxiety:* -Associated with reading	*Problem:* Reading *Solution:* -Notifies researcher of problem; she suggests learners work together; they choose to work cooperatively