Collaborative Conceptual Change during Networked Management Learning (NML)

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Abstract

My research examines the collective construction of knowledge by participants as they complete problem-based exercises during collaborative supply chain simulations in competitive situations over the internet. My research has helped me to improve my educational practice with international students in my physical & virtual classrooms at various post-secondary institutions in Alberta, Canada. The business exercises and simulations (lesson plans & learning scripts) are co-constructions of a networked management learning (NML) activity/program with research participants, using a new technological innovation "ABiSim" a business simulator for use in the networked classroom. Iterative lesson plans and scripts provided for structured learning in a series of team-based competitive business games over the internet simulating real-time demand-driven integrated businesses, illustrative of global strategic alliances and management needs in international settings. Intelligent software agents provided for the exploration of "identities" which can be used to simulate different behaviours and assist managers to learn how to collaboratively construct new knowledge in emerging international business contexts.

Keywords

Networked management learning, management learning, networked collaborative learning, collaborative conceptual change, business simulations, multi-generational classrooms, social networks, social constructivism, action research, personal inquiry, living life as inquiry, living educational theory, reflective practitioner, demand-driven systems, system dynamics, value chains, qualitative research.

Introduction

How do participants construct learning collectively during business simulations in a networked management learning activity or program?

Research Contributions

In carrying out my action research I am seeking to make a contribution to the theory and practice of personal inquiry which impacts and includes theory emerging from 'the reflective practitioner' (Schon, 1983); 'living life as inquiry' (Reason & Marshall, 1987), "living theory" (Levy, 2003) and 'living educational theory' (Whitehead, 2005) within networked management learning (Hodgson & Watling, 2004). My thesis is a personal inquiry where I 'live life as inquiry' using action research and personal engagement where I am both the researcher and subject and I use this approach to improve my own teaching practice (reflective practitioner) in the different teaching situations that I choose to engage with or in those that serendipitously find me. My focus is on me, my learning facilitation practice and the ICT - tools and techniques that I develop. I am interested in how I extract learning and new understanding through a critical analysis and examination of participant experiences during my courses, and seek to contribute to living educational theory in adult, career, and technology education in networked arrangements - networked management learning.

Collaborative Conceptual Change

Participant experiences in my version of NML and its design evolution are affected by how learners construct and make sense of what they experience, how they experience it and how they prefer to change

their experience, how accommodations, customizations and personalized learning lead to greater engagement, group sense-making and deeper collaborative conceptual change. Outcomes of collaborative conceptual effort resulted in identification of participant understanding of business problems, solution formulation, learning engagement, personal and group motivation, team-construction, -building, -communications, -leadership, management, strategy formulation, planning, plan execution, and many business concepts integrally related to supply chain management. Participants were organized into teams, provided orientation and initial training in how to use the system, asked to assess the demand situation that they faced, understand the costing formulas being used, make decisions that they felt were appropriate based on demand they saw, supply product that they have in inventory, understand transportation logistics, plan to replenish inventory as needed, take action and react to changes to their business-cost model that result from their actions. Initial course design had intended outcomes however unexpected outcomes emerged as a result of collaborative conceptual change in participants during various courses at different educational institutes.

Context for my research

At the outset of my research I assumed that as an experienced adult educator my expertise would allow me to judge when my learning artifacts (lesson plans, Information & Communications Technologies (ICTs), & learning scripts) were successful in facilitating the learning needs of adults and when they failed, that I possessed the authority, motivation and experience to modify those artifacts in a responsive & timely manner when students ran into learning difficulties. I view myself as a professional yet one who doesn't subscribe to the tenets of technical rationalization. It's my desire for continually living life as a 'reflection-in-action' (Schon, 1983) and active-reflection that makes my work interesting and self-motivating. I often cannot say what it is that I know and have found myself to be at a loss to describe or produce the descriptions that others view alternately as appropriate or obviously inappropriate. I believe that I am a person who has an avocation, a preference for a way of living where I can go about performing everyday actions in a spontaneous and intuitive manner and through this show myself to be knowledgeable in a special way.

Having used current or emerging technology in my business and computer classes with adult students for many years, I tacitly knew that a collaborative approach is beneficial in developing online and classroom based learning and implicit in the patterns of my actions was a feel for the right stuff as I was dealing with it. My personal judgment, without being able to describe precisely why, was that collaborative learning is attractive for managers and professionals who are extending their education. I believed this to be true mostly because of my experiences and observations in industry where everyone is used to working in teams in problem-based environments. At the same time I have an interest in continuously developing my learning artifacts (lesson plans; ICTs, learning scripts - exercises that require cognitive effort; situational cases that require analysis; tasks that require team work, coordination, delegation, discussion, and decision making; reflective activities that require concept recognition, formation, elucidation and summarization) and to improve the usage of technology in business education because I felt more could be done to enhance student experiences with technology than the cursory manner in which it is used in many educational instances today. I felt that my students would learn in a deeper and more holistic manner if they used technology to aid their learning since it is so much a part of today's society. My experiences were supported by others' observations as they too felt that business education had failed to keep pace with technological advances in the business world (Leidner and Fuller, 1997).

My NML activity as a research program was developed for use with graduate students and senior managers. However as my environment changed, I modified my learning scripts for uses in places and colleges where I taught or wanted to teach and all my adult learning groups were made up of either recent high school graduates or managers or professionals in early-career or mid-career situations in their work lives. Further that many of them were already engaged with various collaborative technologies for productive sharing of information and knowledge in their school, social networks, work-places or networked computer games for recreation. My personal inquiry is a life-long affair and action based and I had realized that there existed during my career in education a gap between the technologies available and their use whether in the physical classrooms or online and distance education programs. I share this with the reader to identify that my research was of a continuing and personal nature, one that would eventually allow me to develop contextualized perspectives as to why this gap has continued to exist even after the arrival of the personal computer, network, information, internet and knowledge age.

Information to knowledge age transition

The agrarian age led us to industrial age which led us to the age of computer technology and thus to the information age, which at internet speed sped us into the knowledge age. Some of us believe we are still in the "Information Age" (Castells, 1996) where technology provides extensive opportunities for organizations to engage in business to business electronic commerce (B2B eCommerce) from afar, on a global basis (Schneider, 2007). Employees who live in one continent are able to perform job duties for an organization on another continent and ship the results of those services unfettered by geographic boundaries. Consequently, many companies have successfully outsourced their business processes (Andrews, 1998) in addition to their manufacturing function. International commerce based on the emergence of competitive supply chains that support inter-organizational value chains (Weisner, 2006) drive the development of new organizational methods and use of integrating technologies that ultimately result in new business opportunities (Schneider, 2007). Information is being collected, organized and analyzed in exponentially larger volumes. Thus the information age has rapidly become the "Knowledge Age" and thus networked knowledge management is more critical. In this area interpreting information that is presented as knowledge through techniques such as business intelligence analytics is being used to verify and validate that information, activity that is increasingly outsourced to an international set of companies that can provide such high order services.

In this rapidly changing environment new technologies also provide opportunities for educational organizations to develop technology mediated courses and broaden the access of their faculty to a global market. While the learning organization became a popular idea in the 1990s as *"...organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together."* Senge (1990: 3), in education which should be the bastion of such reflection little evidence of use of networked management learning exists in the classrooms, perhaps even techno-phobia rules the classrooms of many educators. Electronic communications methods such as voice, video, and text over the internet provide for high quality web-conferencing and allow for a more collaborative real-time dialog between learners in geographically distant locations (Lamaster, 2004). Yet Hesketh et al. (1996) state *'there is no groundswell of movement towards the use of technology; only patches of enthusiasm',* and even today there is still little evidence of their productive use by faculty in their regular classes and limited use in distance education programs who should be primary hosts for such usage.

In exploring the needs of industry and managers in particular, Carr & Dhariwal (2003) claim that there is an increasing demand for online and electronic education, a demand for in-context and ongoing education for workers in the execution of their remote yet collaborative work, especially in global supply chains. Based on Carr's research surveys of 4,000 Canadian managers, Carr & Dhariwal (2003) claim that often experienced managers in these environments have low technology skills and underestimate their future needs. Carr & Dhariwal (2004) further claim that for collaborative practices to emerge between these remote workers more appropriate coaching, mentoring, and team-building exercises/games plus hosted technologies which foster such improvements, are required. These emerging contexts, in my view, drive the need to improve networked management practice. Yet, networked management learning (NML) is a relatively new field of study that is still in its infancy (Hodgson & Watland, 2004), with few research studies that identify the emerging issues. In this context I think it is important to determine who is in our classrooms and whether that has any impact on the use of NML in the classroom by institutions and faculty.

Who is in our postsecondary classrooms?

During my courses in the past and with greater regularity in more recently facilitated courses I discovered that for the first time in history significant numbers of 4 different generations of students are in the same physical and virtual classroom and this is especially true for non-traditional education. Use of technology for the young is an easy transition since they've grown up "playing" with it. For learners from other generations who've had to transition into technology, the use of that technology is more challenging and fearful. Educational design and lesson planning may need to include more personal, flexible and differential learning opportunities than ever before. Within this backdrop there are many, often dissenting views on how learning is best developed, presented and learned by the student or the worker in industry.

So for an increasingly broad range of learners in the same course/classroom my research identifies specifically the issues related to learning facilitation that may lead to greater engagement, group sense-making and deeper collaborative conceptual change. My inquiry may improve tutor practice in that my research may identify how different learners restructure knowledge (Roschelle, 1992, Vygotsky, 1916 reprint 1978; Kolb, 1984; Piaget, 1970; Lewin, 1946), how learners revise their concepts of knowledge (Duschl & Osborne, 2002; James, 1898; Peirce, 1878; Dewey 1916), how deeper mental processing occurs (Chin & Brewer, 1993; Caine & Caine, 1997, 2001); how critical thinking and events are interpreted or introduced (Brookefield, 1987; Blatz, 1992); and how the use of simulations may highlight when learners conception are not adequate (Ziestsman & Hewson, 1986; Chin & Brewer, 1993; Duit, 1999).

The pedagogical view of conceptualizing and restructuring knowledge is the basis of how we understand what we learn and can be used to develop a progressive understanding for how adults conceptualize and restructure knowledge. The critical traditions are important for adults to reflect broadly on how to transfer their learning to life situations, empower them to participate effectively in society or change society and in turn these may be necessary for adults to develop deeper mental processing or motivation for engagement with the learning materials. So what is learning to me and how can I best facilitate learning and what approaches do I take to providing learning situations to participants in my classes?

What is learning and how do teachers/tutors facilitate learning?

I explore this area in my writing to demonstrate to myself and the reader what I understand about my practice and how I prefer to approach the art of teaching or learning facilitation. I believe that what we teach is affected by how we teach it (Laurillard & McAndrew, 2002) and that we cannot teach anybody anything instead rather the best we can do is facilitate learning (Rogers, 1951, Dewey, 1938; Rogers & Friedberg, 1994). I believe that what a student learns is influenced by how the student experiences that learning: the kinds of interaction, support, summarizing and feedback provided by the teacher/tutor (Trigwell, 1995). I believe that student's prior experiences of successful learning models and their failures in learning influence their learning styles and thus their preferences for directed or facilitated learning and this in turn is often influenced by personality styles (Myers & Briggs, 1980, 1995). I believe personality and learning styles affect how students learn, the kinds of materials they seek out and what they understand, further reinforcing or changing their learning styles (Kolb & Fry, 1975) and desires for experiential learning (Lewin, 1946; Vygotsky (1896-1934), Piaget (1896-1980), Dewey (1859-1952), Bruner (1960, 1996)) and both of which are influenced by and influence student preferences for auditory, kinesthetic and visual learning and in turn impact their cognitive (*memory, thinking & reflection*), affective (*attitude & emotion*) and psychomotor (*skills, dexterity, repetition & 'muscle memory'*) capabilities (Bloom, 1956). However there is as much criticism of learning styles (Coffield, 2004; Stahl, 2002; Hargreaves, 2005) as there is support illustrated by the development and use of 71 different theories of learning styles (Coffield, Moselely & Ecclestone, 2004). There is extensive research in these areas for the physical classroom but most of it lies in the study of pedagogy (child-learning) and less in andragogy (adult-learning), especially for online and in NML situations.

There is even less research in online tutor support due to the non-traditional nature of online education however it is increasingly valued as the technologies for online education approach facilitation of learning in a similar and in some ways, superior nature, to those of physical classrooms and its visibility in education has risen with the rapid growth of online universities since the evolution of the internet. This increased visibility, value and need for online tutor research has to be contrasted with how traditional faculty continue to undervalue distance education (Dhariwal, 2007) and credentials from non-traditional environments, perhaps today as a resistance to increasing competition or more likely as a continuation of pre-formed opinions that have become dated but maintained even under the pressure of rapid technology change in society generally and online learning environments, specifically. While different models of learning facilitation exist, most if not all require some form of tutor mediation, and thus their effectiveness and practices need further exploration and documentation, especially for online environments. In the backdrop of multiple generations of learners in the same classroom (physical or virtual), tutor practice needs to become even more flexible and personalized to the individual learner, in marketing terms: mass customization to single customer.

The storage of increasing volumes of data, observations and interpretations (research and analysis) of data require huge databases and data formats and specialized skills to work with that data that not all

academics possess. The capture and storage of data of all forms requires the use of well designed databases along with the ability to convert, organize and interrogate the data and the volumes of text or multi-media that are stored. For researchers this kind of facility is critical to allow storage of large volumes of observational and system captured learning experiences and/or responses in order to analyze them later, but few systems are actually designed for this purpose. For an increasingly broad range of learners in the same course/classroom my research identifies specifically the issues related to customized and personalized learning facilitation that may lead to greater engagement, group sense-making and deeper collaborative conceptual change.

NML evolution and my version of NML

Computer mediated conferencing (CMC) was broadly defined as any form of data exchange between two or more networked computers and learners and included electronic mail and electronic conferencing (Aloha-Sidaway, Maclean & Truehaft, 1990; Florini, 1989; McConnell & Hodgson, 1990; Naidu, 1988). CMC is at the base of current NML environments in education (Bates, 1994; Eastmond, 1994, McConnell & Hodgson, 1994; Tkal, 1997). During the 1990s educational resources in CMC were conceptualized (McConnell & Hodgson, 1990) as being centrally stored, providing equal access to learners and tutors, email communications and access to bulletin boards for text based communications with predictions of future conferencing along with internal & external communications, file transfer, virtual meetings, remote teaching and various other uses being postulated for distance education. CMC definitions described situations where it was possible for two personal computers physically located at different places to instantly display identical information on their computer screens, with the other operator viewing that interaction in real time on the other computer screen and control of both computers able to be passed between the different operators, switching between voice and text communications as needed, and this was defined as Screen Shared Computer Mediated Communications (SSCMC) (Dhariwal, 1991).

There has been much discussion in the literature on the how to use technology in the classroom. Bates, in 1995, proposed '12 golden rules' for using technology in education and training: good teaching matters; each medium has its own aesthetic; educational technologies are flexible; there is no 'super-technology'; all major media types should be available to teachers and learners; balance variety with economy; interaction is essential; student numbers are critical; new technologies are not necessarily better than old ones; teachers need training to use technologies effectively; teamwork is essential; and technology is not the issue but how and what do we want students to learn is.

Burge (1994) suggested pros and cons of using computer conferencing for learning and learning facilitation; Laurillard (1993) recommended how to best combine new and established media in the classroom; Mason (1994) provided rationale of the educational value of interactivity through computer conferencing (aural, visual and text) where she argued for the inclusion of success components such as course design, quality of instruction and support facilities specifying that these are not medium dependent but rather on how well teachers understand the strengths and limitations of the technologies and methods being used or being considered for use in teaching practice. McConnell and Hodgson (1990, 1994, 1995); McConnell (1994, 2000); Jones, Ferreday & Hodgson (2005); Ferreday & Hodgson (2006) addressed issues relating to communications, collaborative learning and gender laden messages in online education and Levi (2003) added to this 'living theory' suggesting a need exists for both a curriculum model (learning objectives) and a pedagogic model (educational design and facilitation) - which includes concepts such as access & participation; orientation & socialization; structured learning; self directed & co-operative learning.

With the advent of faster communications, faster processors, larger memories and low cost internet and technology availability, over time these definitions need to be continually updated to include improved and more comprehensive and diverse communications that occur between operators via computer-mediated formats (instant messages, chat rooms, internet-based conferences and social networking applications such as 'Second Life' and 'Facebook') both formally and informally.

The Athabasca University (SCCORI) Internet Business Simulator (ABiSim)

ABiSim is based on the Massachusetts Institute of Technology (MIT) Beer Game (Forrester, 1960) a forecast-driven table top Board Game used to develop an understanding of system dynamics. It is designed for learning through action, typically in a classroom or corporate boardroom and involves the

physical manipulation of round plastic chips while recording numbers in columns on paper and at the end physically calculating results, recording and comparing group results on a large hand drawn chart, posting to a wall and deconstruction of learning outcomes. ABiSim, an internet based system, is both a forecast-driven and a demand-driven system designed to foster students reflection on logistics, system dynamics and international supply chain management. ABiSim is designed for learning through action, and can be run in a classroom, or at a distance over the internet. The simulator results are computer calculated, visually displayed via computer charts, with the fine details instantly accessible in MSWord ™, MSExcel ™, or HTML formats. Varied data analyses can be performed instantly and comparisons between individual and group actions can be made while discussion may range on the impact of decisions made throughout all of the simulations over any length of time.

In ABiSim learners are provided assignments that require the use of ABiSim over the internet, to solve networked real-time problem-based scenarios involving the management of international supply chains. This is provided for within a single integrated application. In the initial lesson plan there is restricted sharing of data for each individual to access only her/his personal system and personal data, dialogue (discussion, sharing of information, cues, suggestions, recommendations, etc.) is restricted. Progressive assignments allowed sharing of increasing data sets so there is a visual sharing of interrelated information, that is, Screen-Sharing (SS) where everyone sees the same screen/data and each other's operational data and thus everybody else's private business data, however discussion (student-student, tutor-student) is still restricted so that discussion after the simulations have been completed can focus on deconstructing the impact of collaboration through visual sharing of information and personal (individual) interpretation without verbal interpretations by others. In the third lesson plan full Screen Sharing (SS) and CMC (text discussion) is provided for via an internal chat engine integrated with the networked application that provides security and privacy of data to each group, independently of other groups using the same application. Inter-group competitions are provided as motivation to focus on the problem. Learning(s) are deconstructed in small groups and also in large group settings.

I used ABiSim in a number of courses/classes/institutions and I share that next with the reader to situate my particular experiences and iterations for improving my educational practice.
- Athabasca University – Executive MBA one-week residential courses (2003, 2004): 3 different classes of students in one-week residential programs. Different learning artifacts used for each.
- York University – MBA program (classroom based) (2003, 2004, 2005): Faculty modified lesson plans to suit their needs and available time.
- St. Francis Xavier University– SAP Universities Alliance workshop for Faculty - (2004): Faculty (engineering) competed against faculty (business) and groups jointly determined learning outcomes.
- Purchasing managers (NAIT - 2003) and strategic purchasing managers (SUNCOR – 2004 - international oil company) – professionals in the workplace (boardroom locations) half-day and a one day workshop, respectively – identified value and usefulness of various simulations.
- Ecole de Technologie Superieure (ETSML) – Graduate and Undergraduate programs (2004-2007): Teams of students in Montreal use the simulations as ice-breaker and optimization exercises.
- Northern Alberta Institute of Technology – NAIT - Bachelor of Applied Information System Technology (2005-2007): Enterprise Resource Planning (ERP) courses - different faculty leading the exercises and other faculty taking part in the simulations and acting as advisors to groups.
- Athabasca University – M.Sc. Computing and Information Systems (2005-2007): This was the first and recurring trials of ABiSim in a fully online distance program.
- MacEwan College – Bachelor of Applied International Business and Supply Chain Management (2005-2007): Undergraduate students in a business management program in physical networked classrooms experienced simulations and discussed what they learned.
- Waterloo University (2006, 2007) – M.Sc. Management Science: Online program. Different conceptual use and deconstruction included in lesson plans. Focus on complexity, system dynamics, changes in pricing models and deeper conceptual explorations of strategy change required for different scenarios – significant changes to costing models for transportation and inventory holding.

Additional lesson plans for ABiSim have been emerging through this process including the development of intelligent software agents with different 'identities' and how teams use constructed identities to play around with the notion of 'what happens if I act as'.

In addition to the above situations in order to learn about research, ontology, epistemology, sociology and methodology in formal settings I began the process of presenting my changing perspectives broadly at conferences to identify what it was that I was engaged with, what I appeared to be learning and what it was that I should be doing as part of my continuing search for improvements in my teaching practice, and as such those colleagues who attended my sessions, asked questions, offered suggestions and engaged me in dialogue were also co-constructors of my emerging perceptions, understandings and conceptions.

- First international conference on Supply Chain Management – Purchasing Managers Association of Canada (PMAC) (2003) - McMaster University: I presented a view of what a collaborative online research institute could be and what it might provide as products and services to students, researchers, business and industry.
- Networked Management Learning conference (2004; 2006) – Lancaster University: I presented a poster session on ABiSIM to explain what it did, why I designed it the way I did to explore if others had contributions to make towards improving my thinking or the design of ABiSIM. I learned about my research community and its interests. In the second conference I presented my changing perspective on what kind of research I was engaged in and what kinds of collaborative learning emerges out of learners' experiences in networked situations.
- Systems Dynamics Conference (2004) – Oxford University: I presented ABiSim in a poster session to the society which manages and sells the 'MIT Beer Game' to identify what interest the professionals and academics specialized in system dynamics had in ABiSim and what I was doing in the field of collaborative networked learning and how they might contribute by way of questions and dialogue to build my understanding of how I might use ABiSim in different ways in the classroom.
- Association of Information Technology Professionals – National Collegiate Conference (2004; 2005, 2006, 2007): I presented annually at this conference to find out what the IT community thought of my iterative design refinement approach with student groups from schools of technology both using ABiSim and working on improving its overall design and my future research.

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