

Creating and Sustaining Online Learning Communities: Designing for Transformative Learning

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Abstract

Learning can be profoundly and personally transformative when it occurs within a community. Creating knowledge in learning communities can facilitate innovative solutions to increasingly complex problems in today's knowledge society. Designing the right environment to create online communities is a complex task that has implications for designers, facilitators and participants. The aim is to create a community that welcomes and engages in constructive controversy, prompting learners to view their practice in an entirely new way. Three significant environmental factors that will enable the creation of a supportive community in which transformative learning can occur include social presence, authentic learning and interdependency. These are intricately linked and take on different levels of importance in different phases of learning and community development. Getting the balance right and being aware of when to emphasise a particular environmental factor is necessary to establish a community that can effectively engage in constructive controversy leading to personal transformation.

Introduction

An environment of mutual trust enables a community to share and explore individual, beliefs, values and assumptions and to resolve differences by respecting minority views and applying objective reasoning. This requires some degree of intellectual conflict. With a supportive community, conflict can be nurtured into constructive controversy. This is intellectual conflict where individuals seek new knowledge and accommodate others' perspectives. Johnson and Johnson (2009) describe constructive controversy as a process which transforms incompatible beliefs and ideas into new knowledge and perspectives through personal uncertainty and rational discourse. The nature of society and organisations is changing and a traditional approach of 'thinking alone at whatever level of leadership is no longer adequate. The problems are too complex, the interdependencies too intricate, and the consequences of isolation and fragmentation too devastating' (Isaacs 1993, p. 24). Understanding how to nurture intellectual conflict within a community to develop constructive controversy is essential in the knowledge era. Transformative learning is where individuals are critically aware of their own assumptions and are able to assess their relevance to the community. Deep transformative learning can occur within a community when the right environmental factors are present to establish a strong sense of community. 'Nothing happens without 'personal transformation'. And the only safe space to allow for this transformation is the learning community' (Kofman & Senge, 1993, p. 5). To ensure an environment is established that prepares a community to maintain its supportive nature through constructive controversy, an interdependent relationship must first develop between members. This interdependence can only be established once members have a sense of one another through social presence, and an established

learning purpose created through authentic learning experiences. The way in which a community addresses conflicting values and beliefs will influence how learners engage in social presence which can ultimately impact on their learning experience. When individuals have critically assessed their own assumptions and explored these as a community through constructive controversy, a learning community is well situated to build new knowledge on a solid foundation of shared meaning and values. This strong sense of community creates a place in which deep transformative learning assists learners in creating new knowledge and devising solutions to complex modern problems.

Community

The word 'community' can be used to describe groups of people that come together socially for a variety of purposes, for example, to form a community of practice, a learning community or a community of enquiry. It can also refer to the creation of a 'sense' of community. A useful definition of community is provided by Conrad (2005) as 'a general sense of connection, belonging, and comfort that develops over time among members of a group who share purpose or commitment to a common goal' (p. 2). The members of an online learning community will have the collaborative construction of meaningful and worthwhile knowledge as a common goal, which in turn requires interaction and collaboration (Garrison, 2006). According to Vygotsky (1978), collaboration within social environments is necessary for learning. Social interaction is a prerequisite for collaboration and collaborative learning (Kreijns, Kirschner & Jochems, 2003) and, therefore, for the establishment and maintenance of a successful online learning community. Kreijns et al. (2003) also argue that group cohesion depends on the development of meaningful social relationships and stress the importance of community members perceiving that they are mutually dependent on each other to achieve community goals. Shea (2006) lists shared goals, trust and mutual support as features of 'high functioning communities' (p. 37). The importance of social interaction to the success of an online community cannot be underestimated.

Dialogue

The vehicle of community generation and sustenance is dialogue. Dialogue facilitates communal inquiry and the study of knowledge within the communal values and beliefs. Epistemology, or the 'study of knowledge and justified belief' (Stanford University, 2005) cannot exist in isolation from ontology, the philosophical study of how features of existence relate to one another (Stanford University, 2005), and axiology, the philosophical study of values (Stanford University, 2005). Dialogue facilitates community epistemological inquiry and purposefully explores a community's shared ontological and axiological standpoints. For the purpose of exploring the environmental factors that create and sustain communities, 'dialogue' is distinguished from 'debate' and 'discussion', and aims to achieve a greater level of meaning than mere consensus. The root of the word 'consensus' means to have people 'feel together' (Isaacs, 1993, p. 26), but in seeking consensus, often a group works to find what they can 'live with for now' (p. 26) rather than exploring the deeper shared meaning of the group. A working definition used throughout this discussion is adopted from Isaacs (1993) who states that dialogue is 'a sustained collective inquiry into the processes, assumptions and certainties that compose everyday experience' (p. 25). Dialogue allows the exploration of the ontological and axiological basis of a community in a manner that leads the group to an understanding of their community as a whole. Dialogue is distinct from 'debate', which implies there are winners and losers. It is also distinct from 'discussion', which shares the roots of its meaning with the word 'percussion' and means 'to break apart' (p. 35). Alternatively, dialogue places primacy on the whole and seeks to reveal the collective assumptions, beliefs and values of a group. Dialogue is an essential element of transformative learning because it allows a community to reach a place where the unstable nature of shared assumptions, beliefs and

values do not inhibit learning. In an online community, the community develops primarily through dialogue, which is the vehicle to building a shared sense of purpose and facilitate transformative learning.

Design Factors that Support Community

Learning communities offer an opportunity to engage in rewarding learning experiences that can lead to a deeply personal transformation. 'Nothing happens without 'personal transformation'. And the only safe space to allow for this transformation is the learning community' (Kofman & Senge, 1993, p. 5). There are a number of environmental factors that are essential to create and sustain communities that support transformational learning. Five significant factors include: social presence, authentic learning, interdependency, critical discourse and leadership. The first of these factors, social presence, is necessary so that members of the community become familiar with each other as individuals, understand the knowledge each member brings to the community and create the social framework for the community to establish itself. The relationships that learners build during this crucial process of presenting themselves in the online community establish the social infrastructure through which knowledge will flow. The second factor is authentic learning. Authentic learning is learning by doing where the focus is on learning-by-doing real world problem-solving (Lombardi, 2007). Through authentic learning activities, learners are able to move beyond 'knowing' the concepts they are learning to begin to 'understand' these same concepts while they are building relationships. The third factor is interdependence. As learners connect with each other, they discover the value they bring as individuals and how that complements the knowledge already pooled within the group. The establishment of interdependent relationships is crucial for discovering how learners will resolve conflicts as they move into the discomfort of learning. Once the learning community is established, other factors are important to maintain the learning community. These are covered in Part II. These factors need to be present concurrently to create and sustain communities. The environmental factors represented in Figure 1 demonstrate the layers learners move through in deep, transformational learning.

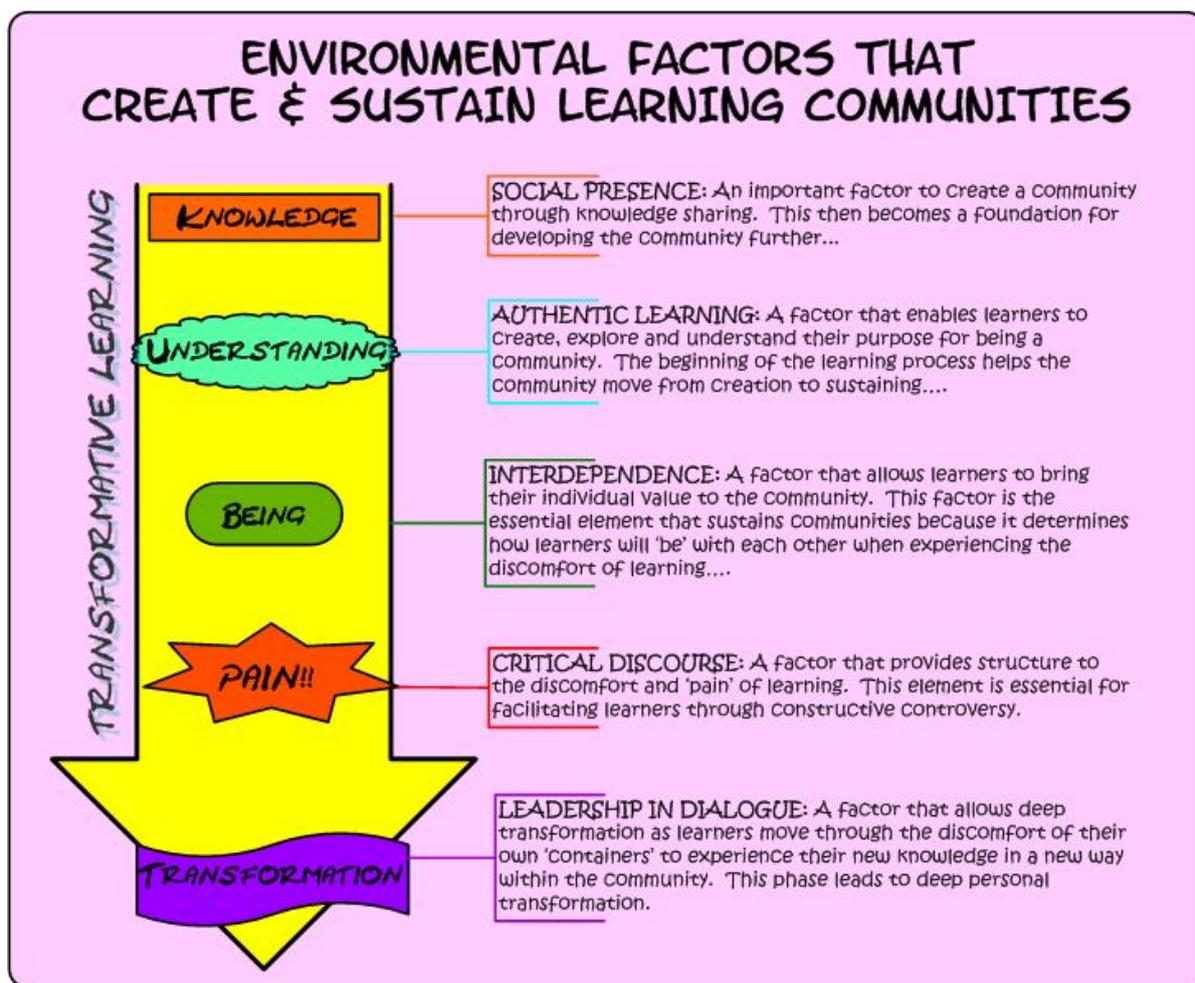


Figure 1: Environmental factors that create and sustain communities to facilitate transformational learning

Social Presence

Social presence is a crucial factor for creating online communities as it is the basis for meaningful interpersonal communication and relationships, which enables learners to share knowledge during the learning process. Social presence has been defined as the 'degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships' (Short, Williams & Christie, 1976, p. 65). In the context of an online community it is a measure of 'how successfully media convey a sense of the participants being physically present, using face-to-face communication as the standard for assessment' (Preece, 2000, p. 150). Garrison, Anderson and Archer (2000, p. 94) define social presence as 'the ability of participants in a community of inquiry to project themselves socially and emotionally, as 'real' people' (i.e. their full personality) through the medium of communication being used. The degree of social presence determines how well members of a community connect with each other on a personal level and is 'an essential precondition for establishing a sense of community and cognitive presence' (Garrison, 2006, p. 27). Put simply, social presence is 'a measure of the feeling of community that a learner experiences in an online environment' (Tu & McIsaac, 2002, p. 131). A high degree of social presence is essential in an online community to establish relationships based on mutual trust that enables the sharing of knowledge.

Social interaction in online learning communities is essential to building social presence but needs to be nurtured through design and learning leadership. Kreijns et al. (2003) believe that social interaction and community building will not automatically take place ‘just because an environment makes it technologically possible’ (p. 336). Designers and facilitators need to be mindful of the importance of strategic measures to build social interaction. Aragon (2003) believes that designers, leaders and participants all have responsibility for developing social connection within online communities and recommends a number of specific strategies that each group can employ. According to Aragon social interaction is often taken for granted. Strategies to build social presence therefore need to be consciously and deliberately adopted. Garrison (2006) suggests guidelines for designers and facilitators to follow that develop a community-building climate. Swan and Shih (2005) highlight the importance of the careful design of discussion and recommend that designers and facilitators should ‘seek ways to evoke personal experience in discussion’ (p. 131). Koh, Kim, Butler and Bock (2007) note the importance of complementing text, which is the dominant form of communication in online communities, with appropriate graphical, audio and video interfaces such as video chat. Tu and McIsaac (2002) found that the quality of online interaction is more important than its frequency. Consequently, designers need to select communication channels that ‘optimize the learner’s self-image and enhance his/her interaction’ (2002, p. 147). Guidelines suggested in the above readings have been adapted and are summarised in Table 1.

Guideline	Designers	Leaders	Participants
Post welcome messages	*	*	
Allow for personal profiles of participants	*		*
Incorporate graphical, audio and video interfaces	*		
Structure collaborative learning activities in groups	*	*	
Provide opportunities for informal or private communication	*		
Initiate and contribute to discussion		*	*
Respond promptly		*	*
Provide frequent feedback		*	
Share personal stories and experiences		*	*
Use humour		*	*
Use appropriate forms of address		*	*

Table 1: Strategies to establish and maintain social presence (Adapted from Aragon, 2003)

A sense of social presence and interaction is marked by ‘increased levels of comfort, intimacy, self-reliance and self-knowledge’ (Conrad, 2005, p. 17) in which mutual trust is established. This takes time to develop but is essential if a learning community is to experience transformation. Therefore, whatever strategies to build social presence are adopted, the time constraints of the particular learning community must be taken into account during the design phase. Time must be allowed for a learning culture to develop, for relationships to be initiated and for knowledge sharing to occur, all of which are necessary for a community to sustain itself.

Authentic Learning

Authentic learning provides an opportunity to refine the learning purpose of the community and to assist the community move beyond the creation phase to consider how it will sustain learning. This is achieved through the 'forward focus' of authentic learning that allows learners to explore the 'real-world' applications of their new learning. Lombardi (2007) believes for authentic learning to be possible, pedagogy needs to focus on 'real-world, complex problems and their solutions, using role-playing exercises, problem-based activities, case studies, and participation in virtual communities of practice' (p. 2). Authentic learning in a learning community requires a common need. It enables the learner to develop their epistemological standpoint within the context of the real-world ontology and axiology of their focus discipline. Real-world relevance has been expressed as the learner's preference to solve real-world problems (Lombardi, 2007; Reeves, Herrington & Oliver, 2002; Mims 2003). Mims (2003) recommends a number of key characteristics in authentic learning experiences. These are as follows:

- Learning is centered on authentic tasks that are of interest to the learners.
- Students are engaged in exploration and inquiry.
- Learning, most often, is interdisciplinary.
- Learning is closely connected to the world beyond the walls of the classroom.
- Students become engaged in complex tasks and higher-order thinking skills, such as analyzing, synthesizing, designing, manipulating and evaluating information.
- Students produce a product that can be shared with an audience outside the classroom.
- Learning is student driven with teachers, parents, and outside experts all assisting/coaching in the learning process.
- Learners employ scaffolding techniques.
- Students have opportunities for social discourse.
- Ample resources are available.

(Mims, 2003)

These characteristics demonstrate the complexity of authentic learning tasks that can provide rich community learning experiences through a feeling of connection to both the real-world and in real-world learning relationships. 'The complexity associated with authentic tasks provides a rationale for group formation: task completion requires the combined resources of an interdependent group of learners' (Palloff & Pratt, 2007). Communication technology enables learners to connect socially within real-world contexts as part of their learning process. The use of Web 2.0 tools enables learners to share and collaborate with experts, other learners and teachers from all over the world (Anderson & Elloumi, 2008). The definitions of authentic learning are varied as demonstrated in Figure 2. This environmental factor is essential for moving learning communities out of the creation phase by allowing them to build an understanding of their purpose and to develop expectations about the direction of their learning journey.

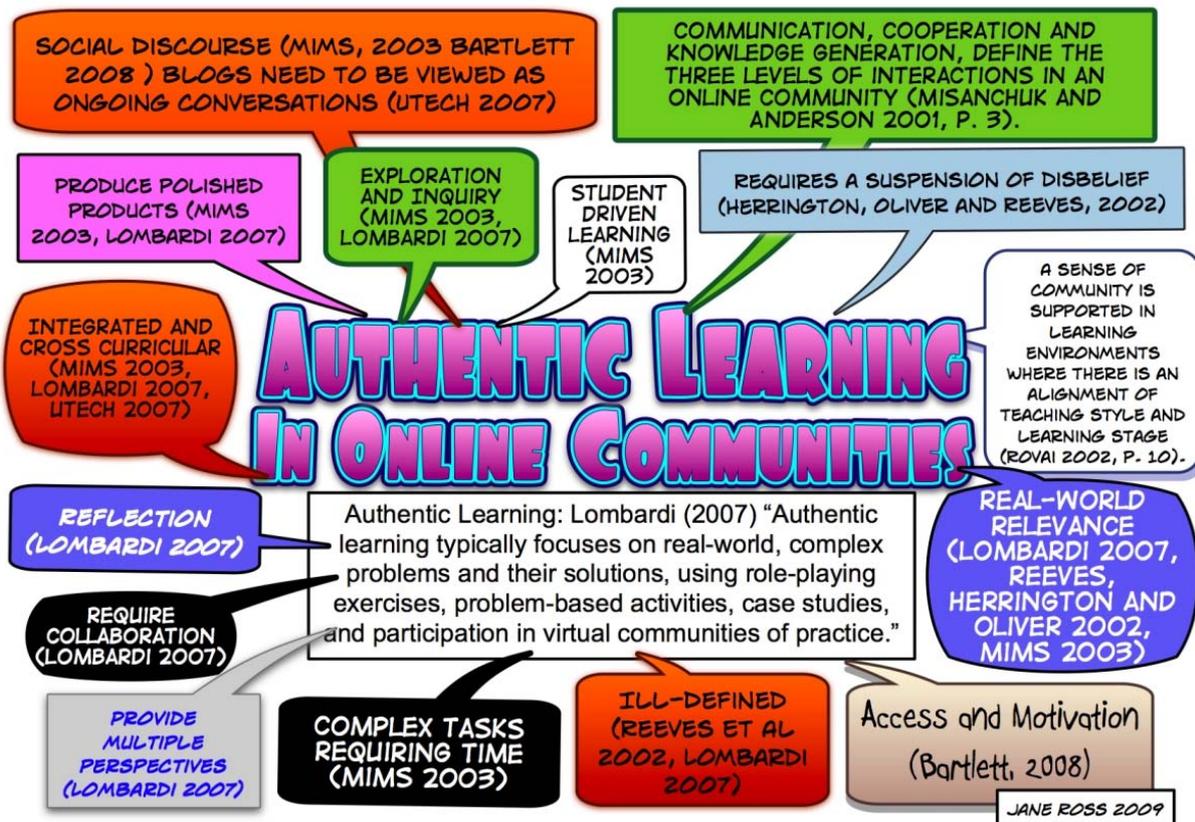


Figure 2: Defining authentic learning

An essential element in using media for communication is the effective establishment of 'suspension of disbelief'. The media used for learning requires that learners experience suspension of disbelief (Herrington, Oliver & Reeves, 2002) in the same process that movie-goers must go through to immerse themselves in media. Just like the movie-goer who must suspend their disbelief in the technological construct of reality for their consciousness to transport them from a movie cinema, a learner must also be transported from the hardware and into the process of learning. This requires that the learner 'accept the worlds that have been created, no matter how unlikely' (p. 2). By employing a suspension of disbelief in learning, learners become instantly engaged. Creating learning communities requires that in 'initial contact with authentic learning environments, many students willingly and instantly engage' (2002, p. 5). The purpose of suspension of disbelief is to remove the conscious awareness about how the film constructs reality for the viewer. Instead of filming real world situations from a wide shot, the camera attempts to recreate the individual perception of an individual within the story. For example, the camera focuses on faces during conversation just as the eye focuses on an individual, drawing the viewer deeper into conversation. In this way, interaction with characters and events on the screen recreates how an individual would interact within the scene as if it were real life. Learning with technology must create a suspension of disbelief in the technological construct of the learning process and relationships. Authentic learning cannot be achieved by recreating the classroom, but by recreating the process and focusing perceptions in learning as if it were face-to-face. This involves a deep understanding of the way learners learn. Technology needs to be able to recreate the dynamics of conversation theory, the social interaction of social learning and provide opportunities for creative conflict. When media facilitates the interactions rather than the classroom, a learner's suspension of disbelief allows them to immerse in the learning without distractions by the technology and the isolation of their geographic distance from their learning community. This suspension of disbelief in the construct of

social interaction is essential if learners are to experience the transformative nature of deep learning. How successfully social presence can be created within the learning community relies on the teacher or learning leader to provide technology and the means by which the learners can be 'present' sufficiently to suspend disbelief. However, the primary vehicle through which suspension of disbelief occurs is the dialogue in which the community engages. Dialogue is the heart of the learning experience and is covered in depth in Part II. A precondition for authentic learning is the suspension of disbelief as it allows learning to move past the artificiality of the technology to focus on the meaningful interactions with other learners in the learning community to facilitate transformational learning.

Interdependence

Online learning communities are created and sustained by a common purpose or goal and by the value they place on the contribution of the individual. Rather than replacing the individual, the common purpose of the learning community affirms the individual. Where individual knowledge is incomplete, individuals are able to identify their knowledge gaps and motivated by their social membership to address these assisted by their peers to come to a deeper understanding. This decreases the teachers 'power' as an expert and enables the teacher to become involved as a peer/coach. These are distinguishing attributes of interdependency: the way reciprocity binds people together, in both process and spirit, and how personal goals become interrelated around a common purpose. Designing for such a learning community goes beyond the online tools themselves and involves the social environment (Bielaczyc, 2006). The aim is to provide the learner with cues for acting cooperatively, a kind of scaffold or platform that allows the group to form and act. Leadership also has an important role to play in facilitating and promoting community-based learning, a teacher's visible role recedes so learners can be empowered and respected for their individual strengths and contributions. Authentic activities provide a motivating and plausible setting for interdependent learning communities.

Goal and task interdependence are two essential components of relationships within the learning community. They help sustain the community through intellectual conflict and creative contention. The primary carriers for environmental cues that prompt interdependence are learning activities (Bielaczyc, 2006) and related assessment practices. Somech (2008) cites the following definitions for task and goal interdependence:

Goal interdependence is the extent to which group members believe they are assigned group goals or given group feedback.
(Saaedra et al. as cited in Somech, 2008, p. 365)

Task interdependence is the extent to which an individual team member needs information, materials and support from other team members to be able to carry out his or her job.
(Van der Vegt, as cited in Somech, 2008, p. 365)

Providing group rewards, particularly in the form of assessment, is a powerful way to create goal interdependence. Group members receiving the same grade can motivate learners to work together (Abrami & Chambers, 1996). The criterion for achieving the same grade provides the cue for learners to build interdependent relationships in order to achieve their common goal. It may not always be necessary to provide group rewards to create a belief among learners that their individual goals are related (Abrami & Chambers, 1996). Some authentic activities can be intrinsically motivating, creating a shared sense of curiosity and providing the basis for goal interdependence. They provide a group with sufficient motivation and focus, making group rewards unnecessary.

Task interdependence may be developed through individual roles and responsibilities, interrelated tasks and the development of specialised expertise (Daniels & Gatto, 1996). Individual context, prior expertise and access to unique resources by individuals may also be points of difference around which task interdependence can be developed. Given that task interdependence differentiates between individual contributions, it can also be the basis for individual accountability either as an obligation to the group (Daniels & Gatto, 1996) or outside the group through such things as reflective assessments (Anderson & Elloumi, 2008). Task interdependence is the basis for valuing individuals for their differences, contributions and the prior knowledge they bring to the learning community. Goal and task interdependence need to be considered in the design of the online community to sustain meaningful interaction that can endure the conflict and discomfort involved in learning.

For a community to risk the creative dynamics of individual expression they must overcome shadow issues to achieve mutual trust and shared meaning. Palloff and Pratt (2007) caution that when learners attempt to connect with each other in an online community, shadow issues emerge. Shadow issues are psychological issues which inform negative behaviours that can inhibit interaction and individual expression. If a community is to take advantage of the creative dynamics of individual expression its members must overcome shadow issues to achieve mutual trust and shared meaning. Smith (2005) explains how learners are naturally drawn to connect with others because they want to avoid isolation and fear rejection. However, the group can also threaten their individuality when mutual trust is not present. These opposing pressures create a psychological tension that may present itself as inappropriate coping behaviours that interfere with the interaction of a community. Learners must achieve a personal and distinct identity within the group (Smith, 2005). Interdependence strikes a balance between individuality and social connectedness, particularly in the way it values difference and individual contributions (Palloff & Pratt, 2007). To effectively sustain online learning communities, mutual respect and shared meaning must overcome shadow issues to enable risk-taking in the learning process.

Cooperative approaches to conflict assist groups in knowledge construction and sustain groups through the contention of learning. Group dynamics theory describes the way learning communities develop through stages and eventually mature (Sweet & Michaelsen, 2007). Learning communities do not usually form spontaneously, particularly in a formal setting (Hudson, Hudson & Steel, 2006). Many fail to mature, instead engaging in competitive or dominating behaviours (Grzeda, Haq & LeBrasseur, 2008). Zhang and colleagues (2009) have noticed that as a group develops there is a corresponding development in knowledge construction that is also evident in improvements to the quality of discourse (Sweet et al., 2007). Both knowledge construction and group development involve cooperative and constructive approaches to conflict (Alper, Tjosvold & Law, 1998; Johnson & Johnson, 2009). The way a group approaches conflict seems to be a crucial factor in its development and effectiveness (Alper et al., 1998) and a focus for design. Building interdependence to sustain a community requires the ability to foster constructive approaches to conflict that will be imperative to promote constructive controversy.

When learners believe their goals are aligned and their individual strengths are necessary to achieve this goal, then it provides a rationale for sustaining learning relationships, provides cues for how to relate to each other and consequently how to approach conflict. Somech (2008) has proposed four possible combinations of task and goal interdependence which prompts competitive or cooperative use of the groups combined resources; distributed knowledge and skills, and material assets such as private data sources:

- 1) Low task and goal interdependence leads to indifference between members of a group and little or no conflict, it fails to reap the rewards of conflict and more critically for the online environment, stifles interaction.
- 2) High task and goal interdependence leads to cooperative and productive approaches to conflict, the sharing of resources, respecting and exploring multiple perspectives.
- 3) Low task and high goal interdependence promotes a low degree of personal accountability where members of a group can exploit others efforts without contributing themselves. This creates uncertainty in the group about other team member's goals and intentions and may predispose the group to competitive interactions.
- 4) High task and low goal interdependence environments require group members to work together and share resources without a common focus. Group members can be tempted to use their power to gain maximum resources for personal objectives. It is a highly unstable and competitive environment.

When designing a learning community, having high goal and task interdependence is crucial to limiting unproductive conflict and nurturing constructive interaction. A particular community's approach to conflict has an ongoing effect on growth and effectiveness (Alper et al., 1998) as social capital is either eroded or developed (Hung & Nichani, 2002; Kilpatrick et al., 2003). In this context social capital represents the affective attributes of relationships that endure beyond an individual interaction and accumulate to support greater levels of trust, respect, intimacy and ultimately group effectiveness. Having high goal and task interdependence creates an expectation of mutual trust that provides a bank of social capital prior to group formation (Somech, 2008). When the group engages in constructive conflict it engages in open-minded discussion that integrates new ideas where individuals are transforming their thinking about knowledge. Group members may disagree with each other's ideas, but they also confirm each other's personal competence (Tjosvold, as cited in Johnson et al., 2009). This process leads to greater levels of disclosure (Johnson & Johnson, 2009) that in turn promote interaction, trust (Palloff & Pratt, 2007) and facilitates risk that learners must take when learning new knowledge that will transform their thinking. This then leads to the further development of social capital because the group becomes more confident it can use all of its resources to meet challenges of constructive controversy within the interdependent context. At the resolution of constructive conflict the group becomes more confident in itself (Alper et al., 1998). When the group approaches its next controversy, the collective feelings of trust, respect and confidence are an asset, which the group draws on to achieve new levels of collaboration.

Membership of an online learning community should empower individual learners to participate in group decision-making and the social construction of knowledge. Given the importance of the environment in establishing respectful and cooperative relationships another consideration is the role of the teacher in design. A related issue is how the environment interacts with the learner to create cooperative relationships: does the environment actively mould passive learners or do learners actively search and interpret the environment. In the online learning environment a teacher's presence is evident primarily through the design of the environment and through facilitation (Anderson & Elloumi, 2008; Palloff & Pratt, 2007). If the object of design is to create and sustain a learning community, then the activities, tasks and assessments that comprise the learning environment must prompt the appropriate interactions between learners (Bielaczyc, 2006). A significant finding is that a learner's environment can prompt competitive or cooperative approaches to conflict (Daniels & Gatto, 1996). Where learners perceive interdependence in their environment they will act cooperatively towards each other. Where interdependence is lacking competitive approaches will follow (Somech, 2008). Initially it was thought that highly scripted

environments were necessary to create goal and task interdependence (Daniels & Gatto, 1996). However, what has been revealed is that people actively search for cues about interdependence in their environment and these cues have a powerful influence on relationships (Alper et al., 1998; Somech, 2008). A teacher's role is to create a learning environment that contains cues for a high degree of goal and task interdependence, so as to encourage cooperation rather than conflict within the community.

Productive online learning environments are an outcome of effective leadership expressed through intentional design. If teachers leave the design of the learning environment to chance then learners may be subject to a range of negative outcomes, and learning that is inferior to individual instruction. When the design of a learning environment does not accommodate interdependent relationships and mutual trust among learners, they may deny each other's competence, withhold information and seek to assert their point of view and impose outcomes on others (Johnson et al., 2009). This reduces team effectiveness and erodes social capital by creating mistrust. Without effective leadership in establishing an environment that fosters interdependency, the community may experience a destructive aftermath that involves continuous conflict as counterparts seek to improve the solution (Somech, 2008). Effective design of the learning environment will facilitate interdependent relationships that will enable learners to prepare for the constructive controversy that is essential to learning.

Conclusion

Transformational learning can be effectively facilitated when communities are established with intentional design focus on interdependent relationships, social presence and authentic learning. Social presence needs to be facilitated in the first instance through effective design and leadership. Providing the technological functions to personally engage with other learners requires more than the opportunity to interact. A teacher will need to lead learners in the interaction through direction and encouragement to engage socially. Establishing a social presence is an essential first step to building interdependent relationships that will facilitate learning. Introducing learners to authentic learning experiences that allow them to 'suspend disbelief' about the constructedness of the social environment will further enhance the social connections that will facilitate a focus on the dialogic exchange that is the vehicle for social learning. Constructed authentic learning experiences that empower the learning community to set their own learning goals needs to be framed within real world contexts. Effective leadership in the learning process will bring attention to the importance of the dialogue in building interdependent relationships for the purpose of goal setting and preparing for learning. This establishment of a network of learners prepares the community to take on the risks associated with controversy in learning and provides a social framework to achieve constructive outcomes. Constructive controversy facilitates transformative learning, which is achieved through critical discourse and effective leadership and is covered in Part II. Through an exploration of the phases of dialogue supported by social presence, authentic learning, interdependence, critical discourse and parallel leadership, learners will be able to achieve deep personal transformation, the result of which is new knowledge that will benefit the community as a whole. The establishment of community provides a strong foundation for transformative learning and is essential to enable learners to engage in creative conflict that can result in knowledge creation that is exponentially greater than the sum of individuals.

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