

Designing for Social Engagement in Online Social
Networks Using Communities of Practice Theory and
Cognitive Work Analysis: A Case Study.

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

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Abstract

New social networking and social web tools are becoming available and are easing the process of customizing online social environments. With these developments in technology, core design efforts are being extended beyond usability for individual users and beginning to include notions of sociability for the engagement of communities of users. This thesis is an investigation of these developments. It is guided by the principal research question: how do you design for social engagement in an online social environment intended to facilitate interaction in a community of users? To address this question, this thesis presents a domain-community model developed from the communities of practice concept and the Work Domain Analysis model used in Cognitive Work Analysis. The domain-community model provides a basis for the design a composition of web components for an online social environment that will addresses issues of social engagement and domain effectiveness.

In a case study, the domain-community model was used as a basis for the redesign of a social networking portal used by an international development leadership community called UCP-SARnet. A social network analysis of core members of UCP-SARnet was conducted before and after the portal was redesigned. From the social network analysis, it was concluded that the structure of UCP-SARnet was positively affected by the redesign: core group members reported they knew one another significantly more after the redesign of the website than before the redesign. User experience measures of the UCP-SARnet portal, website usage data, and a tally of website communication activity also changed significantly with the redesign of the website. This provided more evidence that a design informed by Cognitive Work Analysis and communities of practice produced a measurable effect on the structure of the UCP-SARnet online community. As such, this model can provide a basis for designers of online communities to more systematically account for social phenomena in relation to collective efforts in a given work domain. Furthermore, it is expected the effectiveness of the

model can be taken forward with future work by refining the domain-community model, developing techniques to translate the model into interface concepts, and building practices for community-based research and design.

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List of Acronyms

AIDL	Advanced Interface Design Lab
ASU	Arizona State University
CoPs	the communities of practice concept or theory
COP	specific instance of a community of practice
CWA	cognitive work analysis
MDG	United Nation Millennium Development Goals
SNA	social network analysis
SP	social presence metric
UCP-SARnet	University Community Partnerships for Social Action Research Network
UE	user experience metric
WDA	work domain analysis
WU	website usage metric

Chapter 1

Introduction

With the emergence of social networking and social web technologies, we are seeing a dramatic shift in the way enterprise information technologies are being designed. Ready-to-use social web services and social networking platforms have offloaded much of the low-level coding work allowing designers to easily create customized online social environments. Designers of these systems are looking at more than the visual look-and-feel or usability and are considering the ‘sociability’ of design that can facilitate meaningful exchanges and help build knowledge and practices among communities of users. With these challenges, there is a call for a new set of analytical tools that consider the forces that support social engagement and community development. These analytical tools will provide guidance to a new generation of interface designers, who are going beyond designing for single users to designing interfaces that engage and empower entire communities of users.

The term ‘community’ has very widespread use, yet there is relatively little consensus about how to include community considerations in the process of system design. There seems to be general consensus that there is significant benefit to understanding the nature of community and how they might be mobilized to address issues of large scale importance, such as climate change and poverty (Putnam, 2000). Nonetheless, little has been developed to provide a systems view of communities in conjunction with technical systems aimed to address these large scale issues. As such, this thesis is an initial explorative effort toward developing a systems design approach that accounts for the community dimension of technical systems. The thesis is guided by the high-level research question: *How do you design for social engagement in an online social environment intended to facilitate interaction within a community of users?*

Cognitive Work Analysis (CWA) is useful as a basis for investigating this first research question. In particular, CWA provides a technical framework with multiple layers of analysis necessary for understanding and designing for complex sociotechnical systems: large scale systems that require consideration of both technical and social dimensions of design. While CWA provides a basis for the inclusion of a social dimension in design, it has not yet been used to model and design for a community. The communities of practice concept (CoPs), as developed by Wenger (1998) and Wenger, McDermott, and Snyder (2002), provides a basis for understanding a kind of knowledge community that can form through processes of social learning in knowledge-intensive work environments. The CoPs concept offers a lens for understanding the nature of social engagement in a community of shared knowledge and practices.. Together, the CoPs concept and CWA appear to be complimentary in being able to model large scale systems as well as account for the community dimension in the process of design. As such, with the interest in social networking social web technology, the more specific research question in this thesis is: *Does a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?*

To address this question, work domain analysis (WDA), the first phase of CWA, is extended to represent CoPs from a systems perspective. The domain-community WDA that was developed is used to provide an interior and exterior view of a *particular* community of practice (COP), which gives guidance to designing an online social environment. This provides a theoretical basis for a design approach. Furthermore, social network analysis (SNA) is explored with CWA as a way to represent the structure of a COP within large social systems. SNA provides a means to translate concepts of CoPs into measurable indices that can be used to track changes in a particular COP over time. SNA can also show how multiple COPs may differ, and how multiple COPs may be related. This provides practical measures to determine effects on the structure of an online community.

In order to answer the second research question, the domain-community WDA and SNA were used in the case study of the redesign of a social networking portal of an online international development COP, University-Community Partnerships for Social Action Research (UCP-SARnet). In this case, the author created a domain-community WDA for UCP-SARnet in their current stage of development. Based on the domain-community WDA model of UCP-SARnet, design changes were made to their social networking portal. SNA along with a number of other analytical measures were taken to track UCP-SARnet before and after the design changes were made to see the effect of this approach on the structure of the COP.

This thesis begins with an overview of CWA and CoPs which leads to an integration of the concepts in the domain-community WDA. SNA is included in the overview as it relates to monitoring the structure of COPs. A case study chapter follows, providing details of the redesign of the UCP-SARnet social networking portal in using the domain-community WDA. A methods chapter describes the measures, including the SNA, taken to track the changes to the structure of the UCP-SARnet COP before and after their social networking portal was redesigned. The results chapter summarizes the results of the measures taken before and after the design changes. Finally, discussion and conclusions chapters provide a view of the significance and limitations of the work, as well as a look at future developments of the research.

The reader should note that in this thesis, 'CoPs' will be used as the abbreviation for the communities of practice concept, and 'COP' will be used as an abbreviation for a specific instance of communities of practice.

Chapter 2

Developing a Systems View of a Community of Practice

This chapter brings together literature in the area of CoPs, CWA, and SNA in order to answer the primary research question: *How do you design for social engagement in an online social environment intended to facilitate interaction between users in an online community?* Insights from these research fields are integrated to develop the domain-community WDA, a systems view of a COP. In this systems view, the CoPs concept provides a way to understand how individuals and groups negotiate meaning, and how they can be viewed from the exterior as well as the interior. CWA provides a systems frame, the WDA, to represent the negotiation of meaning as well as the exterior and interior views of a COP. The resultant domain-community WDA model can be used to inform the design of an online social networking portal for a COP. Finally, SNA provides a method of analysis to track structural changes in a COP and determine the interior and exterior effects of any design interventions made with a COP. The domain-community WDA and SNA will be used in the case of the redesign of the website for UCP-SARnet, an international development leadership COP, in Chapter 3.

2.1 Communities of Practice

This section provides a brief synopsis of CoPs including definition, origins and examples of the concept, as well as an outline the tradeoffs and priorities of designing for a COP. Finally, we present a model and a visual interpretation of CoPs, which illustrates how designing for a COP is a two-fold task concerned with (1) an exterior view of how a COP provides value in its greater context, and (2) an interior view of how members of the COP negotiate meaning.

The following is a common definition of CoPs:

Communities of practice are groups of people who share a concern, a set of problems, or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis. (Wenger, McDermott, & Snyder, 2002, p. 4)

CoPs stem from the seminal work of Lave and Wenger (1991) in situated learning and from developments of Suchman (1987) in situated action. The CoPs concept has been applied in a variety of domains including knowledge management and management consulting (Wenger, McDermott, & Snyder, 2002); human resources management (Stahl and Björkman 2006); organizational learning (King 2009); as well as in pedagogy (Kimble, Hildreth, and Bourdon 2008). In these domains, CoPs helps people understand how tacit knowledge may be accessed and employed through formal and informal social learning (Hildreth 2004; Saint-Onge and Wallace 2003; McNichols 2008; Hara 2009; Preece 2004; Brown and Duguid 1991). The approach has been used to inform design strategies for online communities (Hildreth, 2004; Karacapilidis, 2010; Preece, 2004; Stuckey, 2007; Wenger, White, & Smith, 2009) and could be connected to larger systems design approaches like CWA.

There are many examples of COPs. For instance, urban construction workers share a concern for the workmanship and coordination of a large-scale building project, and the workers develop communication practices, techniques, and informal etiquette as they interact from day to day. New parents organize weekly meet-ups with other parents, sharing stories of the highs and lows, as well as practical tips and tricks of caring for their children. Hobbyist astronomers meet online to characterize newfound galaxy formations discovered by deep-space telescopes and, through numerous online interactions with other hobbyists, develop a granular awareness of the features of these formations. From these examples, it should be clear that COPs exist all around us and that the CoPs concept does not necessarily describe a formal group of individuals. We are each part of multiple COPs as we engage in our daily lives.

It could be argued that the uptake of the notion of CoPs in theory and in practice is, in part, due to a critically important assumption it makes about the process of learning. In contrast to behaviorist learning theories, which hold the metaphor of '*learning as acquisition*,' CoPs and social learning theory hold the metaphor of '*learning as participation*' (Fuller, 2007). Instead of seeing the challenge of supporting learning as shaping the content material and the individual learner, CoPs views the support of learning as *shaping a meaningful social context and structures for participation*. This distinction is critical for the full appreciation of the CoPs concept. Rather than focusing on content, CoPs is concerned with how context and structures of participation influence how individuals negotiate meaning and undergo learning. In the next sections, the key principles of CoPs, particularly the negotiation of meaning and the fundamental structure of a COP are discussed.

2.1.1 The Negotiation of Meaning

The negotiation of meaning is both an external and internal process through which an individual experiences their world as meaningful. Wenger (1998, Chapter 1) explains that the negotiation of meaning is always being undertaken by an individual regardless of whether it is an experience happening for the thousandth time or an event that is being experienced for the very first time. Thus, in all situations, individuals “produce meanings that extend, redirect, dismiss, reinterpret, modify or confirm – in a word, negotiate anew – the histories of meanings of which they are part” (Wenger, 1998, Chapter 1). In this way, negotiation is meant to convey both the traditional sense of the word as in ‘to negotiate a price between two people’, but also as an action that requires continuous focus and adjustment as in ‘negotiating a hiking trail’ (Wenger, 1998, Chapter 1). In both of these senses, the negotiation of meaning takes place through an interplay of the internal experience living in the world and external forms we ascribe to the world, or what Wenger (1998, Chapter 1) refers to as a duality of participation and reification depicted in Figure 1.

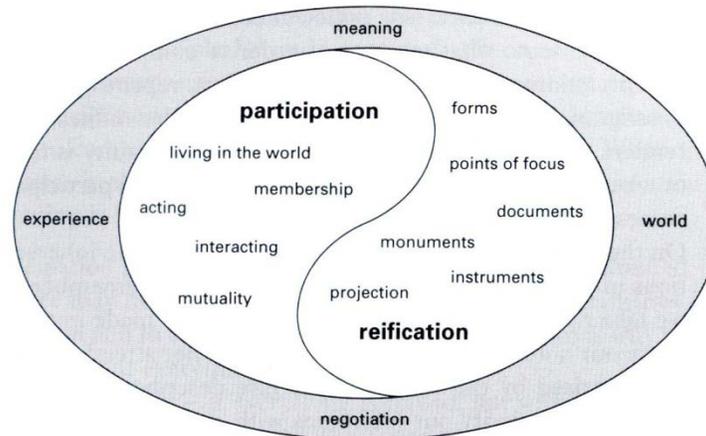


Figure 1: The negotiation of meaning as a duality of participation and reification (Wenger, 1998, Chapter 1).

The distinction between participation and reification is important for the understanding of the CoPs concept. In CoPs, *participation* takes the common usage definition: “To have or take a part or share with others (in some activity, enterprise, etc.)” (Merriam-Webster Online, 2009). There is emphasis that participation is an ongoing process. It considers both personal membership in a community and involvement in social enterprises in a way that “combines doing talking, thinking, feeling and belonging, [...] [while involving] our whole person, including our bodies, minds, emotions and social relations” (Wenger, 1998, Chapter 1). This process requires the possibility of mutual recognition between the participant and other participants, in which they acknowledge that they have the ability to influence each other’s experience of meaning. In having that ability participants recognize something of themselves in each other. Participation, as it is defined by Wenger (1998, Chapter 1), does not denote only harmonious relations and can include conflicting ones as well. Furthermore, giving wider implications to the term, participation cannot be turned off when the actor leaves the context of engagement. For example, professors, do not cease to be professors when they leave the university. They may encounter contexts outside of the university, such as at a restaurant, where they may recognize that elements of their identity as professor come into play when doing

the math to tally the bill, for instance. Participation becomes clearer as we look at its complement in the negotiation of meaning: reification.

Reification, as it is used in the CoPs concept, is “the process of giving form to our experience by producing objects that congeal this experience into ‘thingness.’ In so doing, we create points of focus around which the negotiation of meaning becomes organized” (Wenger, 1998, Chapter 1). For example, in CWA, Vicente (1999) reified the idea of ‘supporting adaptive work’ to create a focus for the reader and practitioner so that he may develop implications and principles for design around that idea. In this way, the CoPs concept intends to capture a range of processes of reification including, “making, designing, representing, naming, encoding, and describing, as well as perceiving, interpreting, using, reusing, decoding and recasting” (Wenger 1998, Chapter 1). In each of these processes an experience of the world is being brought into “thingness”. Though many reifications may seem to have meaning in and of themselves, in fact, they must be complimented with participation to contextualize the meaning (Wenger, 1998, Chapter 1).

Shown in Figure 1, Wenger (1998, Chapter 1) depicts the negotiation of meaning as a duality of participation and reification. Experiences living in the world, acting and interacting we create forms and points of focus, including documents instruments and projections of our reality in the world. This complementary relationship generates insight when we explore the trade-offs between participation and reification (Wenger, 1998, Chapter 1). On one hand, the production of meaning could be distributed more toward reification as with the development of a computer program. The code in a computer program must be interpreted by a machine that, by definition, cannot participate in the meaning of that coded program. On the other hand, the production of meaning can be distributed more toward participation, as with a poem. Though the words are reified forms, the overall piece requires substantial participation in the poem’s content and devices to make meaning in its ambiguity.

This duality, or trade-off, is central to the development of *practices*. As a group of people undergo a negotiation of meaning together, they build a collection of reifications and processes for participation. This repertoire of resources for negotiating meaning, along with structure for mutual accountability in the members of the group, is the conditions for the emergence of a COP. As a group engages together over a period of time in the pursuit some enterprise, they share in learning. It is in this way that, Wenger (1998, Chapter 1) emphasizes, that “COPs can be thought of as shared histories of learning”.

While the participation and reification provide a view of the central process of the negotiation of meaning for an individual, to understand how groups undergo the negotiation of meaning requires three other trade-offs as described by Wenger (1998, Chapter 10): the designed and the emergent; identification and negotiability; and local and global. In the process of optimizing the negotiation of meaning, Wenger suggests that these trade-offs describe the design space in which it is a priority to build structures for alignment, engagement and imagination. A brief description of these trade-offs and priorities is provided in Table 1 and Wenger (1998) can be referenced for more detail, as they are beyond the scope of the current stage of this research. For the purpose of the case study, they provide high-level elements for CoPs to be modeled in the domain-community WDA, as presented later.

Table 1: Trade-offs and priorities of the negotiation of meaning in COPs (Wenger, 1998).

Tradeoffs	Interplay
Participation and Reification	“Design for practice is always distributed between participation and reification – and its realization depends on how these two sides fit together.” (Wenger, 1998, p. 232)
Identification and Negotiability	“Design creates fields of identification and negotiability that orient the practices and identities of those involved to various forms of participation and non-participation. (Wenger, 1998, p. 235)
Designed and Emergent	“There is an inherent uncertainty between design and its realization in practice, since practice is not the result of design but rather a response to it.” (Wenger, 1998, p. 233)
Local and Global	“No community can fully design the learning of another [and] no community can fully design its own learning” (Wenger, 1998, p. 234)
Priorities	Description
Alignment	“Coordinating our energy and activities in order to fit within the broader structures and contribute to broader enterprises.” (Wenger, 1998, p. 174)
Engagement	“Active involvement in mutual process of negotiation of meaning.” (Wenger, 1998, p. 173)
Imagination	“Creating images of the world and seeing connections through time and space by extrapolating from our experience.” (Wenger, 1998, p. 173)

2.1.2 Communities of Practice Model

The negotiation of meaning concept provides a foundation for understanding the nature of COPs and *how* they form. To capture the *range of forms* COPs take, Wenger, McDermott and Snyder (2002, Chapter 2) provide a structural model of COPs comprised of three dimensions: domain, community, and practice. To this, the authors add a compliment to the practices dimension: processes. These dimensions help to distinguish the interior and exterior of a COP and lay the basis for the domain-community WDA model developed in the next section.

The *domain* dimension represents the joint enterprises that motivate the COP and provide value in the greater context of the COP. It is the common ground inspiring the participation of members; it motivates member learning and is the context that gives meaning to member actions (Wenger, McDermott, & Snyder, 2002, Chapter 2). The domain includes the leading challenges and open questions negotiated by community

members. The domain is often characterized by purposes, missions, values, propositions, and goals of the COP, and represents the technical realities of the work domain that a COP must master.

Community represents the quality of social engagement that the community develops in pursuit of the joint enterprises of the domain. The community dimension is the “social fabric of learning” and supports interactions and a willingness to share experience and ideas (Wenger, McDermott, & Snyder, 2002, Chapter 2). The community dimension captures the sense of belonging and can be characterized by notions like interpersonal commitment, acceptance, curiosity, loyalty, care, trust, empathy, and resilience. It is through the quality of social engagement that members of a COP are able to negotiate meaning together.

Practice is the more tangible dimension of the CoPs model. Practice represents the shared repertoire of practice elements such as competencies, tools, technologies, instruments, artifacts, styles of discourse, routine actions, ontologies and points of reference through which the COP engages to address the domain. The shared repertoire of elements in a COP’s practice functions to (a) support the quality of social engagement between members, while (b) allowing the community to effectively sense and respond collectively to activities in its domain. The practice dimension could be thought of as a COP’s core knowledge base.

Going beyond what is suggested by Wenger, McDermott, and Snyder (2002), it is useful to consider a technical analog to practice. For this, the authors introduce the term *processes* as a corresponding term to describe how practices translate to the activities that function to serve the technical purpose defined in the domain. The addition of process will become clearer as we look at a domain-community system model inspired by CWA in the next section.

Figure 2 shows a visual interpretation of the structural model of a COP developed for this thesis. First, in this diagram, it is important to highlight that the members are not directly connected to one another. This is intended to illustrate that it is the shared practices that constitutes the primary relationships between members of a COP.

Figure 2 represents how, from within the COP, the shared repertoire of practices is the means for members to engage with other members toward the purpose set out in the domain as the members understand it. From outside of the COP, these shared practices would be seen from a more technical perspective as processes serving the technical reality of the external context. A network of connections between actors in the community and the practice elements indicates each individual has a unique relationship to the COP's practice and domain. An old-timer (O) in the COP may have links with many of the practice elements, while a newcomer (N) may have few. Double-arrows between the practice/process elements and the domain indicate that the practice/process elements are a means for the COP to sense and respond to changing conditions in the domain. This depiction of a COP is intended to provide a visual understanding of how the domain, community and practice dimension are interdependent. The diagram illuminates the two-fold challenge of designing tools for COPs to address complex issues in the domain, and simultaneously, to consider and foster the quality of social engagement that enables the negotiation of meaning around complex issues in the domain.

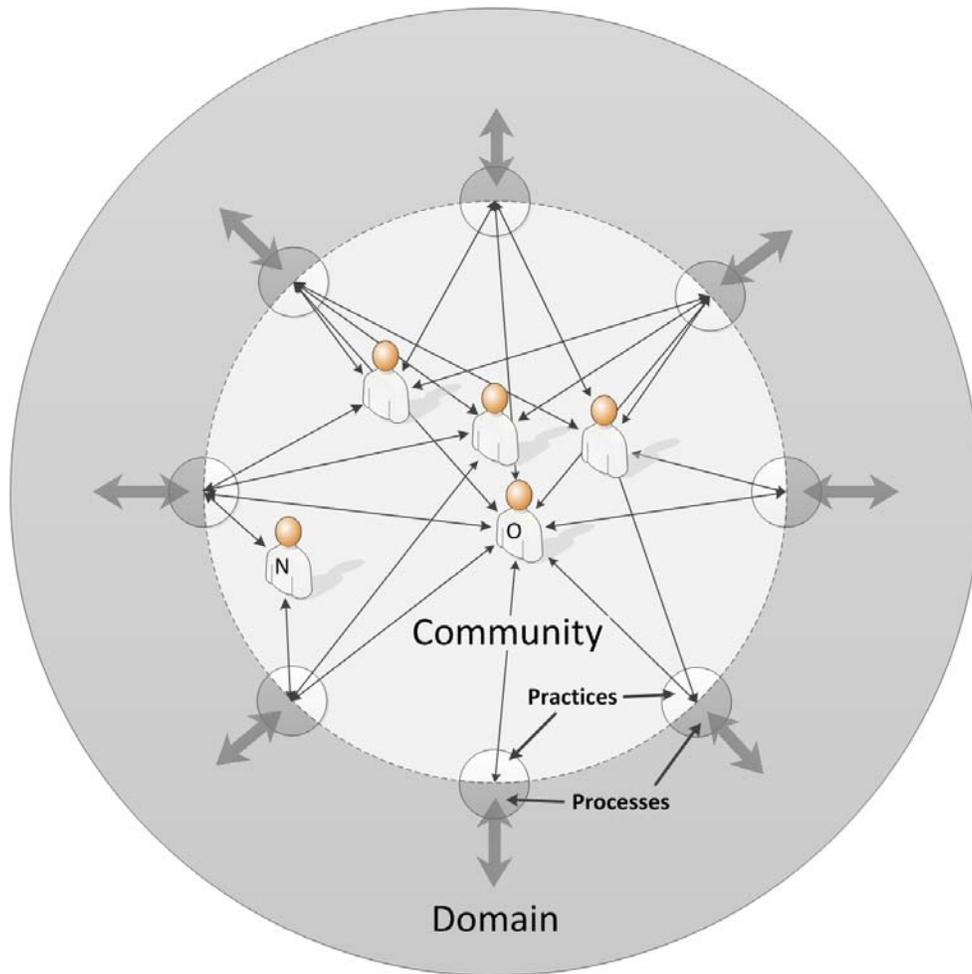


Figure 2: Authors' visual interpretation of the structural model of a COP.

The domain, community and practice/process dimensions give guidance in determining the strengths and weaknesses of a COP. The term 'dimensions' implies a particular angle of view on a COP *as a whole*; therefore, while a design intervention may be aimed to address a weakness in one of these dimensions, it will have effects in all dimensions. Designing for a COP requires a balanced account of each dimension accordingly (Wenger, McDermott, & Snyder, 2002, p. 45). With respect to each dimensions, a designer may ask:

Domain: How does the COP provide value in the greater context?

Community: What are the systems for negotiating meaning that deeply engage members with other members and give them an edge in collectively sensing, adapting, and responding to changes in the conditions of their domain?

Practices/Processes: Do the practices and processes in place effectively, efficiently and elegantly integrate activities of the domain and community dimensions?

2.1.3 Community of Practice Lifecycle

COPs naturally change as time passes developing stronger and broader repertoire of practices, taking on new members, and seeing members depart. Iriberry and Leroy (2009) survey a large volume of literature on the topic of online communities through time and suggest that online communities, including online COPs, go through a natural lifecycle progression. Each stage has its unique challenges and Iriberry and Leroy (2009) bring together many sources that suggest that matching features with each COP's life-cycle stage could more efficiently lead to success. This consideration will be critical both in the design of a strategy and feature-set for an online social environment.

While Iriberry and Leroy (2009) offer a broad review sources to understand design issues related to COP lifecycle stages, Wenger, McDermott, and Snyder (2002, Chapter 4 & 5) offer a CoPs-focused treatment of community lifecycles, suited for this research. Wenger, McDermott, and Snyder (2002, p. 68) suggest COPs follow a cycle that includes five typical stages: potential, coalescing, maturing, stewardship and transformation.

According to Wenger, McDermott, and Snyder (2002, p. 70), at the stage of potential, there is usually a loose, informal network that exists with the potential to form a core group around a shared interest or pursuit. The key challenge for a COP to move beyond this stage is to discover the resources and networks that already exist and imagining where efforts of the COP could lead.

At the coalescing stage, there is usually articulated purpose and plan and a small formal network in place usually as well as events that signify the launch of the COP (Wenger, McDermott, & Snyder, 2002, p. 82). The main challenge of coalescing stage is to establish how the COP will deliver value in the larger context of their domain, while developing trust in the relationships necessary to discuss differences and disagreement around the COP's practice elements.

After demonstrating viability and value in the larger context, word may begin to spread about the COP. There is a growth in membership and the knowledge sharing practices have become more refined. This characterizes the maturing stage. The key challenge in the maturing stage is to maintain focus and value in the defined domain of the COP, while also accommodating new membership and expansion of the COP boundaries (Wenger, McDermott, & Snyder, 2002, p. 97).

In the stewarding stage, there is a regular rhythm in the activities of the COP, and natural shifts in membership, technologies and the COP's relationship to the larger context. At the stewarding stage, there is an established base of expertise around core practice elements, strong relationships and sense of ownership has been built between long-term members. The challenge is to nurture this ownership of the core practice elements, while remaining open to new members and new ideas (Wenger, McDermott, & Snyder, 2002, p. 104).

The transformation stage of the COP lifecycle may occur for a number of reasons and typically signifies a radical change in the nature of the COP. Natural drifts in the trends of the larger context, or sudden changes of the larger context could diminish the relevance of a COP's value. COP stewardship may decline, or the COP may split or merge with another COP or crystallize into a formal institution. Wenger, McDermott, and Snyder (2002, p. 109) urges that this is not an inherently bad or undesirable development and likely not one the COP can avoid happening eventually. As such, the key challenge in this phase is to close the COP in a way that gives members a sense of resolution.

Table 2 provides a summary of the lifecycle stages as a described by Wenger, McDermott, and Snyder (2002, Chapter 4 & 5).

Table 2: Characteristics of the typical COP lifecycle as described by Wenger, McDermott, and Snyder (2002, Chapter 4 - 5).

Stage	Characteristics	Challenges	Key Activities
Potential Discover and Imagine	Informal group with similar interests Loose network Potential to form a core group	Domain: defining the scope that creates genuine interest and aligns with key issues in the larger context Community: Finding others interested in the issues and helping them imagine the value of forming a community Practice: identifying common knowledge needs	Determine and articulate the primary intent of the community Define the domain and identify engaging issues Build a case for action Identify coordinators and thought leaders. Interview potential members Connect COP members Create a preliminary design for the COP
Coalescing Incubate and deliver immediate value	Official launch events Articulation of mission, vision or purpose COP plan and formal network in place	Domain: establish value of sharing knowledge about the defined domain Community: develop trust in relationships to actively discuss differences and disagreement in practice elements. Practice: discover what knowledge should be shared and how to share it.	Build a case for membership Launch the COP Initiate COP events and spaces Legitimize COP coordinators Build connections between core group members Find the ideas, insights and practices that are worth sharing Document Judiciously Identify opportunities to provide value Engage stakeholders of the larger context
Maturing Focus and expand	Demonstrated viability and value Word is spreading of the COP Knowledge sharing practices in place Growth in membership	Domain: defining role in the larger context and relationship to other knowledge domains Community: managing the COP boundaries and heeding distraction from core purpose Practice: organizing the COP's knowledge and taking stewardship seriously	Identify gaps in knowledge and develop a learning agenda Define the COP's role in the larger context Redefine the COP boundaries Routinize entry requirements and processes Measure the value of the COP Maintain a cutting edge focus Build and organize a knowledge repository

Table 3 (concluded): Characteristics of the typical COP lifecycle as described by Wenger, McDermott, and Snyder (2002, Chapter 4 - 5).

Stage	Characteristics	Challenges	Key Activities
Stewardship Ownership and openness	Momentum in the activities of the COP Natural shifts in practice, members, technology and relationship to larger context	Domain: maintain relevance of domain and find voice in larger context Community: keep tone and intellectual focus of the COP lively and engaging Practice: Keep the COP's knowledge on the cutting edge	Institutionalizing the voice of the COP Rejuvenate the COP Hold a renewal workshop Actively recruit new people to the core group Develop new leadership Mentor new members Seek relationships and benchmarks from the larger context
Transformation	Long-term and sudden changes COP relevance fades COP stewardship declines COP splits or merges with another Becomes institutionalized	Close COP with a sense of resolution	Allow a "soft ending", where COP closed without taking the opportunity for commemoration Close the COP with commemoration of member contributions and COP's value in the larger context.

Wenger, McDermott, and Snyder (2002) point out that, while the lifecycle stages are described in sequence, each COP will have its own unique progression through it. It is possible that a COP may move quickly through some stages or spend much time at others. A COP may progress in some ways to later stages, while still facing some inherent challenges in earlier stages. Wenger, McDermott, and Snyder (2002) suggest that their articulation of the COP lifecycle is intended as a guide and not to be taken too literally.

2.2 Cognitive Work Analysis

CWA, as developed by Vicente (1999), is a relatively new perspective in system design methodologies for complex sociotechnical systems. Instead of approaching the redesign of a system around the way people *should* conduct their work (the normative approach), or designing around how people *actually* do work (the descriptive approach), Vicente proposes that a more effective approach to systems design is through determining how people *could* conduct their work (a formative approach) (Vicente, 1999). In other words,

CWA is an approach to system design that attempts to leave open the varieties of ways workers may choose to conduct their work.

CWA is intended to maximize the opportunity for worker adaptability and self-organization in decentralized systems for the purpose of maintaining safe, productive and healthy work environments. As a brief overview, CWA takes an approach to design that is:

Formative: CWA takes a formative approach to design by remaining device-independent in its analysis of the system. Formativity leaves open the full field of design possibilities allowing for emergent concept development. The formative approach avoids issues of inheriting non-useful tools and the task-artifact cycle present in descriptive and evolutionary approaches to design.

Constraint-based: CWA takes a formative approach by modeling the behavior-shaping constraints inherent in the system of concern. Modeling the constraints of the system allows designers to provide workers with computer support based on a “lay-of-the-land” view of how system components actually work together. Theoretically, a constraint-based approach to computer support is intended to build worker skills and provide dynamic information support for decision-makers to maintain reliable system performance and respond to unanticipated events in complex environments. Constraint-based information support provides flexibility for context-conditioned variability in the execution of tasks, which is not addressed in prescriptive approaches.

Ecological: CWA models environmental constraints before cognitive constraints in five ‘phases’. It begins modeling (1) the functional components of the system (environmental constraints) in a WDA, (2) the information necessary to make decisions to control the working order of that system in a control task analysis, (3) then, the strategies used to process that information to make good decisions to control that working order in a strategies analysis. CWA does not make unnecessary assumptions about (4) the social organization in the social organization analysis or the (5) worker competencies (cognitive constraints) required for workers to execute these strategies in the worker competencies analysis. Overall, prioritizing environmental constraints

before social and cognitive constraints leaves open the possibility for many undiscovered social arrangements that might foster distributed self-organization around system control processes.

Vicente (1999) suggests that in knowledge intensive environments, taking this approach to “designing for adaptation is equivalent to designing for continuous learning.” CWA, however, does not do a strong job of explaining how worker practices or community are involved in the work system and how that relates to continuous learning. CoPs can contribute to the method in those ways.

2.3 Domain-Community Work Domain Analysis

It is expected that CoPs can be explored in conjunction with each of the five CWA phases. In this work, however, CoPs is explored in conjunction with the WDA.

The WDA typically describes functional components of a working system or sub-system at varying levels of abstraction – from the concrete physical objects up to the abstract functional purpose of the system at the top. It is usually based on how a technical system has been designed and reflects those functional relationships that show how a technical system meets its designed-for purpose. When used as a basis for design, a WDA provides designers with a means to provide system operators with dynamic information support at the appropriate levels of abstraction depending on the level of complexity of a given situation.

The CoPs model provides a view of the high-level driving challenges of designing for a COP. To make sound design interventions, however, there is a need to represent the operation of a COP at a more granular level. WDA can provide designers with a way to map relationships between components in complex systems that is well-suited to represent a COP as a system. In particular, WDA is useful as a way to differentiate functional components of the domain and community dimensions. Mapping the community dimension provides guidance to improving social engagement by supporting practices that allow a community to negotiate meaning around complex issues in its domain, while mapping the domain dimension provides guidance in supporting the processes that allow a COP to respond to changes in the domain based on the

meaning they have made of those changes. This section describes a domain-community WDA that incorporates the domain and community mappings.

The domain dimension, as described in the CoPs model, is concerned with how a COP functions to provide value in the larger context outside of the COP. The value that CoP provides can comprise expert knowledge, values and priorities and the processes involved in understanding the particular work domains that it supports. In a sociotechnical system, the CoPs view of the domain dimension maps closely to the kind of work structure that is typically considered in a WDA.

CoPs adds a perspective on the community dimension, an element not often modeled in a WDA. For a COP there is desired state of the learning context that supports the negotiation of meaning based on the unique characteristics of the COP, such as its size, or in the case of UCP-SARnet, the COP's lifecycle level of maturity.

Down the WDA in both dimensions, there are differences and relationships between the layers, as shown in Figure 3. On the domain side, there is emphasis on balancing value and priority measures for optimal system performance with respect to the external context. On the community side, these values and priority measures are, most generally, balancing the tradeoffs and priorities for the negotiation of meaning. As mentioned previously in Table 1, the trade-offs are participation and reification, identification and negotiability, the designed and the emergent, local and global, while the priorities are to increase imagination, alignment, engagement (Wenger, 1998, Chapter 10). On both the domain and community side, this level defines the basic nature of the design space. It should be noted that, while there is research to be done to understand how to effectively optimize the negotiation of meaning, this framing of the design space is useful to understand the nature of the community dimension.

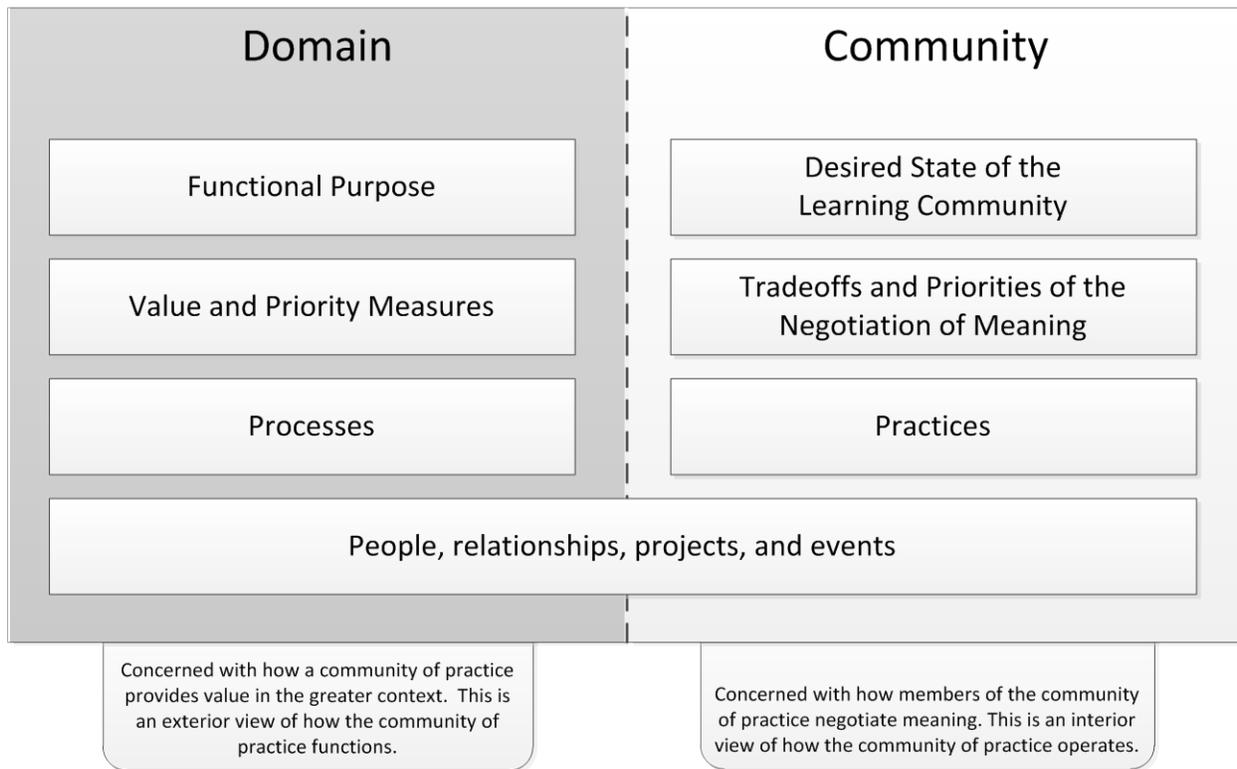


Figure 3: CoPs model represented in a domain-community WDA system mapping.

At a level lower on the domain side of Figure 3, the processes describe those activities that the sociotechnical system must employ to accomplish its purpose. On the community side, the practices level describes the ways in which members engage with one another to share knowledge, improve the quality of relationships and make meaning of changing conditions in the domain. At the bottom of the WDA are the fundamental components of a COP, which include people, relationships, projects, and events. These components are drawn on both sides to show that the objects at this level would be common to both sides of the work domain.

It should be noted the domain-community split in Figure 3 is not meant to imply a disconnection at the higher the levels of the WDA, as the domain and community sides together comprise one work domain. The two sides are analogues seen from different perspectives: the domain seen from the technical perspective

in how value is being achieved in the greater context; and the community seen from a social perspective on how meaning in the COP is being negotiated. The domain and the community systems work in tandem, and the highest functioning COPs succeed at both.

There are many ways to approach design that supports both the domain and community system. In some cases, a designer may be interested in investigating how a new COP might serve a valuable function in a work system and later consider how to form that COP and provide facilities for negotiating meaning. In some cases, a COP may already exist and provide value in the work system. In these cases, a designer may be interested in determining what value the practice is providing and reducing barriers in the domain for this to happen. The designer may also be interested in determining the practices that a COP is already using and improving the facilities for the negotiation of meaning with new communication and networking tools.

What the domain-community WDA provides is a way to see how a COP may function internally and externally so that interface designers may provide the affordances for the monitoring of processes intended to provide value in the external context as well as affordances for engaging in practices that support the negotiation of meaning. This mapping does not imply a set procedure in designing for a COP using the domain-community WDA. Different scenarios will require different approaches.

Issues of social engagement can be affected by elements on the domain side, but are ultimately located on the community side. Typically, system design methods take an exterior systems view, which have provided many effective approaches to design for the domain side. There is much room, however, for development of approaches to design for the community side as well as on its integration with the domain side. The UCP-SARnet Case Background Chapter provides a more focused view on the community dimension as we look at UCP-SARnet and the social networking tools to support engagement in its practices.

2.4 Social Network Analysis

The domain-community WDA as a frame for modeling COPs for the purpose of design; however, as a part of this research, it was important to determine how to track structural changes to a COP over time. In this section, an overview of the SNA is provided as well as how it could be used to track a COP over time. How an SNA can be framed to capture the interior and exterior of a community is also discussed.

As defined by Wasserman and Faust (1994), “a social network consists of a finite set or sets of actors and the relation or relations defined on them.” An actor is any kind of social entity such as an individual or organization, and relations are the types of ties that could be seen as connecting social entities. SNA is a field of research with methods and data analysis tools that help to examine the structure of social networks in meaningful ways.

SNA provides information beyond traditional statistical methods that allow researchers to investigate interdependencies between actors and not just the actors themselves. Where traditional research approaches usually gather information on the attributes of actors as a way to uncover generalized attributes of a population, SNA gathers data about how actors relate to other actors as a way to uncover structural properties of a population. For example, SNA could provide a picture of who is related in sharing usage of particular resources in a population. A direct relational analysis could determine who is acquainted with whom in a population. How the researcher defines the relationship they are interested in depends on the scope and concerns of each particular design effort. Ultimately, the relational information of SNA goes beyond generalized attributes of the population and provides information about how a network of actors functions in relation to one another as a part of the whole.

There are qualitative and quantitative techniques that support SNA. Qualitative techniques include graphs, matrices and diagrams that allow researchers to interpret the structure of a social network visually. For instance, a social network graph may allow a researcher to easily spot communication bottlenecks between

teams that might signal the need for network bridgers. A graph may also reveal a precariously heavy reliance on a central actors, or clusters of actors that may contain useful resources and are not recognized formally. The qualitative view of the network can be enhanced by an array of quantitative techniques based on mathematical concepts that can provide more granular level of analysis that could be used for statistical comparisons. These may include concepts such as network centralization, network density, clustering, among many other mathematically defined network measures. For a more thorough overview of these quantitative measures, see Wasserman and Faust (1994).

2.4.1 Social Network Analysis and the CoPs Lifecycle

SNA provides a variety of ways to analyze COPs over time. With respect to the domain dimension, a SNA could provide information about the channels of connection between members of a COP and individuals outside of the COP. This has been noted to be helpful in determining how and where a COP is providing value in the larger context and where there may be opportunities to improve these connections (Hoppe & Reinelt, 2009). With respect to the community, a SNA can be used to determine the quality of connection between individuals in the COP. This could be helpful in determining if and how to support overall cohesiveness in the COP. With respect to the practice dimension, a link analysis of tools, knowledge pieces and other practice elements could determine which members share useful concepts or perspective about the domain or overall skills with respect to the repertoire of tools used in the domain. This could be helpful to determine where informal COPs exist that might hold valuable knowledge resources and how that COP could be formally supported to build those practice resources further (Wenger, McDermott & Snyder, 2002, p. 72).

The kind of analysis used may depend on the type of COP and its current stage of development. For example, Wenger, McDermott, and Snyder (2002, p. 72) suggest that when organizing a COPs at the potential stage, SNA can provide a picture of where the strong ties already exist. The strong ties in the SNA

provide information about important members to include when launching the COP on a more formal level. Furthermore, at the coalescing stage, with the focus of activity toward building connections between the core group members (Wenger, McDermott, & Snyder, 2002, p. 88), SNA can be conducted to track the level of connectedness on the core team. SNA could provide a means for the COP to evaluate if the level of connectedness is such that the COP can manage the pressures of growth if they begin to expand membership as part of the maturing stage as described in Table 2.

Hoppe and Reinelt (2009) also raise this concern in their treatment of how to use SNA to evaluate different types of 'leadership networks', a term corresponding closely to CoPs. Hoppe and Reinelt (2009) suggest that for a 'peer leadership network', analogous to a coalescing-level COP, the number and strength of the connections between the leaders in the network are important for sustaining the network over time. Hoppe and Reinelt (2009) take this further and suggest that for a field-policy leadership network, analogous to a stewardship-level COP, there is an importance placed how the network connects to individuals and organizations outside of the network. SNA can help in determining bridgers and potential alliances between networks. This aligns with the view of Wenger, McDermott, and Snyder (2002), who suggest that in the maturing and stewardship stages, COPs are building capacities to expand and more clearly define a role in the larger context.

In summary, with regard to COPs, SNA can provide a way for a designer to gain a picture of both the interior of the COP to see how members connect with other members as well as exterior of the COP to see how the COP connects to individuals, organizations outside of the COP. There is some alignment between Wenger, McDermott, & Snyder (2002) and Hoppe and Reinelt (2009) to suggest that at early stages of COP or network development, the internal connections are of importance and at later stages, as the COP or network build internal capacity to expand, external connections also become important.

2.4.2 Social Network Analysis and the Domain-Community WDA

With respect to domain-community WDA, developed in previous sections, SNA helps to provide a description of a COP at the people, relationships, projects and events level – in particular, the structure of the people and relationships. Because the kinds of relationships measured between individuals in an SNA can be decided by the researcher, it is possible to choose the kinds of measures that are correspondent with the distinct nature of the domain and community dimensions.

In the domain dimension, researchers may be more interested in the kinds of relationships that help to determine the value that a COP is providing in its domain. In the domain dimension, a researcher might be more interested in determining whether there are appropriate bridgers in place for logistical communications in a distributed COP. Or perhaps, a researcher would be interested in the overall network reach to determine what level of influence in the greater context is possible through collective action of COP members. In the exterior view of the COP, using SNA in the domain dimension will be oriented toward more objective and discrete relationship measures, such as communications, shared resources, proximity, and joint actions.

In the community dimension, researchers may be more interested in the kinds of relationships that help determine the qualities of experience of participating in the COP. In the community dimension, a researcher might be more interested in determining if the core participants in the COP are close enough to weather clashes of opinion when decisions are made to support a growing COP. Or perhaps, a researcher would be interested in how the COP fosters interpersonal care that is attractive to potential members. In the interior view of the COP, using SNA in the community dimension will be oriented toward perceived relationship measures, such as like and dislike; level of acquaintance; and level of influence.

2.5 Chapter Summary

This chapter was aimed at addressing the first research question: *How do you design for social engagement in an online social environment intended to facilitate interaction between users in an online community?* The CoPs

concept was used as a basis for understanding social engagement. This required consideration of how individuals and groups negotiate meaning and how a COP can be modeled from both the exterior domain and interior of the community. The domain and community dimensions form the domain-community WDA COP systems view based on CWA. The domain-community WDA provides a template to model specific COPs that can help to inform the design of an online portal to support those specific COPs. An assessment of the COP lifecycle, as developed by Wenger, McDermott, and Snyder (2002), is suggested as basis for building the domain-community WDA for a specific COP. Social network analysis is suggested as way to analyze a community structure over time, which is a core element of data gathered for this thesis. In the next chapter, a case-study is presented to show how the domain-community WDA was used to design the social networking portal for the UCP-SARnet international development leadership COP. This case opens the second research question: *Does a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?*

Chapter 3

UCP-SARnet Community of Practice Case Study

In Chapter 2, the domain-community WDA was developed as a response to the first research questions: *How do you design for social engagement in an online social environment intended to facilitate interaction between users in an online community?* The domain-community WDA systems mapping provides a way to model specific COPs and can be used to design online systems that support social engagement within those specific COPs. This chapter provides a case-study of how the domain-community WDA was used to support UCP-SARnet, an international development leadership network and opens the second research question: *Does a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?* This chapter explains how the researcher worked with UCP-SARnet to conduct a COP lifecycle analysis as a way to model the UCP-SARnet using the domain-community WDA. Finally, an overview is provided of how this domain-community WDA for UCP-SARnet was used to redesign the UCP-SARnet web portal. To answer the second research questions, further chapters explain how measures were taken over time to measure the effects on the structure UCP-SARnet COP.

Officially launched in 2008, the UCP-SARnet is an organization based at Arizona State University with a mission to ‘educate, engage and empower communities’ by facilitating global partnerships between universities, local governments, and community organizations. These partnerships are aimed at creating new opportunities for joint action toward the realization of the United Nations Millennium Development Goals (MDGs).

UCP-SARnet maintains a partnership with 42 organizational partners and 971 members including university students, university faculty, community activists, and members of local government. Seven volunteer ‘Regional Coordinators,’ located in Argentina, Australia, Ghana, India, Nigeria, Poland, and South

Africa act as ambassadors for UCP-SARnet, facilitating collaborations between local community organizations, universities, and governments in efforts toward achieving the MDGs. The partners, members, and regional coordinators, led by leadership team of 43 volunteers, work together to organize events promoting the MDGs, source new strategic partnerships, and contribute directly to MDG-related projects.

To support its distributed activities, UCP-SARnet does much of its work through an online social networking portal powered by IGLOO Software (2011). The IGLOO platform provides a suite of features including member profiles, blogging, discussion forums, wikis, calendars, document sharing, status updates, and email notifications. A site manager allows administrators of UCP-SARnet to customize the navigation and display of these features using a drag-and-drop ‘Site Manager’ and ‘Page Editor’. This combination of features allows UCP-SARnet administrators to choose how to stream activities in any of these features through virtually any site structure and page layout. For instance, the administrator can stream new blog and discussion forum posts by dragging and dropping those components and arranging them on the page using the Page Editor.

In July 2010, UCP-SARnet began an effort to revamp its social networking portal on the IGLOO platform with the broad goal of making it ‘more attractive and alive.’ From July through December, the author, a designer from the Advanced Interface Design Lab at the University of Waterloo, worked with UCP-SARnet to redesign the portal. From ongoing interaction with UCP-SARnet stakeholders, the designer based the new site design on a number of factors including:

- the stated goals of UCP-SARnet for 2011(UCP-SARnet.org 2011),
- benchmark evaluations of numerous other non-profit organization websites that are using the IGLOO platform,
- feedback from a wireframe prototype presented to the UCP-SARnet leadership team,
- meetings with the UCP-SARnet leadership team, and the network’s Lead Facilitator,

- interviews of the Regional Coordinators, and
- the designer's knowledge of CoPs.

Design of the UCP-SARnet portal was a process of balancing the requests of the stakeholders of UCP-SARnet with the intuition of the designer informed by CoPs concepts about how to effectively meet these requests. From this design effort, there are strong links that can be drawn between the design decisions made and the domain-community WDA systems map described in the previous section. As such, the case is an illustration of how the domain-community WDA can be used to support social engagement on an enterprise social network.

3.1 Design Approach

Making design changes to the UCP-SARnet social networking portal took a participatory design and participatory research approach. This approach required that the designer and researcher take part in client COP activities and for the members of the client COP to take part in the process of design. As shown in Figure 4, the participatory design and research process is iterative and includes four main phases: (1) laying the foundations, (2) planning, (3) information gathering and analysis, and (4) acting on the findings.

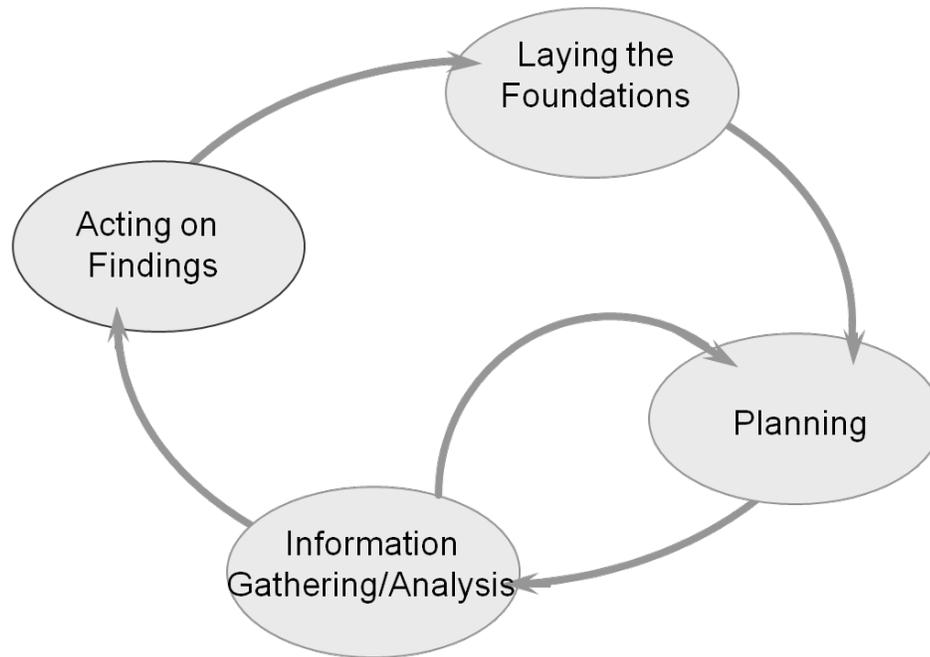


Figure 4: Participatory design and research process used in the redesign of the UCP-SARnet portal (Centre for Community-Based Research, 2010).

In laying the foundations, the designer and the COP established an agreement for the partnership with UCP-SARnet with a proposal that outlined the objectives of the partnership for UCP-SARnet and for AIDL (see Appendix A). The proposal also included the general tasks and timeline required to meet those objectives. The purpose of this step was to come to general agreement of the project scope.

The planning and information and requirements gathering phases worked in tandem. In this phase, the designer attended meetings with the UCP-SARnet COP, held conversations with prominent members of the COP, met regularly with the main network facilitator and conducted a benchmark analysis of similar websites in the domain of international development. Planning included determining how the designer would work with the COP on an ongoing basis to gather the information and requirements for the online portal. In Figure 4, this is depicted as a cycle because uncovering new information has the potential to reveal new areas of investigation, which would, in turn, require some adjustments in the planning.

As a part of the information gathering phase, the designer worked closely with the COP lifecycle cycle model presented in Table 2 as developed by Wenger, McDermott, & Snyder (2002). There is not a recommended process for conducting a lifecycle analysis of this nature. As such, in order to conduct the analysis the designer compared observations of the activities of UCP-SARnet to those indicated by Wenger, McDermott, & Snyder (2002) as characteristics of the levels of maturity they describe. Table 2 provides a breakdown of the level of maturity and their characteristic activities as used in the information and requirements gathering phase.

Using the results of the lifecycle analysis, the benchmark analysis as well as items stated as priorities in the UCP-SARnet year-end goal setting-process, the designer moved into the act on findings phase. In this phase, the designer developed a low-fidelity and high-fidelity prototype of the website to be viewed by the network facilitator and other prominent members of UCP-SARnet for feedback. After coming to agreement in the high-fidelity prototype, the designer made corresponding changes to the live UCP-SARnet website.

The final design implementation was concentrated over the period of a week to create a priority communication period, whereby the designer and those at UCP-SARnet could stay closely connected. During this period, UCP-SARnet members did not have access to the website because of the changes being made. The IGLOO social networking software as a service made it possible to make the design changes over this short period of time because many of the components required had already been created such blogs, wikis, forums, calendar and activity streams. Much of the work was related to arranging these components appropriately to support the kinds of activities determined in the information and requirements gathering phase.

Overall, the process of redesigning the UCP-SARnet internal social networking portal took approximately nine months. Table 3 provides an overview of the specific timing of the most significant events of the design process.

Table 4: Timeline of research and design activities for the redesign of the UCP-SARnet portal.

Dates	Activity
June 25	Proposal approved by UCP-SARnet Lead Facilitator
August 19 – 23	Researcher meets with UCP-SARnet at Leadership Team Year-end Review and Goal Setting.
October 28	Preliminary needs assessment through observation of site use
October 28 – November 16	Benchmark Analysis
November 16 – 30	Interviews with Regional Coordinators
November 26	Evaluation of Low-Fidelity Prototype
December 4 – 7	Participation in Global Alliance for ICT Development in Abu Dhabi
January 10 and 11	Evaluation of high-fidelity prototype
January 12 – 16	Implementation of UCP-SARnet portal (Launch on the 16 th)
January 17 – March 30	Design touch-ups and maintenance

3.2 Community of Practice Lifecycle Stage Assessment

Based on the information and requirements gathering phases of the UCP-SARnet portal redesign, and the researcher’s ongoing conversations with the leadership team, it was determined that prior to the redesign of the portal, the UCP-SARnet online COP was making a transition from the coalescing stage into the maturing stage of the online COP lifecycle as described by Wenger, McDermott, and Snyder (2002). UCP-SARnet faced one of the main challenges in the coalescing stage and all of the challenges of the maturing stage.

With reference to the COP lifecycle characteristics in Table 2, UCP-SARnet had long developed the characteristics and overcome most of the inherent challenges of the coalescing stage. UCP-SARnet had long passed its launch events at ASU, a purpose and mission was presented on its portal, and a COP plan and formal network was in place on the social networking portal. UCP-SARnet had clearly established the value of sharing knowledge about the role of networking in achieving the UN-MDGs and they held regular meetings of their leadership team at ASU to discuss and plan their initiatives. UCP-SARnet was using its knowledge

and skill-base to run Stand-Up Against Poverty Events at ASU as part of a United Nations awareness campaign as well as other similar international development awareness events, but UCP-SARnet was still largely task-oriented. As such, UCP-SARnet faced the challenge of growing the repertoire of skills and practices in its knowledge base and sharing them within the core group.

With reference to COP lifecycle in Table 2, UCP-SARnet faced a challenge inherent in the coalescing stage, but was clearly moving into the maturing stage. UCP-SARnet had demonstrated viability and value in their initiatives such as their events, their information store, their membership base including regional coordinators and their advanced online social networking platform. In the maturing stage, UCP-SARnet was in the process of becoming more publicly visible, refining its knowledge sharing practices and preparing for growth in its membership base. In this stage, UCP-SARnet was challenged to define its role in the larger context of the international development scene, manage the boundaries of the organization as they take on new members and create subgroups, hone in on its core purpose and become organized in its knowledge stewardship.

3.2.1 Recommendations

From the lifecycle assessment, the researcher determined that the redesign of the UCP-SARnet social networking portal should apply a set of key activities to overcome the challenges in its current stage of development as recommended by Wenger, McDermott, and Snyder (2002).

First, to make the full transition out of the coalescing stage, it was recommended that the new UCP-SARnet site focus on supporting building the connections between the core group members. Further, it was recommended that the redesign of the site should also support UCP-SARnet in finding and sharing ideas, insight and practices. These two recommendations were intended to support the process of developing a valuable knowledge base, while building strong connections on the leadership team that will stand against pressures of growth that may occur in the maturing stage.

Second, to begin facing the inherent challenges of the maturing stage, it was recommended that UCP-SARnet focus on continuing to refine its role in the larger context of international development. To do this, it was recommended that the UCP-SARnet portal would support the process of identifying gaps in its knowledge, develop a learning agenda, and more clearly represent its role in the larger international development context.

3.3 UCP-SARnet Domain-Community WDA

The recommendations from the lifecycle analysis and information gathering efforts were used to develop the domain-community WDA. Table 4 shows the domain-community WDA for UCP-SARnet used in the design process. While the community dimension was the focus of analysis, the domain dimension of UCP-SARnet is presented to illustrate its relationship to the community dimension. The domain dimension will not be given direct treatment in this thesis.

On the community side of the WDA for UCP-SARnet, the following needs were determined:

1. *Desired state of the learning community:* Meetings with the UCP-SARnet leadership team and the network's Lead Facilitator were conducted to gather information about UCP-SARnet's primary activities as a COP and its current level of maturity based on the lifecycle stages outlined by Wenger, McDermott and Snyder (2002, Chapter 5). As a result of those meetings, it was determined that the desired state of the learning context for UCP-SARnet was: general agreement on the role of UCP-SARnet in relation to the MDG efforts at-large; strength in the relationships that would allow members actively discuss differences with respect to the UCP-SARnet's practices and role toward the MDG's; having established skills in determining what knowledge was useful to share and how it would be shared.
2. *Priorities and tradeoffs of the negotiation of meaning:* As mentioned, the tradeoffs of identification and negotiability; the designed and the emergent; participation and reification; and the local and global

define the design space, within which facilities for alignment, engagement and imagination are priorities. While the analytical tools have not matured to measure and monitor these elements of the negotiation of meaning, this level provides a helpful representation of the general nature of the community dimension and how it differs from elements of the domain dimension.

3. *Practices:* Given UCP-SARnet's current lifecycle stage, several general practices, as adapted from Wenger, McDermott and Snyder (2002, Chapter 5), were determined that would encourage development toward the desired state of the learning community. These were: building connections between the core participants; identifying opportunities to provide value in the larger context; finding the ideas and insights that are worth sharing with other members; identifying gaps in the knowledge; engaging stakeholders and refining the COP's role in the larger context.
4. *People, relationships, projects and events:* The objects in this COP are its members, their projects, partnerships and events. A non-exhaustive list is provided in Table 4.

Table 5: Domain-community WDA for the UCP-SARnet COP.

	Domain	Community	
Functional Purpose	Achieve the UN Millennium Development Goals (MDGs)	Agreed upon role in the larger context, Strength in relationships to actively discuss differences with respect to the domain and practice, Established what knowledge should be shared and how to share it.	Desired State of the Learning Community
Value and Priority Measures	Span of the external network vs. strength of the connections, Social action vs. research results Power of the researcher vs. power of the communities, Mobilize knowledge, mobilize communities, Bring awareness about MDGs and impel collective social action toward their achievement, Educate, engage and empower communities.	Participation vs. reification; designed vs. emergent; identification vs. negotiability; local vs. global. Increase alignment, engagement and imagination.	Priorities and Tradeoffs of the Negotiation of Meaning
Processes	Building formal partnerships, hosting networking and public outreach events, collaborating with partners.	Building connections between the core participants, identifying opportunities to provide value in the larger context, finding the ideas and insights that are worth sharing with other members, identifying gaps in the knowledge, refining the COP's role in the larger context	Practices
People, Relationships, Projects, Events	Network Facilitator, leadership team members, Regional Coordinators, peripheral members, Knowledge Partners, Organizational Partners, Memorandums of Agreement with Organizational Partners, Executive Meetings, Stand-Up Against Poverty Events, Bridging the World virtual event.		People, Relationships, Projects, Events

3.4 Overview of UCP-SARnet Website Redesign

Figure 5 shows the main components of the UCP-SARnet homepage before design changes. Figure 6 and Figure 7 show the main components of the UCP-SARnet website after the redesign effort. The design before the website changes was focused on organizing static content. The homepage was designed for both onlookers to the site such as potential members, and partners, as well as current members and partners of UCP-SARnet. In the redesigned UCP-SARnet website, the focus was on organizing content generation and content streams. The front page was designed for onlookers, potential members and partners, while a Members Area page was created for current members and partners of UCP-SARnet. Distinguishing the front page and Members Area

was intended to help give members a sense of UCP-SARnet's role in the larger international development world (front page), while supporting the building of connections and sharing of ideas and insights between core COP members (Members Area).

Table 5 describes how social networking features were employed to meet the requirements specified by the community side of the WDA. The *Components* column lists the prominent features designed into the UCP-SARnet website. The *Design Concept* column describes the intended function of the design component, and the *Community Support* column describes how that function connects to the requirements of the community side of the domain-community WDA and at what level of abstraction. The domain is also supported by these design elements, but is not discussed.

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University-Community Partnership for Social Action Research
affiliates students, university faculty, community activists and governmental officials engaged worldwide in achieving the UN Millennium Development Goals (MDGs). The network provides a platform for the multicultural exchange of visions, ideas and best practices aimed at MDGs.

Ms. Rosemary Okello-Orlale, Executive Director of AWC Feature Service (Kenya)

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Figure 5: UCP-SARnet Homepage screenshot before design changes.



Figure 6: UCP-SARnet Front Page after design changes (UCP-SARnet, 2011). Note that the lower half has been cropped due to space constraints.

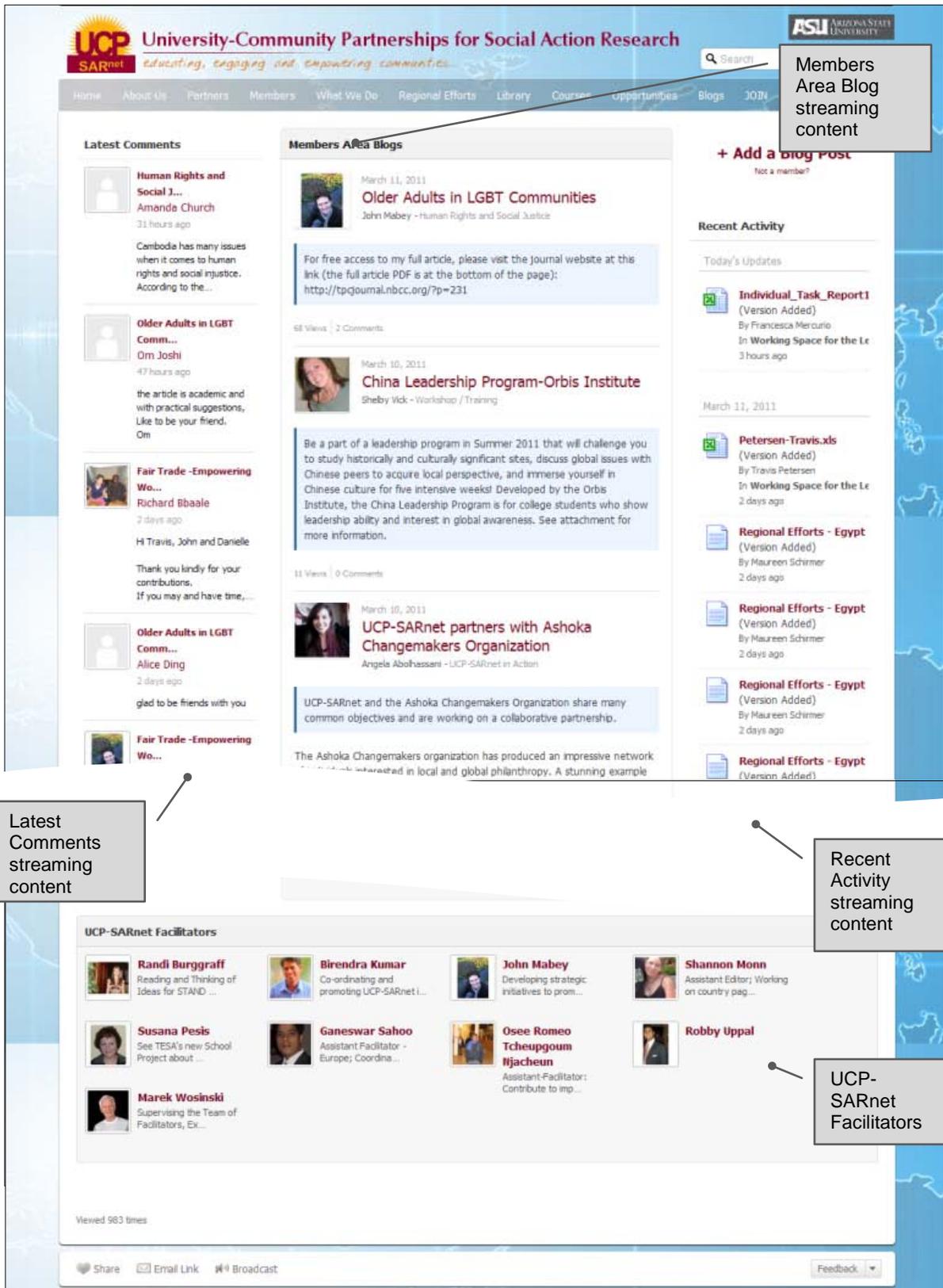


Figure 7: UCP-SARnet Members Area after design changes (UCP-SARnet, 2011). Note that a middle portion and footer has been cropped due to space constraints.

Table 6: Design components of the UCP-SARnet website and how they address elements in the community dimension of the domain-community WDA.

Components	Community Support	Design Concept
Homepage	Staying current in the external communications provides members with a way to view and reflect on UCP-SARnet's role in meeting the MDGs. In doing so, members may begin dialog to refine and come to alignment on the COP's role in the larger context of meeting the MDGs. (Desired state of the learning community)	External facing page focused on presenting activities and successes of UCP-SARnet's efforts toward MDGs, Congregates information and artifacts relevant to meeting the MDGs, Provides a space for communication to prospective member and partners, and other stakeholders in the larger context of the MDGs.
Photo banner rotator	Providing a visual image of how UCP-SARnet is providing value in the MDG efforts aids in members' identifying new ways they may provide value. (Practices)	Visually displays specific efforts toward MDGs, Presents examples of member participation.
UCP-SARnet in Action blog	By allowing members to monitor the outgoing communication, it helps create an orientation toward providing value in the external context. (Practices) This orientation affects the dialog in the Members' Area toward identifying opportunities to provide value in the meeting of MDGs and reveal gaps in the knowledge of how to provide that value. (Practices)	Provides a communication stream aimed to potential members, partners and other stakeholders in the larger context.
Members Area	Focusing on content authoring, sharing and dialog helps to give member experience with using the knowledge so, over time, UCP-SARnet members may establish what knowledge should be shared and how to share it. (Practices) Setting a more informal context for dialog helps members build the strength in relationships to actively discuss differences with respect to the domain and practice. (Desired state of the learning community)	Internal facing page focused on content authoring, sharing, and exchanging dialog, Provides a central space for informal dialog about the MDGs and UCP-SARnet as a COP, Congregates internal information, and artifacts relevant to the internal operations of UCP-SARnet.
Members Area blog	Providing a flexible and informal medium for internal dialogue supports all of the practices. (Practices)	Provides a communication stream for internal dialog about the MDGs and how the COP can improve its efforts toward them.

Table 7 (concluded): Design components of the UCP-SARnet website and how they address elements in the community dimension of the domain-community WDA.

Components	Community Support	Design Concept
Recent Activity bar/ Latest Comments bar	By providing a historical view of the dialog, members are better able to track conversations in such a way that helped in learning what knowledge should be shared and how. (Practices, People and Relationships) Encouraging message reciprocation encouraged the leadership team to build a variety of connections through shared content matter and personal exchanges, etc. (Practices, People and Relationships)	Provides a historical view of the internal communication streams and comments as well as the exchange of documents and other artifacts, Encourages revisiting the site by showing what's new and allows members to catch-up with any unfolding dialog, Encouraged message reciprocation by making comments more visible to the whole COP.
Facilitator's frame	By giving recognition to these shared roles and their similar relationship to the UCP-SARnet COP, this component helps to build connections between facilitators. (Practices, People and Relationships)	Gives recognition to facilitators of their role in supporting the internal activities of UCP-SARnet.

The general approach in the design of the UCP-SARnet website was to give the content some level of impermanence as blogs and comments would eventually be pushed off the bottom of the communication streams. This is a contrast to the highly permanent nature web components like wikis or static content pages. It was in this sense that the designer traded-off reification for participation by allowing members to put out new ideas without feeling like it was going to be a long-term element in UCP-SARnet's content repertoire. At UCP-SARnet's current level of maturity, this trade-off was appropriate as a way to increase imagination.

The focus of the design was to provide a medium where practices could emerge. As such, in the design of the UCP-SARnet website there was not a one-to-one relationship between the features deployed and the practices they were intended to encourage. For instance, it was decided that the Members Area blog as a more open medium in such a way that it could support all of the practices outlined in the community dimension. It is possible that as the practices emerge, the designer may provide facilities to enhance them. Though out of the scope of the thesis, it is helpful to understand that it was in this sense that the designer traded-off the benefits of structured design for allowing emergence of how members wished to use the blog.

Similar kinds of design choices could be made in the tradeoffs of local and global, as well as identification and negotiability. While those elements are not given direct treatment in this thesis, it is important to know how the priorities and trade-offs of the negotiation of meaning might be considered more thoroughly in future work.

In Table 5, the reader will notice several references to elements of UCP-SARnet's domain, which is consistent with the domain-community WDA. Where the domain dimension is concerned with what UCP-SARnet does in the external context, the community dimension is concerned with how the members of UCP-SARnet *relate to* or *make sense of* what it does. Table 5 describes how some components of the UCP-SARnet website help members relate to what UCP-SARnet does in the external context so that they may be better able to come to alignment on its specific role.

In sum, the design effort for UCP-SARnet was aimed to support the community dimension of the UCP-SARnet. We believe that that the new design of the UCP-SARnet website significantly enhanced the UCP-SARnet COP's ability to make meaning of what it does, which includes its relationship to its domain. As such, while social engagement is an element of the community dimension, we suggest that supporting it required a broad analysis that distinguishes the domain and community systems perspectives.

3.5 Chapter Summary

This chapter provided a background of the mission of UCP-SARnet as a unique COP, as well as the specific design and research approach that was used to rework the UCP-SARnet social networking portal. Using a COP lifecycle assessment, it was determined that UCP-SARnet was clearly moving from the challenges of the coalescing stage of development into the challenges of the maturing stage of development, as articulated by Wenger, McDermott, and Snyder (2002). With the details of UCP-SARnet's mission and the COP lifecycle assessment, a domain-community WDA model was created for UCP-SARnet and was used in the development of the UCP-SARnet's new social networking portal. The following chapters describe how an

SNA was conducted and how website usage and quality measures were tracked before and after website design changes were made. The results of these data provide a view of the effect of the design changes on the structure of the UCP-SARnet COP.

Chapter 4

Methods

In the previous chapters, the domain-community WDA was developed as a way to represent COPs for the purpose of design. The domain-community WDA was then applied in the case of the UCP-SARnet COP and the redesign of their social networking portal. This chapter describes how the researcher measured the effects of this design to answer the secondary research question: *Does a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?* In particular, this chapter discusses how surveys were conducted for a social network analysis, a social presence analysis and user experience analysis. The chapter also discusses how site usage data was gathered for a website usage analysis and communication analysis. Together, these analyses helped to determine if changes to structure of the UCP-SARnet social network corresponded to changes in social presence, user experience, usage and communication patterns of the website. Correspondent changes in the website measures and the social network analysis would be evidence for changes to the website producing an effect on the structure of the UCP-SARnet COP.

Several measures were taken to track the effects of the design changes to the UCP-SARnet portal. There were measures taken through a survey repeated three times over a period of roughly six months, which included a SNA, social presence measures and basic user experience indicators. The data from these surveys were designed to provide a snapshot of the UCP-SARnet leadership team before and after design changes were made to the website. There were also measures that could be monitored on an ongoing basis, including website content postings and website usage.

4.1 Surveys of UCP-SARnet Leadership Team

Three identical surveys were conducted with the UCP-SARnet leadership team, over about six months (see Appendix B). Each survey was distributed by email and completed online using Google Forms. The first survey (S1) was conducted immediately before design changes were made to UCP-SARnet. The second survey (S2) was conducted about 2.5 months later, and the third survey (S3) was conducted about 2.5 months after S2. Out of the 43 members on the UCP-SARnet leadership team, there were 26 respondents to the first survey, 24 respondents in the second survey and 17 respondents in the third survey. Between the three surveys there were 14 base respondents that completed all three surveys.

Figure 8 shows the distribution of survey responses over the six month period. The semi-transparent circles represent individual survey submission dates of the base survey respondents. The triangle above each cluster of circles indicates the average respondent submission times for each survey. The average times suggest the survey responses occurred in roughly 2.5 month intervals from the initial survey.

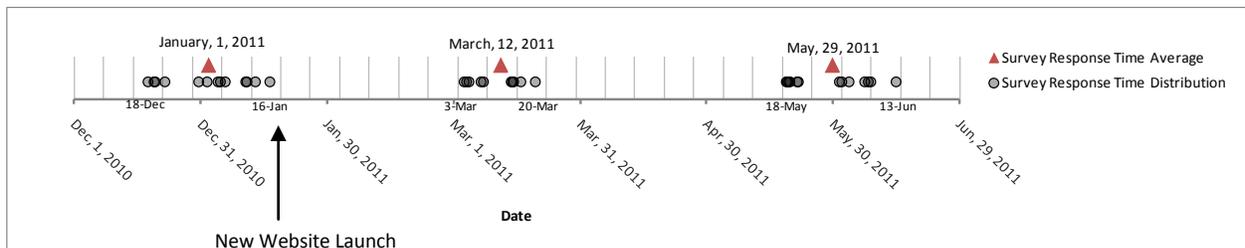


Figure 8: Distribution of survey responses for S1, S2, and S3 over about a six month period.

The surveys were structured into four sections: About You, Relationships Within UCP-SARnet, and Relationships to External Organizations, The UCP-SARnet Website. The About You section gathered basic demographic information of the respondents and included names for the purpose of identifying actors in the SNAs. The Relationships Within UCP-SARnet section of the surveys was used to determine the connections between members of the leadership team, which made up the SNA of the interior of the COP. The

Relationships to External Organizations was used to determine how the leadership team was connected to the UCP-SARnet organizational partners, which made up the SNA related to the exterior of the UCP-SARnet COP. . The UCP-SARnet Website section gathered information about the respondent's impressions of the website including the social presence measures.

When processing data from the surveys, respondent names were immediately converted to a three-digit unique identifier to protect anonymity of the participants.

4.2 Actor-Actor Social Network Analysis

The first component of the SNA consisted of an actor-actor analysis. As a part of the design requirements, it was determined that the UCP-SARnet COP was at a particular stage in their lifecycle where building connections between the core group was a priority. As such, the actor-actor SNA was designed to take a general measure of the level of connectedness on the UCP-SARnet leadership team. This would help to assess the effect of design changes on the community side of the domain-community WDA.

The data for the actor-actor SNA was gathered using a survey question that asked the respondent how well they knew other members of the leadership team. The respondent could choose their response from a three-point Likert scale: don't know this person, know somewhat, and know well. This question was intentionally vague in terms of how "knowing someone" was defined and the respondents were encouraged to answer with their gut feeling. The question was framed to appeal to the respondents' intuitive sense, which was aligned with the general aim of building connections in the core group – a factor of design in the community dimension of the UCP-SARnet COP.

For each of the three surveys administered, the data was processed into a list of interaction edges (don't know, know somewhat, or know well) between a source actor and a target actor (three-digit actor identifier), which was imported into SNA software. There are many varieties of SNA software available for use and Cytoscape was chosen for its flexibility and quality of rendering network graphs, as well as its ability to

calculate standard SNA statistics. After importing the edge data, a graph consisting of actor nodes and interaction edges was generated. The graph was a directed graph in the sense that it was possible that one actor could sense they knew target actor well, while that target may not, in fact, sense that they knew the source actor well.

The surveys administered were voluntary for the UCP-SARnet leadership team, so there was a slightly different set of respondents for each survey. Because there was an interest in tracking connectedness of the leadership team over time, the graphs generated were of those respondents that filled each of the three surveys. Including all respondents would have skewed the visual properties of the network graphs based on number of respondents for each survey and it would become difficult to determine if the number of edges increased within the base respondents.

With regard to the actor-actor SNA, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Survey 1 will increase the number of personal connections between members of the UCP-SARnet leadership team over time.

To test this hypothesis, actor-actor social network graphs of directed 'know well' connections were drawn and analyzed to view the new connections and how those connections were distributed throughout the base respondents. Using the count of the 'know well' connections for each respondent, a repeated measures ANOVA was conducted over each survey to determine if there was a significant increase in the number of 'strong' connections over time. Given a significant result of the repeated measures ANOVA, post hoc tests would be conducted to compare the mean number of connections between S1 and S2, S2 and S3, and S1 and S3 to determine between which surveys the significant changes may have occurred.

As a compliment to the repeated measures ANOVA, the network density of the 'know well' networks was calculated for each survey time. The network density is simply a ratio of the number of edges present in the network over the number of pairs in the network. The density measure would help to determine the extent of

the changes to the network – a higher change in density would correspond to a stronger effect of the website redesign. It would be calculated using the following equation,

$$density = \frac{number\ of\ edges}{number\ of\ possible\ pairs}$$

where the number of pairs in a directed graph is calculated using the equation,

$$number\ of\ pairs = (number\ of\ nodes) * (number\ of\ nodes - 1)$$

4.3 Actor-Org Social Network Analysis

The second component of the SNA consisted of an actor-org analysis to see how members of the UCP-SARnet leadership team were connected to the organizational partners. Again, as part of the lifecycle analysis, it was determined UCP-SARnet was moving into a particular stage of development where engaging external stakeholders was an important factor and this SNA helped to provide a picture of any new connections made between the UCP-SARnet leadership team and their external partners, which would help to assess the effect of design changes on the domain side of the domain-community WDA.

The data for the actor-org SNA was gathered using a survey question that asked respondents what level of connection they had with each of the UCP-SARnet partners. The respondents chose from a three-point Likert scale: strong connection, weak connection, and unaware. Unlike the actor-actor survey question, this question was given more concrete definitions for each of these responses. Strong connection was defined as having met or communicated with a member of the organization. Weak connection was defined as having heard of the organization, but not met or communicated with anyone from that organization. Unaware was defined as not having heard of the organization at all. The more concrete definition of this question was needed for a more objective view of the social network. This more objective view of the social network is related to the domain dimension of the UCP-SARnet COP.

In the same way as the actor-actor analysis, the data was organized into a list of interaction edges (strong connection, weak connection, or unaware) between source actor and target actor (three-digit actor identifier), which was imported to Cytoscape. The resulting graphs were an undirected graph with the assumption that the level of connections stated by the respondents would be the level connections that the organization would also state if surveyed.

With regard to the actor-org SNA, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Survey 1 will increase the number of connections between the UCP-SARnet leadership team and the UCP-SARnet organizational partners over time.

To test this hypothesis, the actor-org social network graphs of undirected ‘strong’ connections were drawn and analyzed to view the new connections and how they were distributed throughout the base respondents. Using the count of ‘strong’ connections for each respondent, a repeated measures ANOVA was conducted over each survey to determine if there was a significant increase in the number of ‘strong’ connections over time. Given a significant result of the repeated measures ANOVA, post hoc tests would be conducted to compare the mean number of connections between S1 and S2, S2 and S3, and S1 and S3 to determine between which surveys the significant changes may have occurred.

As a compliment to the repeated measures ANOVA, the network density of the ‘strong’ networks was calculated for each survey time. Like the actor-actor network, these would help to determine the extent of the changes to the network – a higher change in density would correspond to a stronger effect of the website redesign.

Because the actor-org network was undirected, the number of possible pairs was half as much,

$$\text{number of pairs} = \frac{[(\text{number of nodes}) * (\text{number of nodes} - 1)]}{2}$$

Furthermore, in contrast to the actor-actor network, the number of nodes increased or decreased as respondents drew new connections or dropped connections with more organizational partners over each

survey. Therefore, in the calculations of density, it was not a simple increase in edges that would increase density, but the calculation also had to factor in the change in the number of nodes in the networks over time.

4.4 User Experience Analysis

The purpose of gathering user experience and social presence information was to determine how the user’s experience of the UCP-SARnet website changed from before and after the website redesign. This portion of the study was intended to loosely supplement the SNA, such that if there were changes to the UCP-SARnet network, and a change in the experience of the website, together, that would help to link the changes in the network with the changes to the website and not some other external force.

The user experience questions were kept very simple in order to reduce the time required to fill the surveys. The user experience portion included two questions: (UE-Q1) how the respondent would rate the quality of the front page, and (UE-Q2) if they felt that looking at the front page gave them a sense of who is involved with UCP-SARnet and what they were doing.

Table 8: Questions used for the user experience portion of the UCP-SARnet website improvement survey with corresponding Likert scale.

Question #	Statement	Likert Scale				
UE-Q1	On the following scale, how would you rate the UCP-SARnet's front page?	1-Poor	2-Fair	3-Good	4-Very Good	5-Excellent
UE-Q2	From the front page, I have a clear sense of who's involved with UCP-SARnet and what they are doing.	1-Strongly disagree	2-Disagree	3-Neither agree or disagree	4-Agree	5-Strongly Agree

The first question (UE-Q1) was answered on a five-point Likert scale (poor, fair, good, very good, and excellent). The first question was aimed at domain dimension to determine how members of UCP-SARnet thought the front page would present the people and work of UCP-SARnet to external stakeholders – an exterior perspective. The second question (UE-Q2) was answered on a five-point Likert scale (strongly

disagree, disagree, neither agree or disagree, agree, and strongly agree). The second question was aimed at the community dimension to determine how members of UCP-SARnet experienced the front page from the respondent's point of view – an interior perspective.

With regard to user experience, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Survey 1 will change the way the UCP-SARnet leadership team relates to the UCP-SARnet website both in terms of the perceived quality and how they imagine external stakeholders will view the site, each over time.

To test this hypothesis, a non-parametric Friedman test was conducted for each of the user experience questions over the three survey times. If there was a significant effect over S1, S2, and S3 for either of the user experience questions, a post hoc test was conducted to compare the results between S1 and S2, S2 and S3, and S1 and S3 to determine between which surveys the significant changes may have occurred.

4.5 Social Presence Analysis

In this research, social presence with respect to the UCP-SARnet online portal was measured. Measures of social presence accompanying measures of actor-actor or actor-org social network structure would help to determine if the changes of the quality of the UCP-SARnet website corresponded with changes in the UCP-SARnet social network structure.

The social presence analysis was more closely related to the community dimension of the CoPs model. As mentioned in Chapter 2 in the Communities of Practice Section, the negotiation of meaning requires the possibility of mutual recognition between a participant and other participants, in which they acknowledge that they have the ability to influence each other's experience of meaning. Social presence, as defined by Short, Williams, and Christie (1976), is the "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships..." (65). It is thought of as a property of the communication medium and has been used as a predictor of learner satisfaction in a text-based medium

(Gunawardena & Zittle, 1997). As the “salience of the other person... and consequent salience of interpersonal relationships...” relates to the possibility of mutual recognition and the ability to influence another’s experience of meaning, social presence could be seen as a rough indicator of the conditions for the negotiation of meaning in an online medium.

The social presence component of the survey consisted of a 14 question Likert scale questionnaire that was adapted from a questionnaire developed and validated by Gunawardena and Zittle (1997) for the purpose of measuring social presence. Table 7 and Table 8 show the questions and Likert scale used in the in the social presence component of the UCP-SARnet survey.

Table 9: Questions used for the social presence portion of the UCP-SARnet website improvement survey adapted from Gunawardena and Zittle (1997).

Question #	Statement
Q1	*Messages in UCP-SARnet were impersonal
Q2	UCP-SARnet is an excellent medium for social interaction
Q3	I felt comfortable conversing through UCP-SARnet
Q4	I felt comfortable introducing myself on UCP-SARnet
Q5	The introduction(s) enabled me to form a sense of the online community I was part of
Q6	I felt comfortable participating in discussions on UCP-SARnet
Q7	The moderators created a feeling of an online community
Q8	The moderators facilitated the discussions on UCP-SARnet
Q9	*Discussions on UCP-SARnet tends to be more impersonal than face-to-face discussions
Q10	*Discussions on UCP-SARnet are more impersonal than audio teleconference discussions
Q11	*Discussions on UCP-SARnet are more impersonal than video teleconference discussions
Q12	I felt comfortable interacting with other participants on UCP-SARnet
Q13	I felt that my point of view was acknowledged by others on UCP-SARnet
Q14	I was able to form distinct individual impressions of some participants even though we communicated only via UCP-SARnet

* questions reverse coded.

Table 10: Likert rating-scale used for the social presence portion of the UCP-SARnet website improvement survey.

Rating code	1	2	3	4	5
Likert rating	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree

With regard to the social presence measures, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Survey 1 will increase the salience of interpersonal relationships over time.

To test this hypothesis, a Friedman test was conducted on each social presence measure over S1, S2 and S3. For the measures where a significant effect of the survey time was observed, pairwise post-hoc tests were conducted to compare the results between S1 and S2, S2 and S3, and S1 and S3 to determine between which surveys the significant changes may have occurred.

Some concerns should be noted about how well the social presence measures of Gunawardena and Zittle (1997) can represent social presence of the UCP-SARnet online portal. First, UCP-SARnet does not have moderators. While the UCP-SARnet facilitators could be seen as moderators, the respondents may have been confused by Q7 and Q8. Second, introductions were not practiced on the UCP-SARnet portal, so Q5 may not have had relevance to the respondents. Finally, Q10 and Q11 refer to audio conferencing and video conferencing, which the respondents may not have had experience with. As such, Q10 and Q11 may have also created confusion for respondents. While these were concerns, it was not feasible to develop a new questionnaire for the purpose of this study. As such, the questions stayed close to the original wording of the Gunawardena & Zittle questionnaire (1997) with the only change being the reference to UCP-SARnet.

4.6 Website Usage Analysis

Google Analytics was set up for the UCP-SARnet web portal, which allowed the researcher to track various usage metrics over time. Google Analytics allows tracking of both return users and new users to the UCP-SARnet website. For the purpose of tracking usage from the UCP-SARnet leadership team, return users were of particular interest. With respect to social engagement of the UCP-SARnet leadership team, the researcher tracked how often return users visited the site, how many pages they looked at during each visit to the site and the time they spent during their visit.

Similar to the social presence measures, the website usage analysis helped to determine if there was a relationship between UCP-SARnet site traffic that corresponded to changes in the UCP-SARnet social network structure. In order to compare the site usage data with the survey data the researcher selected three periods of ten weeks corresponding to the three survey dates: Period 1 (P1) ten weeks before the release of the website on January 16th, 2011, corresponding to S1; Period 2 (P2) ten weeks leading up to near the end of S2; and Period 3 (P3) ten weeks leading up to the near the end of S3. Table 9 provides a summary of these periods.

Table 11: Website usage analysis periods as they correspond to the survey dates.

Period	Period Range	Survey	Survey Response Range
P1	November 7, 2010 – January 15, 2011	S1	December 18, 2010 – January 16, 2011
P2	January 16, 2011 – March 26, 2011	S2	March 3, 2011 – March 20, 2011
P3	March 27, 2011 – June 4, 2011	S3	May 18, 2011 – June 7, 2011

With regard to the website usage analysis, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Period 1 will change overall website usage for the UCP-SARnet leadership team over time.

To test this hypothesis, a MANOVA was conducted with the weekly average of each usage measure to see if there was an effect of the period on the site visits, page views per visit and time on site for returning users on the UCP-SARnet website portal. This broad MANOVA is followed up with univariate ANOVAs for each of the three website usage measures to determine which web usage measures were significant over the three periods. Finally, a post-hoc Tukey test was used to difference in the means of each web usage measure across periods. While the main research question is answered with the MANOVA, the follow up test and the post-hoc tests were conducted to determine which website usage statistics showed a significant effect over the three periods and over which periods the significant effect may have occurred.

4.7 Website Communication Analysis

The website communication analysis was concerned with the blog and comment posts made on the UCP-SARnet web portal through P1, P2, and P3 as defined in Table 9. Similar to the website usage analysis, the communication analysis consisted of a count of the blog posts, comment posts and unique bloggers and commenters over each week. Looking at these metrics provided a view of how the UCP-SARnet members were using the redesigned UCP-SARnet website, which featured a community blog stream. Overall, this analysis provides another layer to the website usage analysis to determine if there was a relationship between the activity in P1, P2, and P3 on the site structure of the actor-actor and actor-org social network over S1, S2, and S3.

With regard to the count of posts to the website, the main hypothesis was:

The redesign of the UCP-SARnet social networking portal at the end of Period 1 will increase the number of blog posts, comments, and unique weekly posters to UCP-SARnet over time.

Similar to the hypothesis in the website usage analysis, to test this hypothesis, a MANOVA was conducted with the weekly blog posts, comments and unique weekly posters to see if there was an effect of the period on the frequency of communications on the site. This broad MANOVA is followed up with multiple univariate ANOVAs for each of the three communication measures determine which web usage measures were significant over the three periods. For the measures with significant univariate ANOVAs, post-hoc Tukey tests were used to determine between which period the significant effects may have occurred. While the main research question is answered with the MANOVA, the follow up test and the post-hoc tests were conducted to determine which website usage statistics showed a significant effect over the three periods and over which periods the significant effect may have occurred.

4.8 Chapter Summary

In this Chapter, several hypotheses were proposed as they related to the measures used to track the effect of the redesign of the UCP-SARnet portal over the three surveys (S1, S2, and S3) in correspondence with three periods (P1, P2, and P3). It was expected that the redesign of the website would increase the number of connections both between members of UCP-SARnet and between UCP-SARnet and its organizational partners. Furthermore, it was expected that user experience of the UCP-SARnet website would be improved and that the level of social presence would increase. Finally, it was also expected that raw usage of the UCP-SARnet website would increase along with an increase in frequency of communications such as blogs, and comments on blogs. While the principal measures for the structure of the UCP-SARnet COP were the social network analyses, they are paired with measure of the quality of the website (user experience, social presence, website usage and communication) to help verify whether improvements to the website were the main factor causing structural changes in UCP-SARnet or if there were other external factors involved.

Chapter 5

Results

In the previous chapter, methods were described that would help to determine if changes to the structure of the UCP-SARnet social network was linked to several measures of the UCP-SARnet website including social presence, user experience, raw usage, and communication patterns. In this chapter, the results of these analyses are presented. Graphs of the social network analyses present how the UCP-SARnet's internal connections (actor-actor) and external connections (actor-org) changed from survey to survey. Following the social network analysis is the user experience, social presence, website usage and communication analyses. These analyses present many statistical figures and it is recommended that readers reference the results summary table (Table 20) at the end of the chapter.

5.1 Actor-Actor Social Network Analysis

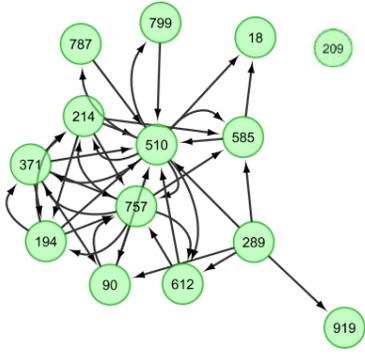
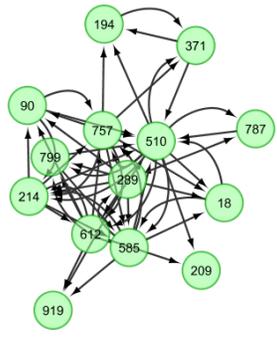
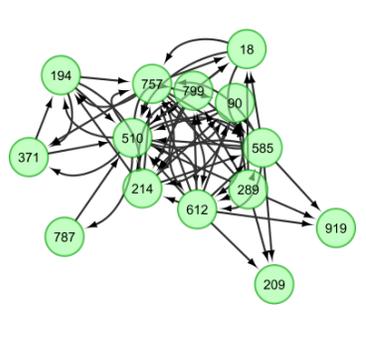
Table 10 shows the Actor-actor SNA for the 14 base respondents of the UCP-SARnet leadership team at Survey 1 (S1), Survey 2 (S2), and Survey 3 (S3). These graphs show the 'know well' connections between the respondents at the time of each survey and are accompanied with some basic statistics for comparison. Table 11 presents graphs of the *new* 'know well' connections created between S1 and S2; S2 and S3; and S1 and S3.

In Table 10, the visual structure of each graph was generated using the force-directed layout algorithm provided by Cytoscape, which puts nodes with the highest number of neighbors closer to the center of the graph. The reader will notice that the network graphs become tighter from S1 to S2 and from S2 to S3 indicating that the 'know well' connections increased after design changes were made to the website, and increased again when the third survey was administered.

From a quantitative perspective, there was an increase in the average number of neighbors, number of edges, network density and multi-edge node pairs each from S1 to S2 and from S2 to S3. The difference of the average number of neighbors from S1 to S2 was 1.28, and the difference from S2 to S3 dropped to 0.71. Similarly the difference of the number of edges for S1 to S2 was 16 and from S2 to S3, the difference dropped to 12. This also occurred for the network density increasing 0.08 from S1 to S2 and 0.07 from S2 to S3. These results suggest that effect in the increase of connections was more pronounced immediately after the redesign of the website.

Multi-edge node pairs, the “Know well” connections that went both ways between pairs of respondents, did not follow the pattern where the initial effect was pronounced. Multi-edge node pairs increased by 5 from S1 to S2 and by 7 from S2 to S3.

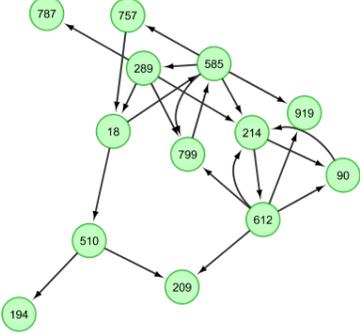
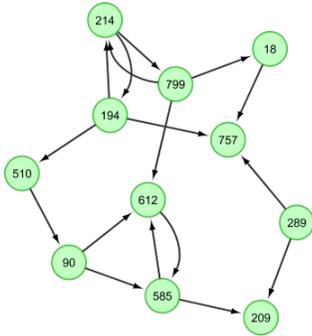
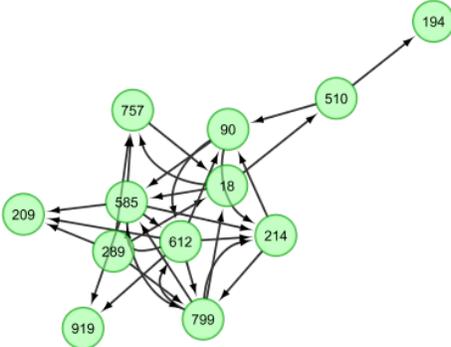
Table 12: Actor-actor SNA showing ‘know well’ connections for S1, S2, and S3. Note that S2 and S3 were taken after design changes to the UCP-SARnet social networking portal.

Survey 1		Survey 2		Survey 3	
					
Network Diameter	3	Network Diameter	4	Network Diameter	3
Avg. Number of Neighbors	4.15	Avg. Number of Neighbors	5.43	Avg. Number of Neighbors	6.14
Number of Nodes	14	Number of Nodes	14	Number of Nodes	14
Number of Edges	41	Number of Edges	57	Number of Edges	69
Network Density	0.23	Network Density	0.31	Network Density	0.38
Multi-edge Node Pairs	14	Multi-edge Node Pairs	19	Multi-edge Node Pairs	26

In Table 11, the visual structures of the difference graphs were also generated by the force-directed layout algorithm in Cytoscape. The S1S2 difference graph shows all the edges in S2 that did not appear in S1. Similarly, the difference graphs of S2S3 and S1S3 show new edges that appeared from S2 to S3 and S1 to S3, respectively. It is important to note that in the difference graphs, the number of edges does not correspond with a direct difference of the edges at each survey in Table 10. This is because some respondents may have considered another member as a “Know well” connection in one survey, but not in subsequent surveys. For example, respondent 612 claimed they knew 510 well in S1, but not in S2. The difference graphs show only new edges and does not show where edges may have been lost. While this may not ideal from a quantitative perspective, the difference graphs were considered useful in analyzing the changes from survey to survey because they are less dense than the individual survey graphs in Table 10.

Qualitatively, there appears to be more new connections between S1S2 than there are from S2S3, but in each graph these connections seemed to be uniformly distributed over the total number of respondents. Looking at the quantitative measures, in S1S2 the number of new connections was 23, while the number of new connections in S2S3 was 17. While there was a decrease in the number of new connections from S1S2 to S2S3, the new connections were distributed over 93% of the total respondents (13 out of 14) in S1S2 and 79% of the respondents in S2S3 (11 out of 14). Correspondingly, in S1S3, the new connections were distributed over 86% of the population (12 out of 14). Overall, each the S1S2, S2S3 and S1S3 difference graphs show there is a fairly uniform distribution to the increase in edges, suggesting more uniform effects on the COP.

Table 13: Actor-actor difference SNA showing the difference in ‘know well’ connections between surveys.

S1S2 Difference Graph (S2 minus S1)		S2S3 Difference Graph (S3 minus S2)	
			
Network Diameter	8	Network Diameter	4
Number of Nodes	13	Number of Nodes	11
Number of Edges	23	Number of Edges	17
Multi-edge Node Pairs	3	Multi-edge Node Pairs	3
S1S3 Difference Graph (S3 minus S1)			
			
Network Diameter	5		
Number of Nodes	12		
Number of Edges	31		
Multi-edge Node Pairs	7		

For further analysis, Table 12 and Figure 9 show the mean number of ‘know well’ connections over the 14 base respondents at S1, S2, and S3. In agreement with the SNA graphs, the mean number of connections increased more between S1 and S2 than between S2 and S3. The standard error for each survey was high showing some overlap between surveys indicating that there was a range of numbers of connections, where

some respondents knew many other respondents well, while some respondents knew relatively fewer respondents well. A repeated measures ANOVA with a Greenhouse-Geisser correction determined that the mean number of ‘know well’ connections differed statistically significantly from S1, S2 and S3; $F(1.159, 15.064) = 8.361, p < 0.05$ (SPSS output can be found in Appendix D). A post hoc test revealed that the mean increase of 5 connections from S1 to S2 was significant ($p < 0.05$). Furthermore, the mean increase of 2.42 between S2 and S3 was significant ($p < 0.05$). This suggests that there was an effect of the timing of the surveys: S1, before the design changes, S2, about 2.5 months after the design changes, and S3 about 5 months after the design changes.

Note that a post-hoc correction was not used to adjust the threshold for significance for the actor-actor ‘know well’ connections. It was determined that this was appropriate due to the low number post-hoc tests conducted, and the exploratory nature of the research, where it was considered important to avoid Type II statistical errors.

Table 14: Mean number of ‘know well’ connections of the 14 base respondents at S1, S2, and S3.

	Survey 1	Survey 2	Survey 3
Mean number of ‘know well’ connections	8.33	13.33	15.75
Standard Error	2.03	2.98	3.27

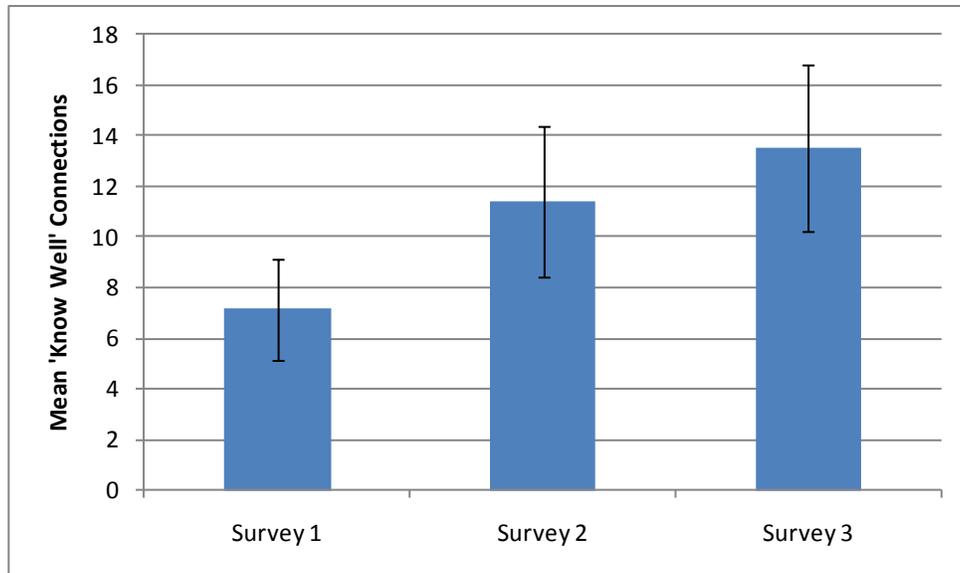


Figure 9: Graph of mean number of ‘know well’ connections of the 14 base respondents at S1, S2 and S3. Error bars indicated standard error.

5.2 Actor-Org Social Network Analysis

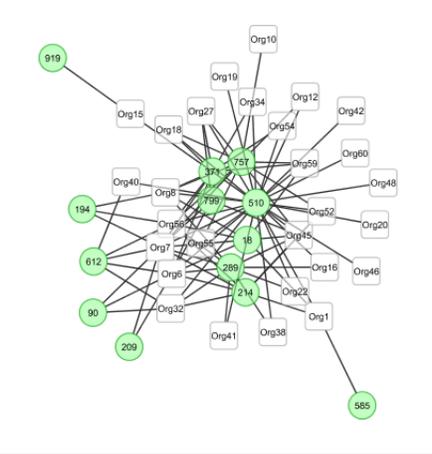
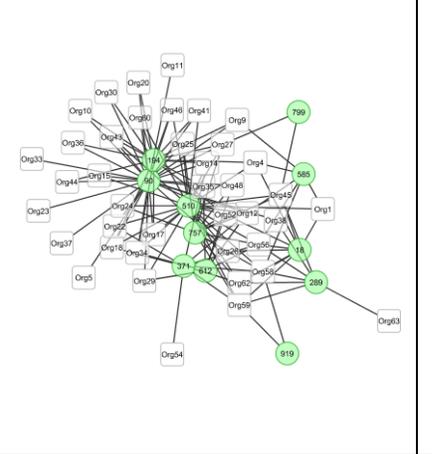
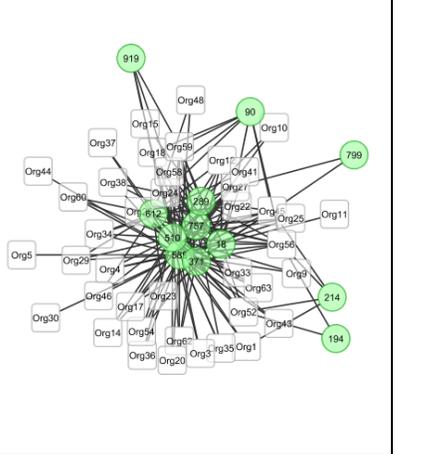
Table 13 shows the actor-org SNA for the 14 base respondents of the UCP-SARnet leadership team at S1, S2, and S3. These graphs show the ‘strong’ connection between respondents and the organizational partners of UCP-SARnet at the time of each survey and are accompanied with statistics for comparison. Similar to the actor-actor results in Table 11, the graphs in Table 14 present the *new* ‘strong’ connections created between S1 and S2; S2 and S3; and S1 and S3.

In Table 13, the visual structure of each graph, again, was generated using the force-directed layout algorithm provided by Cytoscape. These graphs become tighter from S1 to S2 and from S2 to S3 suggesting that there was an increase in ‘strong’ connections after the website changes were made and after the S3 was administered.

From a quantitative perspective, there was an increase in the average number of neighbors, number of edges, and number of nodes from S1 to S2 and S2 to S3. The difference of the average number of neighbors from S1 to S2 was 0.63, and the difference from S2 to S3 increased to 0.87. The number of nodes from S1

to S2 increased by 10, while the number of nodes from S2 to S3 increased by only 2. Similarly, the number of edges from S1 to S2 increased by 38, while the number of edges in S2 to S3 increased 28. The density of the network is based on the number of possible connections so the increase in edges was not enough to offset the increase in nodes from survey to survey, so the network density remained stable at about 0.10 to 0.11 through each survey point. Nonetheless, while the density did not increase, these results suggest the actor-org network growth in terms of number of nodes occurred and the growth was more pronounced from S1 to S2 than S2 to S3.

Table 15: Actor-org SNA showing ‘strong’ connections for S1, S2, and S3. Note that S2 and S3 were taken after design changes to the UCP-SARnet social networking portal.

Survey 1		Survey 2		Survey 3	
					
Network Diameter	5	Network Diameter	5	Network Diameter	4
Avg. Number of Neighbors	4.39	Avg. Number of Neighbors	5.02	Avg. Number of Neighbors	5.89
Number of Nodes	41	Number of Nodes	51	Number of Nodes	53
Number of Edges	90	Number of Edges	128	Number of Edges	156
Network Density	0.11	Network Density	0.10	Network Density	0.11

In Table 14, the visual structures of the difference graphs were also generated by the force-directed layout algorithm in Cytoscape. Like the difference graphs of the actor-actor SNA, the S1S2 difference graph shows all the edges in S2 that did not appear in S1 and the S2S3 and S1S3 difference graphs shows all the new edges that appeared from S2 to S3 and from S1 to S3, respectively. Again, it is important to note that the difference

graphs do not correspond with a direct difference of edges from survey to survey as listed in Table 13 because some respondents may have considered an organizational partner a ‘strong’ connection in one survey but not in subsequent surveys – some edges may have been lost from survey to survey. Theoretically, this should have happened less in the actor-org SNA because the survey questions were more precise about the definitions of the connection strength based on communication; however, it still occurred as respondents likely still answered quickly to the best of their memory. Again, these are helpful to see the nature of the changes from survey to survey because they are less dense than the survey graphs in Table 13.

Qualitatively, there appears to be a similar increase in the number of connections with one or two of the respondents making many new ‘strong’ connections. In S1S2, the number of new connections was 92, while the number of new connections in S2S3 was 82. S1S2 shows that new connections were distributed over 71% of the base respondents (10 out of 14). Similarly, S2S3 and S1S3 show that new connections were distributed over 79% of the base respondents (11 out of 14) and 71% of the base respondents (10 out of 14), respectively. However, in contrast to the actor-actor difference graphs in Table 11, many of the new connections were centered on just a few of the actors. In S1S2, many of the new connections were centered on Actor 194 and Actor 090, and in S2S3 many of the connections were centered on Actor 585. What the reader will notice is that in the S1S3 graph, Actor 194 shows only one new connection, this suggests that this respondent may have misinterpreted the survey question. Regardless, the actor-org difference graphs show different characteristics than the actor-actor graphs and the new connections were not uniformly distributed over the respondents, which suggests that isolated factors may have affected some of the respondents individually.

Table 16: Actor-org difference SNA showing the difference in 'strong' connections between surveys.

S1S2 Difference Graph (S2 minus S1)		S2S3 Difference Graph (S3 minus S2)	
Network Diameter	6	Network Diameter	7
Number of Nodes	47	Number of Nodes	51
Number of Actor Nodes	10	Number of Actor Nodes	11
Number of Edges	92	Number of Edges	82
S1S3 Difference Graph (S3 minus S1)			
Network Diameter	4	Number of Nodes	50
Number of Actor Nodes	10	Number of Edges	113

For further statistical analysis, Table 15 and Figure 10 show the mean number of ‘strong’ connections over the 14 base respondents at S1, S2, and S3. In agreement with the SNA graphs in Table 13 and Table 14, the mean number of connections increased more between S1 and S2 than between S2 and S3. Similar to the actor-actor SNA, the standard error for each survey was high showing overlap between surveys indicating that there was a range of number of ‘strong’ connections, where some respondents said they knew many organizations well, while some respondents knew relatively fewer organizations well. However, a Repeated Measures ANOVA determined that the mean number of ‘strong’ connections did not differ in a statistically significant way from S1, S2 and S3 with $F(2,22) = 1.450, p = 0.256$ (SPSS output can be found Appendix E). With this result, it is conceivable that the increase in the number of ‘strong’ connections increased from survey to survey by some level of chance and should be treated accordingly.

As with the actor-actor SNA results, a correction factor was not applied on the post-hoc analysis to avoid committing Type II statistical errors.

Table 17: Mean number of ‘strong’ connections of the 14 base respondents at S1, S2, and S3.

	Survey 1	Survey 2	Survey 3
Mean number of ‘strong’ connections	6.43	9.14	11.14
Standard Error	1.84	2.48	3.25

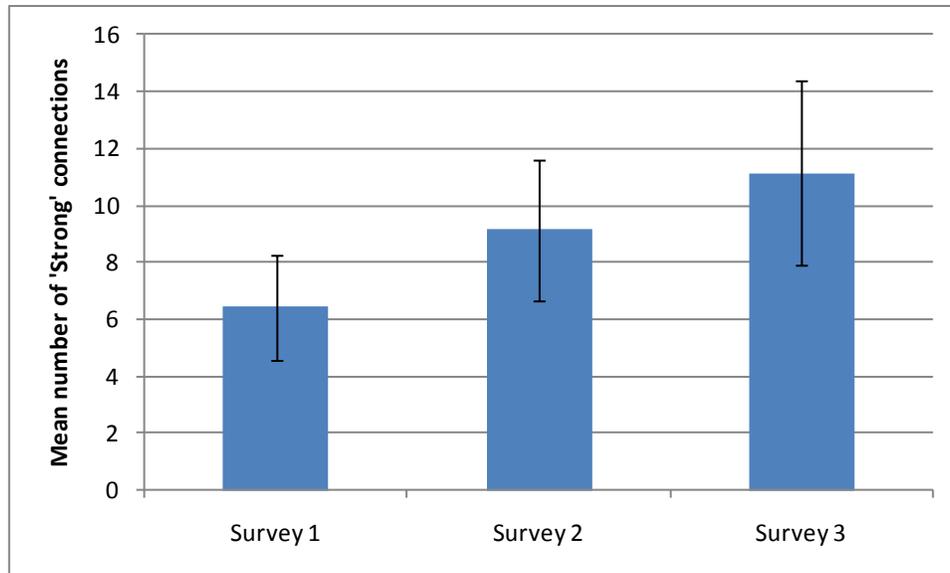


Figure 10: Graph of mean number of 'strong' connections of the 14 base respondents at S1, S2, and S3. Error bars indicate standard error.

5.3 User Experience Analysis

Table 16 and Figure 11 present the distribution of the responses from the 14 base respondents for the user experience questions over S1, S2, and S3. This data shows there appeared to be an effect from S1 to S2, but not from S2 to S3 for both questions.

Table 18: Distribution of responses to UE-Q1 and UE-Q2 user experience questions from the 14 base respondents over S1, S2, and S3.

		Likert Response Code				
		1	2	3	4	5
UE - Q1	S1	7%	43%	29%	14%	7%
	S2	0%	0%	21%	36%	43%
	S3	0%	14%	7%	50%	29%
UE - Q2	S1	0%	21%	36%	36%	7%
	S2	0%	14%	21%	29%	36%
	S3	0%	7%	21%	36%	36%

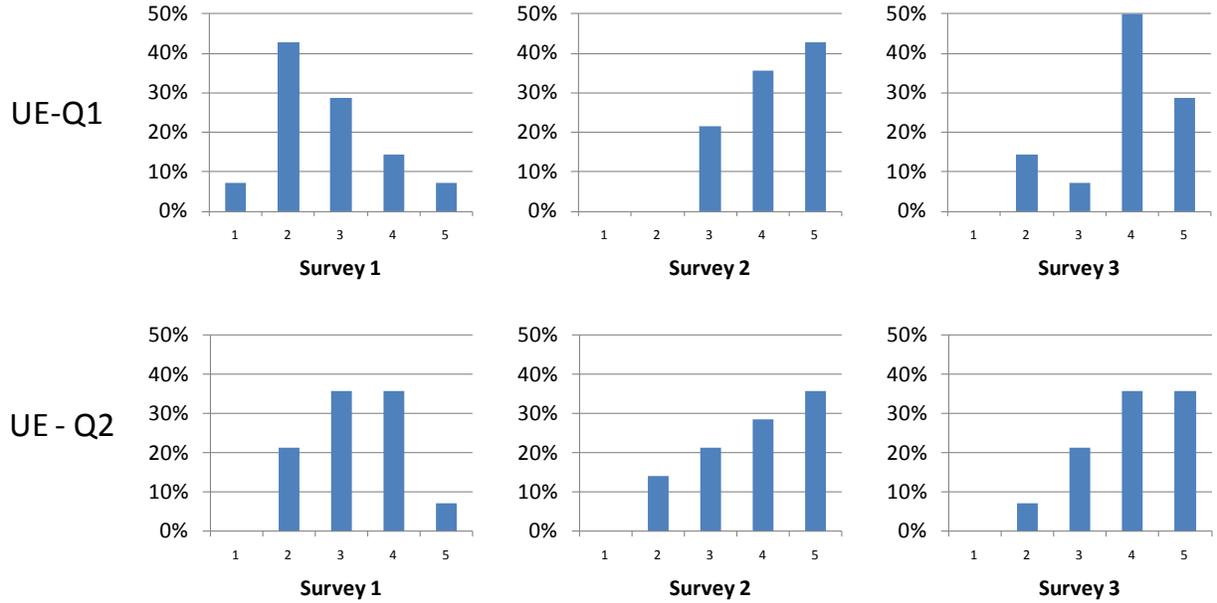


Figure 11: Distribution of the responses to UEQ1 and UEQ2 user experience questions from the 14 base respondents over S1, S2, and S3.

Related to UE-Q1, there was a statistically significant difference perceived in how the respondent would rate the quality of the front page ($\chi^2(2) = 16.263, p < 0.005$) (SPSS outputs can be found in Appendix F). Post hoc analysis with Wilcoxon Signed-Ranks Tests were conducted showing a significant difference between S1 and S2 ($Z(2) = -2.969, p = 0.003$), and S1 and S3 ($Z(2) = -2.719, p = 0.007$), but no significant difference between S2 and S3 ($Z(2) = -0.647, p = .518$).

Related to UE-Q2, there was not a statistically significant difference in whether respondents felt that looking at the front page gave them a sense of who is involved with UCP-SARnet and what they were doing ($\chi^2(2) = 2.976, p < 0.226$).

5.4 Social Presence Analysis

A Friedman analysis of the responses to the 14 social presence questions by the 14 base respondents showed significant results on SP-Q2, SP-Q3, SP-Q6, and SP-Q7 as listed in Table 7 (SPSS output can be found in Appendix G). Table 17 and Figure 12 show the distribution of responses for these questions.

Table 19: Distributions of responses to social presence questions from the 14 base respondents over S1, S2, and S3.

		Likert Response Code				
		1	2	3	4	5
Q2	S1	0%	29%	29%	<u>36%</u>	7%
	S2	0%	0%	21%	<u>43%</u>	36%
	S3	0%	0%	29%	29%	<u>43%</u>
Q3	S1	0%	21%	14%	<u>57%</u>	7%
	S2	0%	0%	7%	<u>57%</u>	36%
	S3	0%	0%	21%	29%	<u>50%</u>
Q6	S1	7%	14%	14%	<u>36%</u>	29%
	S2	0%	0%	14%	29%	<u>57%</u>
	S3	0%	0%	14%	<u>57%</u>	29%
Q7	S1	0%	21%	<u>36%</u>	29%	14%
	S2	0%	0%	36%	<u>36%</u>	29%
	S3	0%	7%	21%	<u>43%</u>	29%

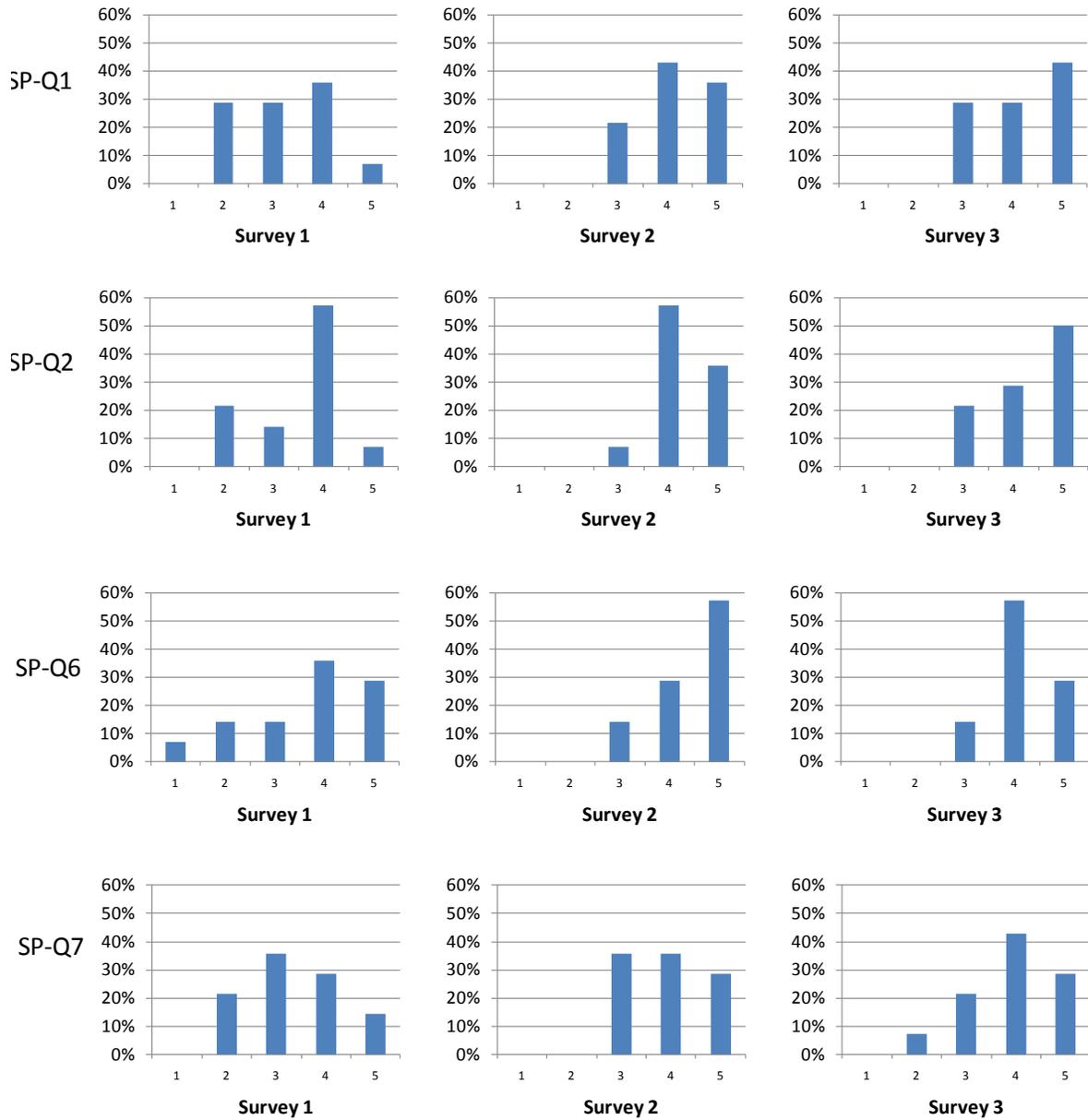


Figure 12: Distribution of responses for the social presences questions that showed a significant effect over S1, S2, and S3.

Related to SP-Q2, there was a statistically significant difference perceived in UCP-SARnet being an excellent medium for social interaction ($\chi^2(2) = 12.602, p < 0.05$). Post hoc analysis with Wilcoxon Signed-Ranks Tests were conducted showing a significant difference between S1 and S2 ($Z(2) =$

$-2.739, p < 0.05$), and S1 and S3 ($Z(2) = -2.812, p < 0.05$), but no significant difference between S2 and S3 ($Z(2) = 0.000, p = 1.000$).

Related to SP-Q3, there was a statistically significant difference in perceived comfort conversing through UCP-SARnet ($\chi^2(2) = 9.941, p < 0.05$). Post hoc analysis with Wilcoxon Signed-Ranks Tests was conducted and there was a significant difference between S1 and S2 ($Z(2) = -2.812, p < 0.05$), and S1 and S3 ($Z(2) = -2.484, p < 0.05$), but no significant difference between S2 and S3 ($Z(2) = 0.000, p = 1.000$).

Related to SP-Q6, there was a statistically significant difference in perceived comfort participating in discussions on UCP-SARnet ($\chi^2(2) = 7.824, p < 0.05$). Post hoc analysis with Wilcoxon Signed-Ranks Tests was conducted and there was a significant difference between S1 and S2 ($Z(2) = -2.428, p < 0.05$), but no significant difference between S2 and S3 ($Z(2) = -1.414, p = 0.157$), or between S1 and S3 ($Z(2) = -1.732, p = 0.083$).

Related to SP-Q7, there was a statistically significant difference perceived in moderators creating a feeling of online COP ($\chi^2(2) = 6.054, p < 0.05$). Post hoc analysis with Wilcoxon Signed-Ranks Tests was conducted, and there was significant difference between S1 and S2 ($Z(2) = -2.309, p < 0.05$), but not between S2 and S3 ($Z(2) = 0.000, p = 1.000$), or between S1 and S3 ($Z(2) = -1.903, p = 0.057$).

5.5 Website Usage Analysis

Table 18, Figure 13, Figure 14, Figure 15 show the mean levels for each of the website usage variables measured for the UCP-SARnet social networking portal over P1, P2, and P3. Each period was 10 weeks long corresponding closely to the survey dates for S1, S2, and S3. The statistical analysis uses the returning users because it most closely describes the site usage of the UCP-SARnet leadership team; however, the statistics for all users were shown to provide more context for the reader.

Table 20: Website usage analysis data for all users and returning users over P1, P2, and P3.

			Period 1	Period 2	Period 3
Weekly Site Visits	All Users	Mean	567	944	844
		Standard Error	36	23	55
	Returning Users	Mean	216	466	314
		Standard Error	21	20	31
Weekly Page Views Per Visit	All Users	Mean	5.10	6.40	3.83
		Standard Error	0.52	0.37	0.27
	Returning Users	Mean	8.54	8.85	5.31
		Standard Error	1.13	0.72	0.28
Weekly Average Time on Site	All Users	Mean	4.80	5.62	3.46
		Standard Error	0.59	0.35	0.32
	Returning Users	Mean	9.05	8.49	5.60
		Standard Error	1.22	0.58	0.47

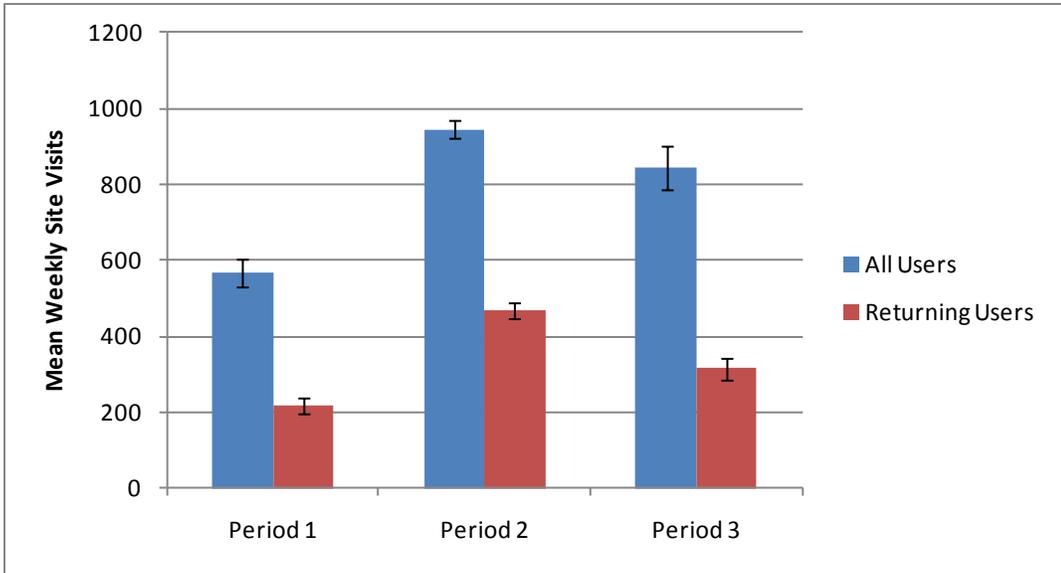


Figure 13: Mean weekly site visits during each period for all users and returning users.

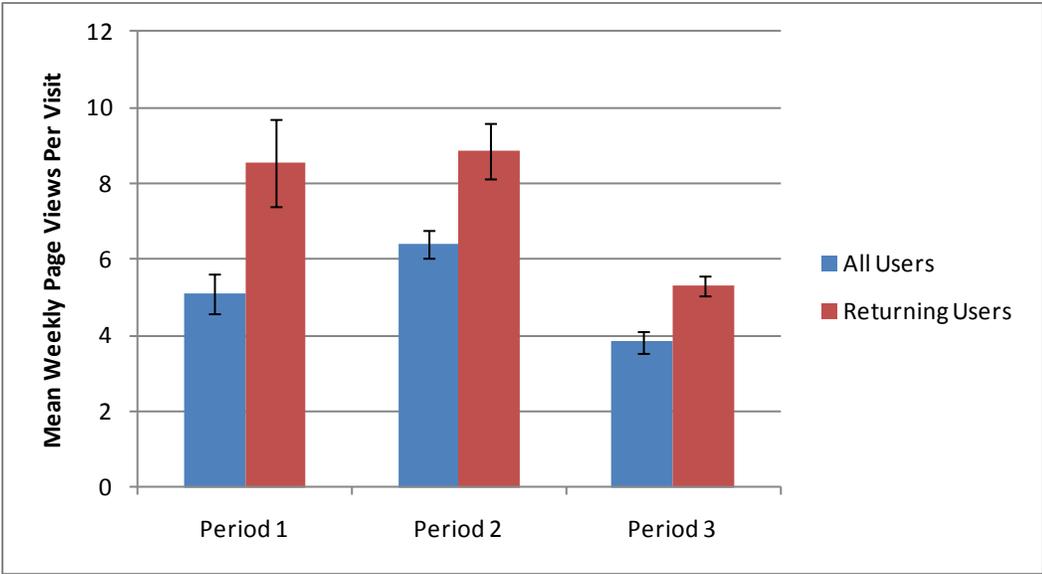


Figure 14: Mean weekly page views per visit during each period for all users and returning users.

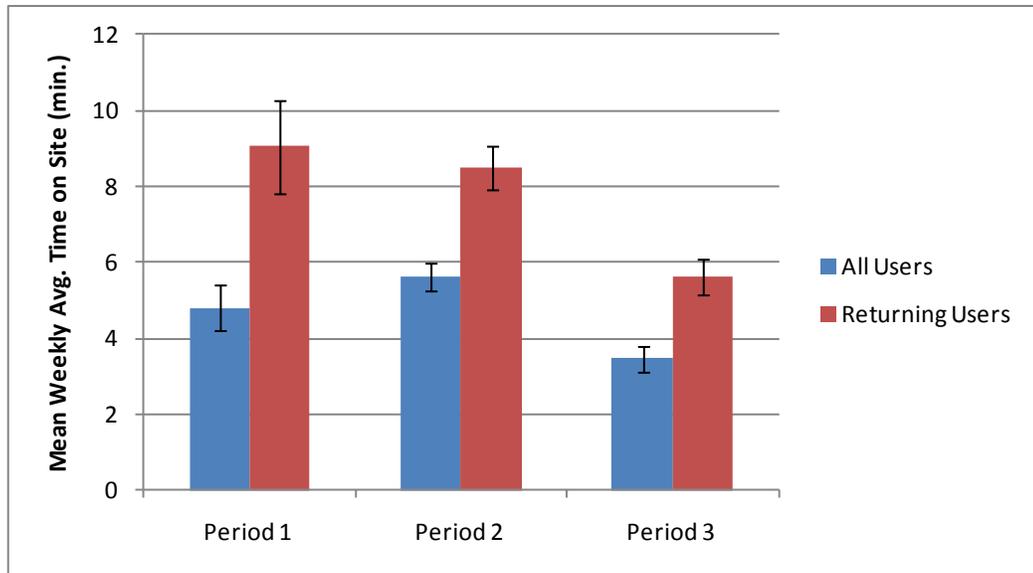


Figure 15: Mean weekly average time on site during each period for all users and returning users.

A MANOVA was conducted using the returning users data with Weekly Site Visits (WU-1), Weekly Page Views Per Visit (WU-2), and Weekly Average Time on Site (WU-3) as dependent variables and P1, P2, and P3 as the independent variable. Box's M Test for equality of covariance matrices was not significant at the $p < 0.001$ rejecting the null hypothesis that covariance matrices of web usage variables are equal across periods, satisfying the assumption of homoscedasticity for MANOVA (SPSS output can be found in Appendix H).

The MANOVA including WU-1, WU-2 and WU-3 showed that there was a statistically significant difference between periods with respect to the UCP-SARnet website usage variables ($F(6, 50) = 9.72, p < 0.05, Wilks' \lambda = .213, partial \epsilon^2 = 0.538$).

Follow-up univariate ANOVA tests were conducted using the returning users data. The univariate ANOVAs showed that there was a significant effect over the three periods on weekly site visits ($F(2, 27) = 26.25, p < 0.05, partial \epsilon^2 = .660$), page views per visit ($F(2, 27) = 6.138, p < 0.05, partial \epsilon^2 = 0.313$), and weekly average time on site ($F(2, 27) = 5.057, p < 0.05, partial \epsilon^2 = 0.273$).

Post-hoc tests between periods were conducted using Tukey HSD. Mean scores for weekly site visits were different between P1 and P2 ($p < 0.005$), P2 and P3 ($p < 0.05$), and P1 and P3 ($p < 0.005$). Mean scores for page views per visit were not different between P1 and P2 ($p = 0.957$), but were different between P2 and P3 ($p < 0.05$) and P1 and P3 ($p < 0.05$). Finally, mean scores for weekly average time on the site were not different between P1 and P2 ($p = 0.881$), marginally different for P2 and P3 ($p = 0.050$), and significantly different between P1 and P3 ($p < 0.05$).

5.6 Website Communication Analysis

The website communication analysis consisted of statistics based on number of content posts to the UCP-SARnet site over each period, which was concerned with the number of blog posts and comments, as well as unique bloggers and commenters each week.

Table 19 and Figure 16 show the content statistics based on number of posts to UCP-SARnet over P1, P2, and P3. Similar to the Website Usage Analysis, a MANOVA was conducted with weekly blog posts, weekly comments and weekly unique users as dependent variables and P1, P2, and P3 as independent variable. Box's M Test for equality of covariance matrices was significant at the $p < 0.001$ accepting the null hypothesis that covariance matrices of web usage variables are equal across periods, which did not satisfy the assumption of homoscedasticity for MANOVA (SPSS output can be found in Appendix I). As such, the overall effect of the period on the three website content statistics could not be determined.

Table 21: Content statistics based on post type on UCP-SARnet web portal over P1, P2, and P3.

		Period 1	Period 2	Period 3
Weekly Blog Posts	Mean	0.4	12	6
	Standard Error	0.16	1.74	1.74
Weekly Comments	Mean	0.4	17.2	1.9
	Standard Error	0.27	6.69	0.59
Weekly Unique Users	Mean	0.6	7.9	3.9
	Standard Error	0.31	0.99	0.95

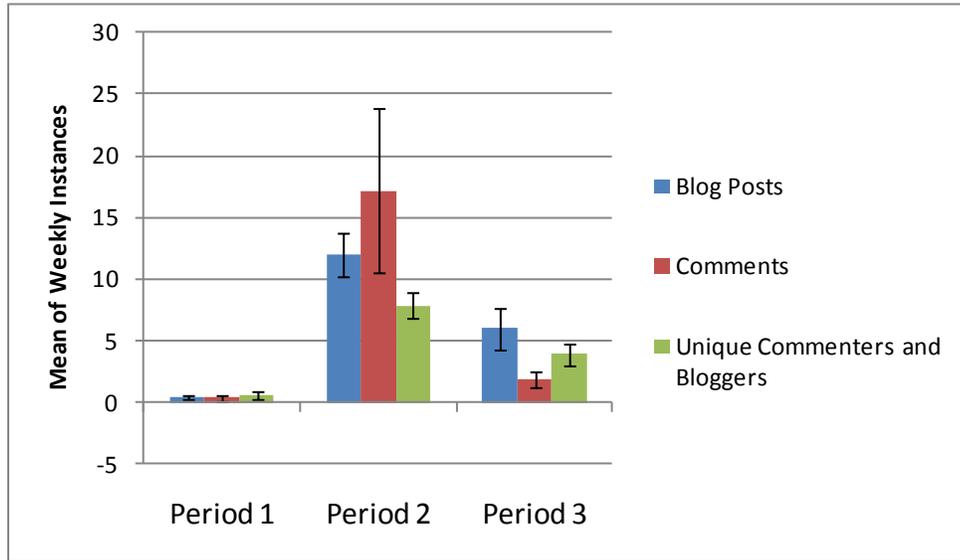


Figure 16: Content statistics based on post type on UCP-SARnet web portal over P1, P2, and P3.

Follow-up univariate ANOVA tests were conducted for each website content analysis variables. The univariate ANOVAs showed that there was a significant effect over the three periods on weekly blog posts ($F(2, 27) = 16.630, p < 0.05, partial \epsilon^2 = .552$), weekly comment posts ($F(2, 27) = 5.747, p < 0.05, partial \epsilon^2 = 0.299$), and weekly average time on site ($F(2, 27) = 20.247, p < 0.05, partial \epsilon^2 = 0.600$).

Post-hoc tests between periods were conducted using Tukey HSD. Mean scores for weekly blog posts were different between P1 and P2 ($p < 0.005$), P2 and P3 ($p < 0.05$), and P1 and P3 ($p < 0.05$). Mean scores for weekly comments were different between P1 and P2 ($p = 0.05$) and P2 and P3 ($p < 0.05$), but were not different between P1 and P3 ($p < 0.960$). Finally, mean scores for weekly unique commenter's and bloggers were different between P1 and P2 ($p < 0.05$), and P2 and P3 ($p < 0.05$), and P1 and P3 ($p < 0.05$).

5.7 Results Overview

Table 20 and Table 21 provide an overview of the statistical tests conducted for this thesis. In summary, while both the actor-actor SNA and the actor-org SNA showed an increase in the mean number of connections through S1, S2, and S3, repeated measures ANOVA on the number of connections revealed significance in only the actor-actor SNA. With regard to the respondents' perceptions of the UCP-SARnet website, Friedman tests showed significance differences between S1, S2, and S3 for UE-Q1, SP-Q2, SP-SQ3, SP-Q6, and SP-Q7, but not the others. With regard to the website usage and communications, MANOVAs showed significant results in the site usage analytics and the content analysis, but was unable to be conducted on the communications count due to failed homoscedasticity of the data. The follow up univariate ANOVAs of the communications count showed significant effect of periods in blog posts, comments and number of unique weekly bloggers and commenters.

5.8 Chapter Summary

This chapter provided an overview of the statistical results of the data comparing before and after the redesign of the UCP-SARnet social networking portal. The social network analysis showed a significant increase in connections between members of UCP-SARnet after the new website was launched. Correspondingly, there was a difference in the website quality measures improved after the website was launched. In the next chapter, these results are discussed in relationship to the original research questions.

Table 22: Results summary of survey data.

Section	Hypotheses	A priori Test	Significant?	F / χ^2	Hypothesis df	Error df	p-values	Post Hoc Pairwise p-values		
								S1-S2	S2-S3	S1-S3
Actor-Actor SNA	Increase in 'know well' connections	Repeated Measures ANOVA	Yes	8.361	1.159	15.064	0.009	0.029	0.008	0.007
Actor-Org SNA	Increase in 'strong' connections	Repeated Measures ANOVA	No	1.343	1.677	21.797	0.278	N/A	N/A	N/A
User Experience	UE-Q1	Friedman	Yes	16.263	2	22	0.000	.003	.518	.007
	UE-Q2	Friedman	No	2.976	2	22	0.226	N/A	N/A	N/A
Social Presence	SP-Q1	Friedman	No	4.286	2	22	0.117	N/A	N/A	N/A
	SP-Q2	Friedman	Yes	12.605	2	22	0.002	.006	1.000	.005
	SP-Q3	Friedman	Yes	9.941	2	22	0.007	.016	1.000	.013
	SP-Q4	Friedman	No	5.034	2	22	0.081	N/A	N/A	N/A
	SP-Q5	Friedman	No	1.317	2	22	0.518	N/A	N/A	N/A
	SP-Q6	Friedman	Yes	7.824	2	22	0.020	.015	.157	.083
	SP-Q7	Friedman	Yes	6.054	2	22	0.048	.021	1.000	.057
	SP-Q8	Friedman	No	5.097	2	22	0.078	N/A	N/A	N/A
	SP-Q9	Friedman	No	4.389	2	22	0.111	N/A	N/A	N/A
	SP-Q10	Friedman	No	1.077	2	22	.584	N/A	N/A	N/A
	SP-Q11	Friedman	No	3.842	2	22	.146	N/A	N/A	N/A
	SP-Q12	Friedman	No	2.214	2	22	.331	N/A	N/A	N/A
	SP-Q13	Friedman	No	5.688	2	22	.058	N/A	N/A	N/A
	SP-Q14	Friedman	No	4.514	2	22	.105	N/A	N/A	N/A

Legend:

Apriori Test Significant	Post Hoc Test Significant
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Table 23: Results summary of web site usage and content analysis of UCP-SARnet website over P1, P2, and P3 corresponding to surveys.

Section	MANOVA					Follow up Univariate ANOVA						Notes	
	Hypothesis	F()	p-value	Wilks' λ	ϵ^2	Hypothesis	F (2, 27)	p-value	Post Hoc Tests				
									P1-P2	P2-P3	P1-P3		
Site Usage Analytics	Increase across all site usage variables over periods	F(6,50)=9.72	0.000	0.213	0.538	Increase in site visits for returning users	26.250	.000	0.000	0.000	0.023		
						Increase in page views per visit for returning users	6.138	.006	0.957	0.020	0.010		Decrease from period to period.
						Increase in time on site for returning users	5.057	.014	.881	0.050	0.017		Decrease from period to period
Comm. Analysis	Increase across all content types over periods	N/A	N/A	N/A	N/A	Increase in Blog posts	16.630	.000	0.000	0.016	0.025	MANOVA not conducted due to violation of homoscedasticity assumption.	
						Increase in Comments	5.747	.008	0.013	0.025	0.960		
						Increase in Unique users	20.247	.000	0.000	0.005	0.021		

Legend: Apriori Test Significant Post Hoc Test Significant

Chapter 6

Discussion

In this section, the results of Chapter 5 are reviewed with regard to how they answered the principal and secondary research questions. The evidence is in favor the domain-community WDA as a tool that could effectively inform the design of a web portal for an online community. Care should be taken, however, in interpreting the results and a section that outlines some limitations of the research is provided. Finally, to guide future work in this area of research, several future research questions are posed, along with brief proposals for conducting that research. In particular these proposals suggest some next steps in further developing CoP-based CWA involving SNA at the theoretical level. The future work proposals also suggest how to connect this theoretical work with community-based research and design scenarios.

6.1 Research Questions

In this thesis we set out to answer (1) *How do you design for social engagement in an online social environment intended to facilitate interaction between users in an online community?* With this question in mind, the CoPs concept was explored in conjunction with the CWA to develop a domain-community WDA as an approach to design for an online social environment that considers issues of social engagement. With this development, the follow up question in this thesis was (2) *Could a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?* With this question in mind, the domain-community WDA was applied in the redesign of the UCP-SARnet COP social networking portal and a SNA was conducted with the UCP-SARnet leadership team to monitor changes to the level of connectedness between members of the leadership team, as well as between leadership team members and the UCP-SARnet organizational partners at three points in time. In conjunction with the SNA measures, data about the

leadership team's perceptions of the website as well as website usage and communications was tracked in correspondence with the three points in time of SNAs.

6.2 Structure of the UCP-SARnet Community of Practice

The actor-actor SNA and the actor-org SNA provided a view of the structure of the UCP-SARnet COP and how it changed in correspondence with the changes to the UCP-SARnet social networking portal.

As mentioned in Chapter 4, the actor-actor SNA used a Likert scale that was based on the respondents' intuitive response to how they felt they were connected to other members of the UCP-SARnet leadership team, which related closely to the community dimension of the UCP-SARnet COP. The SNA graphs showed that there was a significant increase in connections before and after the website was launched with a significant increase observed between each S1, S2, and S3. Furthermore a large proportion of the respondents gained new connections from before and after the website changes occurred, which suggests that the factors that increased the connections were not isolated. Since the website is a central part of the UCP-SARnet leadership team's daily operations, it is plausible that changes to the website would have had the broad effect of increased connections as observed in the actor-actor SNA.

The social presence questions and UE-Q1 were designed to gather information about how the perceptions of the UCP-SARnet website changed as it related to the community dimension of the UCP-SARnet COP. Along with the changes in the actor-actor SNA, there was a significant increase in four out of 14 measures of social presence from S1 to S2 with little indication of a decrease of social presence in the other 10 social presence measures. Three out of these four social presence measures also showed a significant increase from S2 to S3. Furthermore, UE-Q1, showed a significant increase from S1 to S2 and from S1 to S3. This is evidence that there was a perceived improvement in the quality of the website as it related to the community dimension of the UCP-SARnet COP happening after the website was redesigned.

With regard to the site usage, there was an initial increase in site visits of returning users from P1 to P2, and P2 to P3, which was expected. However, there was unexpected significant decrease in site visits from P2 to P3. Furthermore there was a significant decrease in the page views over each period as well as time spent on the site for returning users. So while the site visits increased from P1 to P2, there seemed to be a general decline in the number of pages viewed and the time spent on the site from P1 to P3.

Interestingly, the site usage decline was accompanied by a considerable increase in the number of blog posts, comments and unique contributors per week from P1 to P2 and, while there was a decline in all communication metrics from P2 to P3, there was a significant increase in blog posts and unique contributors from P1 to P3 (comments increased, but not significantly).

The decline in the site usage in combination with the increase in communications activity may be explained by two factors. First, it is possible that seasonal effects were present. Since the UCP-SARnet leadership team is largely made up of students at ASU, the decline in site usage and communications from P2 to P3 may have been due to students being on their summer holidays, which would have exams beginning early in May, roughly halfway into P3. Leadership team members may have been occupied during this time and reduced their activity on the UCP-SARnet website. It is also plausible that the website changes caused a decrease in usage by simplifying the tasks allowing leadership team members more efficiently complete those tasks on the site. On the original UCP-SARnet website, to view the comments on a blog a member would have to click on the blogs link to see the most recent blogs then click through to an individual blog page to view the comments. In the redesigned site, the Members' Area page showed both the blogs and the recent activity. It is possible that with the Members' Area, members did not need as much time to read the important communication or traverse to comments of the individual blog posts. So while seasonal effects cannot be ruled out and the direction of the changes in the page views and time on site was unexpected, the changes were still significant and show a reasonable correspondence in timing of the redesign of the website.

In sum, since there was a reasonable change in site usage and communications, as well as improvement in the perception of the quality of the site after the website was released, there is strong support that the changes observed in the actor-actor SNA were due to the changes to the website. With the formal connections made between the redesign of the UCP-SARnet website and the domain-community WDA for the UCP-SARnet, there is some evidence to suggest that a design informed by CWA and CoPs could produce a measurable effect on the structure of an online COP.

The actor-org SNA was related more closely to the domain dimension of the UCP-SARnet COP, as it used a Likert scale with more distinct definitions based on communications and contact with organizational partners. While the average number of neighbors and number of edges increased from before and after the website was released, the density did not increase and there was not a significant effect of connection to organizational partners over the survey periods. This suggests that from the domain perspective, the redesign of the website did not significantly affect the structure of the UCP-SARnet COP. While the design of the website was not aimed to support the domain dimension, it was predicted that the structure of actor-org SNA for UCP-SARnet would be affected through the notion of interdependence with the community dimension. This was not the case. It is possible, that if the domain dimension is not directly designed for, it would have taken more time for actor-org effects to appear.

It should be noted, however, that efforts on the domain level would be defined by the COP itself and, while making connections with the external stakeholders was considered a general effort for UCP-SARnet, it may not have been a priority chosen by UCP-SARnet at their current stage of development. Therefore, further efforts to evaluate effects of interventions on the social network structure of the UCP-SARnet COP in the domain dimension should be in alignment with the specific priorities that UCP-SARnet has in its current strategies to address issues in its domain.

6.3 Limitations

There are several caveats that should be considered in the interpretation of the results. These caveats include the connection between the design changes and the domain-community WDA; the measures used to detect links between the design interventions and changes in the structure of the COP; and how to define success with regard to the community-based research as a whole.

With regard to the connection between the design changes and the domain-community WDA, some boundaries should be noted. The domain-community WDA provides a way to develop an interface as a composition of multiple functional components as they are related to the items at various levels of the domain-community WDA. The astute reader will recognize, however, that there can be multiple ways to support the functional components of the domain-community WDA. One should note that the WDA within CWA is not a methodology, but a framework and the model is framed to provide a way of thinking about design problems, not executing a solution. As such, the domain-community WDA was not intended to provide a method for the redesign of the UCP-SARnet portal. The lifecycle analysis and the links made between the domain-community WDA and the features of the new UCP-SARnet portal design provided a methodology for requirements gathering; however, when this research reaches a stage where repeatable studies are valuable, it may be of value to include specific methods for translating the functional components into interface components. One may consider explicitly using techniques from the areas of user-centered design, user experience design, interaction design as well as social interaction design. There are a variety of techniques in these design areas that will link nicely between the domain-community system model of CoPs (which can provide a set of system-level requirements) and the interface components (which will require user-level requirements).

With regard to the measures used to detect links between the design interventions and changes in the structure of the COP, some points should be noted. In the actor-actor and actor-org SNAs, there was

evidence of 'know well' and 'strong' connections being dropped from one survey to the next. This suggests that the interpretation of the Likert scale for the relationships appeared to have shifted over S1, S2, and S3 or may not have been clear to the respondents. It is also possible that filling the actor-actor and the actor-org surveys may have been overwhelming. In future research, measures should be taken to mitigate and monitor these dropped connections in the cases where it would not make sense for an existing relationship disappear, such as in the case of knowing someone well, or having communicated to someone.

In regards to the changes in the structure of the UCP-SARnet actor-actor and actor-org SNAs, there are factors outside of the website usage that may have had an effect over the periods. The UCP-SARnet leadership team held weekly meetings and often worked together in public outreach events. Some members of the leadership team would participate in conferences together and there were regular social events held at the Lead Facilitators residence in Arizona where members of the leadership team could interact in a more informal context. Each of these activities has the potential to build relationships and make connections with organizational partners and, therefore, could have contributed to changes in the structure of the actor-actor and actor-org SNA's for UCP-SARnet. In future research, it may be possible to include self-report factors on how much respondents felt that the website contributed to their relationship levels in the cases where they were strong. Furthermore, it may be worthwhile to maintain a log of activities that occurred offline that can be used in the process of interpreting the results.

In regards to the changes in the usage of the website, as previously mentioned, seasonal effects cannot be ruled out. In particular, since the UCP-SARnet members were largely student volunteers, curriculum-related events, such as the beginning of term, midterm period, final exam period, and summer vacation would likely have had effects on the UCP-SARnet site usage. In future research it may also be possible to examine the usage in more detail, such as by week. In addition to the offline activities log (midterms, final exams), a

curriculum event log could be maintained and noted in the site usage analytics software to be used at the time when interpreting the data to account for external factors that may affect site usage.

6.4 Future Work

In reflecting on this work, there are several opportunities for future research. Given the exploratory nature of this project, many research questions have been opened. The following tables provide an overview of the research questions, brief research proposal statements to address those questions, along with a rationale. The tables are separated into major themes of the research including future research as it relate to the UCP-SARnet social networking portal, CoPs, CWA, community-based research and design methods, SNA, content analysis, user experience and social presence measures, and website usage analysis.

There are a broad range of suggestions for future work, however, it is expected that there will be useful relationship between each of the questions investigated. Future research should aim to integrate the concepts and methods.

Table 24: Research questions and proposals for future work on the topic of CoPs.

Question	Proposal	Rationale
<p>Q1. What are the implications of the distinction between the domain, community, and practice dimensions of a COP</p> <p>Q2. What are the different varieties of COPs?</p> <p>Q3. Is there a characteristic lifecycle for the different kinds of COPs? What are they?</p> <p>Q4. How might interface design efforts be organized for the different varieties of COPs?</p>	<p>P1. Further investigate the distinctions and relationships between the domain, community, and practice dimensions of the CoP model.</p> <p>P2. Expand the classifications of types and stages of COPs.</p> <p>P3. If cases are available, determine if there are any characteristic lifecycle paths for the various types of COPs.</p> <p>P4. Given these characteristic paths, determine if there is any indication that interface design techniques could have supported the process.</p>	<p>Distinguishing domain, community and practice dimension in CoPs theory helped to provide insight in the design process. In particular, the distinction between the domain and community dimension, emphasized in the domain-community WDA, provides an interesting link between how a group negotiates meaning and how it is able to respond in its domain environment. It is expected there is much more to learn about how these dimensions relate that would inform design.</p> <p>In the development of this research, it quickly became clear that studying and designing for COP is much more akin to evolutionary biology than something like physics. Each COP will have its distinctive anatomy, internal processes and growth patterns. Organizing an appropriate classification scheme could help to determine larger patterns that occur in COPs and, in turn, help to inform proactive design interventions</p>

Table 25: Research questions and proposals for future work on the topic of CWA.

Question	Proposal	Rationale
<p>Q1. Are there tradeoffs and priorities of the negotiation of meaning beyond what was listed in the domain-community WDA in Table 4? What would they be and why would they be important to consider?</p> <p>Q2. How would the domain-community WDA be complimented by CoP-related developments in the other CWA phases (Control Task Analysis, Strategies Analysis, Cooperation Analysis, and Competencies Analysis)?</p> <p>Q3. How might COPs be considered a collective entity of itself in CWA and how might be represented in the different phases? Would it be reasonable to consider interface designs for the COP as a collective entity (not just the individual users)?</p>	<p>P1. Investigate the high-level values and priorities CoPs researchers, and knowledge management practitioners are using to monitor and strategize around CoPs.</p> <p>P2. With reference to the community dimension of the domain-community WDA, consider how individuals make decisions at various levels of the abstraction hierarchy. Consider how these decisions would be incorporated into a decision ladder used in the Control Task Analysis phase of CWA.</p> <p>P3. Determine how a collective entity might be represented in the phases of CWA and consider the implications this would have for designs developed from these models.</p>	<p>The nature of how individuals and groups negotiate meaning together is central to understand CoPs in design; however, the nature of meaning is inherently difficult to represent in any axioms or laws. The learning architecture offered by Wenger (1998) offers a good beginning to this effort, but new developments in CoPs and social learning theory will likely come about and should be applied in the values and priorities level of the WDA.</p> <p>WDA is but the first phase of CWA and including further stages will, like the domain-community WDA, be mutually beneficial for both the development of CoPs and CWA. Initially, for CoPs, this will help to understand the decision-making process around community elements of the COP. For CWA, the effort can help to build out the range of applications to include social processes.</p> <p>Because much of what a COP does is through relationships with other members, it is possible that more fundamental properties exist with respect to the COP as a whole and this could inform a novel approach to design.</p>

Table 26: Research questions and proposals for future work on the topic of community-based research and design.

Question	Proposal	Rationale
<p>Q1. What are the interaction design methods best suited to use information from a CoPs-informed CWA as a foundation for a set of features, layouts and navigation structure for a social networking portal for a specific COP?</p>	<p>P1. Investigate how to use outputs of CWA system modeling in the variety of interaction design methods available. Consider beginning this effort with persona and scenario development techniques as a way to develop an interaction architecture that supports key use-stories for key users.</p>	<p>In future research it will be helpful for a variety of researchers to connect and collaborate around repeatable design and research methods. Personas and scenarios is an increasingly popular technique used in interaction design that may be able to utilize the richness of information that are provided in CWA models.</p>
<p>Q2. In what ways does COP-member involvement in the research and design methods affect the quality of the design outcome when designing for COPs</p>	<p>P2. Develop measures to mitigate issues of designer-client power differentials in the process of research and design to ensure that interventions are sensitive to the worldview of COP stakeholders.</p>	<p>The CoPs concept stems from constructivist notions, which suggests that one must actually participate in COP activities to design with a reasonable appreciation of the COP’s world-view. To account for CoPs in a systems analysis and design, an analyst needs methods for the design to participate in the COP and for COP members to participate in the design process. Researchers of participatory design and participatory action research have been developing a strong set of theories and techniques for understanding how research can be done with communities, while respecting inherent power dynamics and ensuring the knowledge gained from the work can be disseminated for the benefit of the COP and not just the sake of research. It is expected that use of these techniques would improve the design outcome of a community-based project</p>
<p>Q3. In what ways could the lifecycle analysis become a formal process that could be integrated with CWA and the chosen design methods?</p>	<p>P3. Begin formalizing the lifecycle analysis process. This may begin using a content analysis approach (see Appendix I), interviews, as well as participation in COP processes (ethnography). Ideally, classifications for COPs based on a lifecycle analysis should be defensible and repeatable.</p>	
<p>Q4. How does a researcher or designer define success in community-based research and design efforts?</p>	<p>P4. Further investigate the field of participatory action research, action research and community-based research to build a formal set of criteria to measure success in community-based design and research projects.</p>	

Table 27: Research questions and proposals for future work on the topic of SNA.

Question	Proposal	Rationale
<p>Q1. What are the causes and implications of ‘dropped’ connections that occur when multiple social network analyses are conducted with a group over time?</p> <p>Q2. How might the designer and the COP use information shown in the structure of the SNA?</p> <p>Q3. In what ways might other data sources be layered on to a SNA to help to provide a richer picture of the ‘story’ of the COP?</p>	<p>P1. Investigate best-practices for SNA surveying to see if there is any indication of concerns about ‘dropped’ connections over multiple SNA surveys. Develop a way to disclose ‘dropped’ that allows a way to convey the implications in interpreting the network graphs.</p> <p>P2. Examine the links in the social network analyses created for the UCP-SARnet S1, S2, and S3 graphs and consider what structural properties might be useful to monitor over time for the purpose of design.</p> <p>P3. Examine how qualitative techniques such as ethnography, content analysis, and narrative techniques can be integrated with a SNA for the purpose of design.</p>	<p>Dropped connections is likely a feature of most longitudinal SNAs and it is expected there are standards emerging for how this is treated and presented.</p> <p>For this research, it was sufficient to look at the social network structures from a high-level to determine if changes had occurred; however there is an opportunity to look at various properties of the network maps to see where there are resources that could be utilized by the COP that are not yet being utilized or supported. For example it may be that certain individuals play a bridging role between groups and a design could support these kinds this kind of network structures.</p>

Table 28: Research questions and proposals for future work on the topic of content analysis.

Question	Proposal	Rationale
<p>Q1. In what ways can the content posted on the UCP-SARnet portal or the portal of other COPs provide information about how to support that COP? Can the content posted provide indication of the typology and lifecycle stage of that COP?</p>	<p>P1a. Determine reasonable coding units for the content analysis for content posted on the site (blog posts, discussion forum posts, wiki posts, comments). The coding units may be the entire post, paragraphs within the post, or sentences within the post.</p> <p>P1b. Determine coding categories that are mutually exclusive and help to determine what level of maturity the COP is in. Build these categories from the practices being supported as listed in the domain-community WDA.</p>	<p>In this research, a content analysis was conducted on blog and comment posts during P1, P2 and P3 (see Appendix I). It showed that the UCP-SARnet communications activity through each period were largely oriented toward building connections, finding ideas worth sharing. It may be possible that the content analysis could provide a ways for a designer to determine the lifecycle stage of a COP as a way of accelerating the maturing process for the benefit of the COP. Content analysis requires some planning and foresight and to do so it is recommended researchers review the work of Stemler (2001), and Krippendorf (1980).</p>

Table 29: Research questions and proposals for future work on the topic of user experience and social presence measures.

Question	Proposal	Rationale
<p>Q1. What user experience measures would help to understand how a social networking portal is perceived with respect to the domain and community dimensions of a COP? What kind of online experience maximizes learning potential within specific COPs?</p> <p>Q2. In what way would social presence measures be further developed to determine the salience of interaction with other individuals and the salience of consequent interpersonal relationships as they relate to social networking portals for COPs?</p>	<p>P1. Investigate the conditions for experiences that support learning in useful directions. Determine measures that might help to assess the how well a learning environment supports self-directed learning both at the individual and the group level. It may be worthwhile to determine what measures may maps to specific levels of each dimension of the domain-community WDA.</p> <p>P2. Investigate the relationship between “salience of interpersonal relationship” as described by Short, Williams, and Christie (1976) and “the possibility of mutual recognition” as described by Wenger (1998, pp. 56). If appropriate, determine how measures of social presence can be adapted to more explicitly capture the “possibility of mutual recognition”.</p>	<p>Setting the conditions for learning in any environment is not a trivial process. A review of concepts and techniques for supporting self-directed learning at the individual and the group levels would be important factors in supporting the community dimension of the domain-community WDA.</p> <p>Possibility of mutual recognition is a condition for participation as it relates the ‘duality of participation and reification’ in the negotiation of meaning. Developing a validated a set of questions that could determine the level of ‘social presence’ in this regard will become useful in evaluating the effectiveness of a design in supporting the community dimension of a COP.</p>

Table 30: Research questions and proposals for future work on the topic of website usage analysis.

Question	Proposal	Rationale
Q1. How can the array of website usage metrics be interpreted with respect to a COP?	P1. Investigate how website usage metrics are being used to interpret the health of an online COP portal. Consider inquiring with a range of online COPs to determine best practices.	Website usage analytics are common place in the area of web development and services like Google Analytics have made the data readily accessible for analysis. It is difficult, however, to make a clear interpretation of the data since the intention behind each site visit is not captured. It will be important to understand how this data can be integrated with other data sources such as user experience measures or SNA.

Table 31: Research questions and proposals for future work on the topic of the UCP-SARnet social networking portal.

Question	Proposal	Rationale
Q1. How might the portal support the student volunteer turnover that goes through the UCP-SARnet COP?	P1. Consider running incoming and outgoing interviews or surveys of UCP-SARnet members to determine if there are any ways to expedite the learning process for incoming members and retain current members.	Incoming and outgoing interviews could be an opportunity for members to make explicit pieces of their experience with UCP-SARnet that could improve the quality of experience in participating with UCP-SARnet and make it easier to learn what is necessary to become a fully participating member.
Q2. How might the portal instill a sense of the mission and purpose of UCP-SARnet and encourage members to identify opportunities to provide value in the domain and identify gaps in the knowledge base for how that value might be provided?	P2. Develop a strategy with the leadership team to encourage participation on the UCP-SARnet blog with respect to identifying opportunities to provide value and identifying gaps in the UCP-SARnet knowledge base.	As mentioned, a preliminary content analysis of the UCP-SARnet blogs and comments over P1, P2, and P3 revealed that few communications identified gaps in the knowledge base or identified opportunities to provide value. While activities of this sort may occur during face-to-face encounters between members, there is an opportunity to bring this kind of dialog onto the portal to help move UCP-SARnet to a further stage of maturity as a COP.
Q3. How might the website more directly serve the UCP-SARnet COP in domain-related issues such as raising money for events, facilitating direct dialog with organizational partners, and supporting people in the developing world?	P3. Work with the UCP-SARnet leadership team to become clear about its mission and goals with respect to its domain and seek out resources to develop functionality on the UCP-SARnet portal that can support the strategies for achieving the UCP-SARnet mission and goals.	It was noted that the focus of this project was the community dimension of the UCP-SARnet COP. Future design work with UCP-SARnet should begin to look at how the UCP-SARnet portal can offer functionality in the domain dimension that directly supports the COP goals in the context of international development.

6.5 Chapter Summary

In this chapter, the results of the social network analysis and the website quality measures were interpreted. The results showed a significant increase in member-to-member connections in UCP-SARnet as well as a significant change in website quality measures. Because the design was informed by the domain-community WDA, as developed from the CoPs concept and CWA, it was concluded that these results showed some evidence to positively support the secondary research question: *a design informed by CWA and CoPs does produce measurable effect on the structure of an online community*. Factors, such as a repeatable design methodology, seasonal effects on the usage of the website, as well as questions of how to define success when working with an autonomous community, were highlighted for consideration when interpreting these results. Finally, based on this overall research effort, several areas for future work were laid out for how one might continue this research into the future. It was recommended that the CoPs concept be investigated further to develop a stronger understanding of the relationships between the domain and community dimensions of a COP. It was also recommended the CoPs concept be modeled beyond WDA and into other phases of CWA. Furthermore, recommendations were made about the design methodology, data gathering techniques and SNA, as well as how to best support UCP-SARnet as a unique COP going forward.

Chapter 7

Conclusions

Explorative in nature, this thesis sought to answer *how do you design for social engagement in an online social environment intended to facilitate interaction between users in an online community?* To address this question, the theoretical background of CoPs was connected to a design framework based on CWA to create a domain-community WDA, a system mapping that can inform the design of an online social environment. The distinctive feature of the domain-community WDA is in the conceptual division between domain and community dimensions of a COP in which the domain describes an exterior view of the COP as how it provides value in the larger context, and the community describes an interior view of how the COP members are engaged in the process of negotiating meaning of activities in the domain and activities of interrelations between members. The domain-community map, as illustrated in the case of the UCP-SARnet portal, is intended to allow designers to consider elements of social engagement in conjunction with technical components of the work domain.

As a part of the development of the domain-community WDA the secondary question in this research was *could a design informed by CWA and CoPs produce a measurable effect on the structure of an online community?* To answer this question a domain-community WDA was created to model the UCP-SARnet COP. With the model the UCP-SARnet portal was redesigned with focus on supporting COP activities of the community dimension such as building connections between the core participants, identifying opportunities to provide value in the larger context, finding the ideas and insights that are worth sharing with other members, identifying gaps in the knowledge, refining the COP's role in the larger context. Using a SNA of core members of UCP-SARnet, it was concluded that the structure of the UCP-SARnet COP did change and core group members reported they knew one another significantly more after the redesign of the website

than before the redesign. Furthermore, user experience measures of the UCP-SARnet portal, website usage data and a tally of website communication activity also changed significantly in correspondence with the redesign of the website providing some evidence that a design informed by CWA and CoPs produced a measurable effect on the structure of the UCP-SARnet online COP. However, there were several limitations to the study that affected the confidence of the results in the areas of the clarity of the design methodology, interpretation of the SNA, and accounting for seasonal effects in longitudinal data.

In reflection of the study, proposals for future research were developed to both address limitations in this particular study and outline opportunities for future work. Going forward, it would be of particular interest to extend the domain-community WDA to other phases of CWA, further develop techniques for SNA in conjunction with online COPs and continue to inquire about how to define success in community-based research projects.

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Appendix A: UCP-SARnet Partnership Proposal

Research Plan: Supporting Strategic Action in an Emerging Leadership Network: Taking a Participatory Approach to Social Network Analysis

June 9, 2011

Background and Introduction

Officially launched in 2008, the University Community Partnership for Social Action Research Network (UCP-SARnet) is an organization committed to educating, engaging and empowering communities by creating and facilitating global university-community partnerships. UCP-SARnet is at its beginning stages of developing its online social networking portal to further build a community of students, university faculty, community activists and members of local government in search of solutions to the issues articulated in the Millennium Development Goals.¹

In June 2010, UCP-SARnet joined forces with Adam Euerby, a Master's student working in the Advanced Interface Design Lab (AIDL) at the University of Waterloo in Canada under the supervision of Dr. Catherine M. Burns at the University of Waterloo in Canada. Together AIDL and UCP-SARnet have developed this participatory research plan aimed at understanding how best to employ social networking technology to support the short- and long-term goals of UCP-SARnet. To do this, a participatory approach to social network analysis has been proposed to determine the impact of design changes made to UCP-SARnet's social networking portal.

This research plan takes a participatory approach designed to include key stakeholders at UCP-SARnet in the process of developing research questions, as well as metrics and targets with regard to the social network analysis. It was designed to ensure that the data collected can support high-level strategic actions for UCP-SARnet as a whole, and provide a meaningful feedback mechanism for the individual actions of the UCP-SARnet members.

¹ Reproduced from: <http://ucpsarnet.iglooprojects.org/aboutucp/mission>

The following proposal outlines the research to be conducted along with developments to UCP-SARnet expected in the following year. In an effort to ensure that both UCP-SARnet and the student investor's interests in the project are met, the research will aim to achieve two mutually beneficial **objectives**:

Gain an understanding of how the UCP-SARnet community develops as the ICT Team makes changes to the UCP-SARnet social networking platform.

Support the ICT Team in developing appropriate metrics and reasonable targets to determine the success of design interventions made toward meeting the short-term and long-term organizational goals of UCP-SARnet.

The first objective is intended to meet the primary research interests in the development of Adam's Master's thesis, which is to be completed in August 2011. The second objective is intended to meet the primary ICT development needs of UCP-SARnet.

Project Stakeholders

UCP-SARnet contains a wide range of stakeholders in the outcome of this project as well as the success of the network as a whole. For purpose of feasibility, these stakeholders are categorized into principal stakeholders and secondary stakeholders. The principal stakeholders are those that have a direct relation to the outcome of this project, whereas the secondary stakeholders have will be minimally impacted by the outcome of this project.

Principal Stakeholders:

Executive Team Members

ICT Research Team

ICT Team

Members (Faculty, Students, Community Members)

Organizational Members

Secondary Stakeholders

Knowledge Partners

Local Community Organizations

Long-term and Short-term Goals of UCP-SARnet

The short-term goals for the coming year of the development on this social networking platform are aimed at achieving UCP-SARnet's **long-term mission**:

UCP-SARnet is building a global community of students, university faculty, community activists and members of local governments engaged in search for solutions to the most pressing global issues of our time articulated in the UN Millennium Development Goals.¹

To achieve this mission, UCP-SARnet has taken an **overarching strategy**:

We contribute to educating community leaders by inspiring university-community partnerships, promoting community engaged research, compiling a library of online resources and utilizing ICT to facilitative cross-sector collaboration and multi-cultural dialog.¹

UCP-SARnet's overarching strategy employs a number of key **strategic initiatives** that together are designed to support the long-term mission:

1. Organize an online resource hub that allows stakeholders to discuss concepts surrounding community development, easily find and publish effective solutions, and to disseminate best practices;
2. Invite university faculty to leverage our online library by integrating it into their educational offerings, and promote community-based research as an effective tool for educating community leaders;
3. Link research to local needs and to the global development agenda;
4. Connect civic organizations, local governments, and universities via online networking and live events;
5. Offer online professional development courses for community leaders and government officials;
6. Engage a global network of Regional Coordinators of students and young activists that serve as local liaisons of UCP-SARnet.

In reflection of the history of activity at UCP-SARnet, and in coordination with the latest developments of the UCP-SARnet's network and resources, a list of **8 short-term goals** have been

articulated as aims for the ICT Tea². In the coming year the ICT Team should aim to achieve these goals using the technology available to them on the IGLOO platform:

1. Activate Regional Coordinators, creating and filling in with relevant content community spaces for current coordinators and search for new coordinators in countries where we have our members.
2. Restructure our portal by making it more functional, alive, better organized and more user friendly for members, as well as attractive for potential sponsors.
3. Effectively contribute to organization of the following conferences: CU Expo 2011 in Canada, Development of Sustainable Workforce in Shanghai in April 2011, 2012 Millennium Development Goals conference in Zhengzhou (China). During these conferences we will have to promote the MDG eNabler.
4. Fully develop the concept of Global Leadership Tours and organize the first tour in Summer 2011.
5. Establish collaboration with the Rutgers University, UN Foundation and UN Millennium Campaign.
6. Progress with the Gandhi College for Social Work in India.
7. Progress with Professional Development Training (including work on Chinese version of the training.)
8. Find sponsors.

Table 30 will provide more detailed view of UCP-SARnet's short-term goals. The metrics refer to the units that will be used to take measurement of the current status and targets. The design strategies will outline how the ICT Team plans to achieve the targets for each of the goals listed.

² Determined in communications with UCP-SARnet network facilitator, Dr. Marek Wosinski, September 5, 2010

Table 30: UCP-SARnet short-term goals for ICT Team

Goal	Metrics	Current Status	Targets	Design Strategies
Activate regional coordinators				
Improve user experience for current members, new members				
Support conference work				
Support Global Leadership Tours				
Support inter-organizational collaboration				
Support Gandhi College for Social Work in India				
Support Professional Development Training				
Draw sponsorship				

Tasks

To achieve the two research objectives of this project, in the following year the following tasks will be completed by the researchers in this project:

1. Monitor and analyze site usage statistics on an ongoing basis over the following year.
2. Participate in regular meetings with the ICT Team to develop metrics, targets and design strategies to meet the goals of UCP-SARnet.
3. Implement design interventions with ICT team.
4. Conduct a social network analysis (before ICT design intervention, shortly after a design intervention and a period of time after a design intervention)
5. Conduct a qualitative analysis of key members' perceptions UCP-SARnet (before a design intervention, shortly after a design intervention and a period of time after a design intervention).
6. Report results and analyses.
7. The details of these tasks are outlined in the following section of this proposal.

Task 1: Monitor and analyze site usage statistics

To monitor site usage we look a number of site usage statistics such as registrations, contributions, bounce rate, pageviews, time on site, repeat visitors, visitor loyalty, endorsements, newsletter response rate, as well as incoming links and online mentions³. Alone, these details will only provide us with quantitative data and not a full picture of the network. Qualitative data must be gathered to offer aid in the interpretation of the raw usage statistics.

This task will support the targets for development in Task 1 toward Objective 2. This data will also be used toward the research objectives as a way fleshing out a snapshot of the state of UCP-SARnet before and after the ICT Team's design changes.

Task 2: Develop metrics, targets and design strategies with ICT Team

At the outset of the project, it is suggested that the ICT Team meet to begin filling in Table 30 to develop design strategies using the IGLOO platform. These targets can be framed in terms of site usage statistics gathered with Google Analytics, in terms of the content published to the network portal, or in terms of the responses to the proposed surveys for the social network analysis.

³ This is currently based on the recommendations of a community management specialist, Martin Reed. Source: <http://www.communityspark.com/online-community-metrics-numbers-you-need-to-pay-attention-to/>. A scholarly source should be found to supplement this reference.

This task is directly aimed at achieving Objective 2 in direct service to the goals of UCP-SARnet; however, the outcome may indirectly affect the outcome of Objective 1 in service of the general research goals. More details on the specific targets will form as the ICT Team begins meeting regularly.

Task 3: Implement design interventions

After determining the current status of UCP-SARnet using the metrics and targets, the ICT Team will make changes to the UCP-SARnet online portal, based on the strategies proposed. These changes will be made on an ongoing basis over the following year as the ICT Team sets its meetings.

Task 4: Conduct a social network analysis

The social network analysis is the task that will require the most explanation. In summary, the proposed social network analysis will aim to map the relationships between the members of UCP-SARnet as well as the relationships between the members and other organizations. Mapping and visualizing these relationships will allow the members of UCP-SARnet to see high-level network activities that can inform strategic decision making. For example, the analysis can show who are the central actors in the network as well as who are 'bridgers' between UCP-SARnet and other organizations. It is expected that the social network analysis serve as an invaluable feedback mechanism to the network as a whole, allowing members to directly observe the magnitude and reach of their impacts.

To best achieve Objective 1 and 2 for this project, several elements will have to be determined with UCP-SARnet network facilitator, Dr. Marek Wosinski:

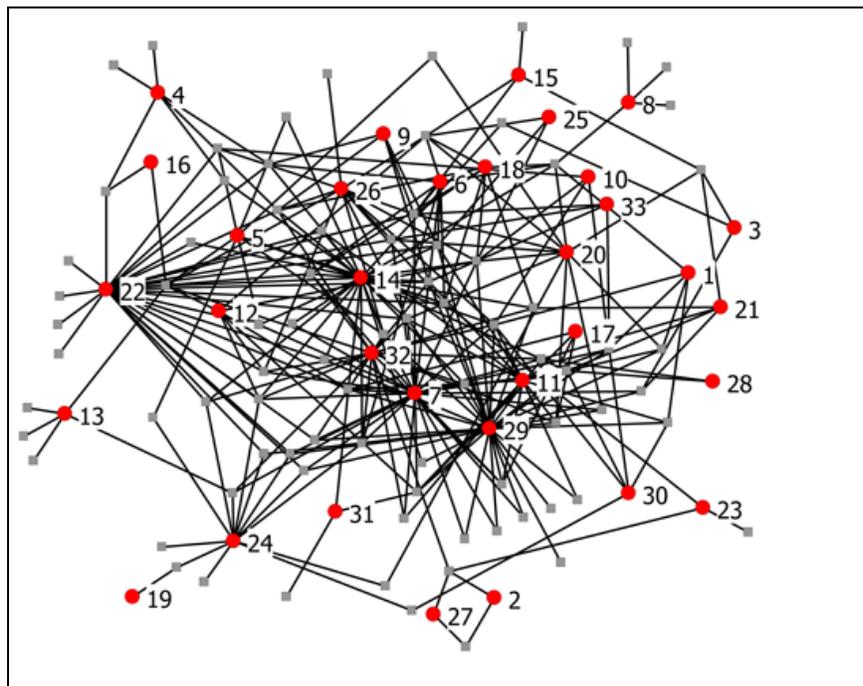
- Who are the key members within UCP-SARnet?
- Who are the key external players (outside of UCP-SARnet)?
- What are the most meaningful relationships to track within the membership of UCP-SARnet?
- What are the most meaningful relationships to track between the members of UCP-SARnet and other organizations?

With this information, a survey will be developed that will be run three times with the key members within UCP-SARnet: First, before any changes are made to the UCP-SARnet portal by the ICT Team; second, three to four weeks after the changes have been made; and third, about three to four

months after the changes have been made. It is expected that each survey is expected to take no longer than 30 minutes to complete.

The information from these surveys will yield a network map similar to the one shown in Figure 17 below. From this diagram the CAYL Schott organization was able to determine that the members represented by Node 22 and Node 13 were strong bridgers to other organizations. It also revealed that organization with links to multiple members with CAYL Schott could be considered to be woven into the network, which might suggest that these external players would be more easily leveraged for partnership or collaboration in projects⁴.

Figure 17: Example of social network map: Collaboration Network of CAYL Schott, including fellows (labeled dots) and key external players (unlabelled dots)⁴



More details on the background of the origin of this procedure for social network analysis can be found in the final section of this document.

Task 3 is being conducted primarily to achieve the Objective 1 in service of the research as it will provide strong quantitative and qualitative picture of how UCP-SARnet is developing as the ICT

⁴ Hoppe, B., Reinelt, C. (2009). [Social Network Analysis And the Evaluation of Leadership Networks](#). *Leadership Quarterly*, Elsevier.

Team makes changes to the portal. However, since the social network analysis is being designed specifically to account for the long-term and short-term goals of UCP-SARnet, it is expected that it will be an invaluable tool toward achieving Objective 2 in service of UCP-SARnet.

Task 5: Conduct survey of key members’ perceptions of UCP-SARnet

This task will supplement Task 2 and Task 3 by gathering relevant subjective data from the UCP-SARnet key members. These survey questions will be part of the same survey conducted for Task 3. The questions posed on this survey will be focused to ensure that survey time for participants does not exceed 30 minutes.

The questions for survey should be written in conjunction with the targets developed for the short-term goals of UCP-SARnet. These should be determined during the initial meetings with the ICT Team. It is expected that these survey questions will gather usability and user experience information regarding the design of the community spaces and the front page of UCP-SARnet. These questions will serve Objective 2.

The survey may also contain questions that supplement the data gathered for the social network analysis. For example, it may be interesting to see how people’s perceptions of the reach of the network compare with the actual network picture when the analysis is complete. This would help to determine whether the social network analysis would be a valuable ongoing feedback mechanism to inform the network members. These questions will be primarily aimed at achieving Objective 1, but will likely help in achieving Objective 2.

Schedule

Table 31 outlines the approximate dates for the milestones in the project.

Table 31: Approximate dates for the milestones in the research project.

Approximate Dates	Milestone
Mid September	List high-priority short-term and long-term goals of UCP-SARnet
Mid September	Determine metrics, targets and ICT development strategies toward
Mid September	Complete baseline survey

Approximate Dates	Milestone
End September	Implement design changes to the UCP-SARnet
Mid October	Complete intermediate survey
Mid October	Preliminary Analysis of Results include
December-January	Complete final survey
January-February	Conduct analysis of data gathered
February-March	Complete first draft of Thesis

Resources required

To complete this research project Adam will need access to several resources:

1. A link on the front page of UCP-SARnet directed to research disclosure statement for ethics.
2. Key members on the UCP-SARnet to distribute the surveys
3. Ongoing communication with the ICT Team
4. Ongoing communication with network facilitator Marek Wosinski
5. Access to Google Analytics data and UCP-SARnet website activity

Background on origin of procedures for the social network analysis in Task 3

To offer some background for why this approach was chosen for the social network analysis, the background of the origin is summarized. This social network analysis procedure is based on that recommended by Hoppe and Reinelt (2009)⁴, for the evaluation of leadership networks. In a recent submission to Leadership Quarterly they describe a network like UCP-SARnet as a *field-policy leadership network*. They summarize the characteristics of field-policy leadership networks:



Field-policy leadership networks enable leaders to work across boundaries more effectively. They have the capacity to mobilize large numbers of people around a common cause, influence the cultural and political discourse, and bring diverse perspectives into the policymaking process. Well-developed field-policy networks can influence systems change by

better aligning frames, interests, and people across sectors, cultures, and communities in ways that have the potential to produce large scale effects.

This leadership network description resonates very closely to the long-term mission and strategic initiatives of UCP-SARnet outlined above. There is further resonance as Hoppe and Reinelt (2009)⁴ go on to explain the key dynamics of a field-policy leadership network:

“ Successful field-policy leadership networks help members find common cause with unexpected allies. They rely on bridgers who reach out and connect across diverse communities, cultures, sectors, and disciplines. Building alliances often starts slowly. Leaders first need to learn each other’s language and stories, find common ground, and establish trust. Field-policy networks usually start as peer leadership networks. Once trust is established, leaders are better positioned to tap into and mobilize their networks around a common cause.

In evaluating field-policy leadership networks, Hoppe and Reinelt (2009)⁴ suggest a number of questions that can be asked by the researchers and the organization:

- Is there evidence of greater sharing and collaborating across communities and sectors, at national, state, and local levels?
- Who are the bridgers in the network?
- Is the network expanding to include likely and unlikely alliances?
- Are diverse leaders aligning their priorities and working together towards common goals?
- Do people across the network share common frames (e.g., language and metaphors they use to describe problems, explain why they exist, and ways to address them)?
- Do members of the network coordinate their efforts to mobilize large numbers of citizens to engage in policy activism?
- Do members gain access to policy and field leaders through the network?
- Do networks contribute to positive policy changes? Do they contribute to creating more coherent fields of practice?

It is expected that many of these questions will be addressed in the completed social network analysis.

Appendix B: UCP-SARnet Website Improvement Survey

The three website improvement surveys were identical, with the exception of the title and the follow-up message. Below is the Survey 3 as it appeared for the respondents in this study.

UCP-SARnet Social Network Improvement Survey 3

This survey is the third installment of an ongoing effort to grow the UCP-SARnet community and provide leading-edge services for all members and partners. We are confident that information from this survey will help UCP-SARnet make long-term decisions about how to advance the network so that the members are better served and we meet the UCP-SARnet mission.

The results will give us a picture of how the members of UCP-SARnet are connected and how members are experiencing the website. This will be a great source of information for the executive team to understand where we can focus our efforts in both website design and long-term strategy.

The survey should take roughly 20 minutes to complete.

* Required

About You

First Name *

Last Name *

Organization *
ex. Arizona State University, Microsoft, etc.

Program or Department *
ex. Psychology, User Experience Design, etc.

Title *
ex. Student, Program Manager, etc.

When did you become a member of UCP-SARnet? *
ex. September, 2009

How find out about UCP-SARnet? *

- Referred by another member
- Found it searching the Internet
- Through a conference or event
- Other:

Why did you become a member of UCP-SARnet? *

Please check all that apply to you.

- I'm deeply interested in social action research
- I agree with the cause to create university-community partnerships
- I'm looking for leadership opportunities
- I'm interested in skill-building experiences
- I want a chance to work with leaders from other countries
- I want to contribute to meeting the UN Millennium Development Goals
- I see this as an important stepping stone for my career
- UCP-SARnet provides resources for other organizations I'm a part of
- Other:

Have you been involved in a project featured by UCP-SARnet? *

- Yes
- No

If Yes above, please check all projects that you have been involved in.

Please check all projects that you've completed tasks for.

- STAND UP Events
- Virtual Meetings "Bridging the World"
- World Academy for the Future of Women
- Gandhi College of Social Work
- Community-University Exposition 2011
- Professional Development Training for Community Leaders
- Global Leadership Tours
- Expanding UCP-SARnet based community-related courses
- Participatory Research Project on the Development and Impact of UCP-SARnet
- Conference on Sustainable Workforce 2011 in Shanghai (China)
- Summer Global Leadership Camp at Sias (China)
- Millenium Development Goals Conference 2012 in Zhengzhou (China)
- Other:

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UCP-SARnet Social Network Improvement Survey 3

* Required

The UCP-SARnet Website

On the following scale, how would you rate the UCP-SARnet's front page? *

It may help to navigate to the page in another window for this: <http://ucpsarnet.iglooprojects.org/>

- Poor
- Fair
- Good
- Very Good
- Excellent

From the front page, I have a clear sense of who's involved with UCP-SARnet and what they are doing. *

To what degree do you agree with the statement.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Recalling your experience using UCP-SARnet in the past 6 months, *

Please indicate how much you agree with the following statements

	Strongly disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly agree
Messages in UCP-SARnet were impersonal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UCP-SARnet is an excellent medium for social interaction	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable conversing through UCP-SARnet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable introducing myself on UCP-SARnet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The introduction(s) enabled me to form a sense of the online community I was part of	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt comfortable participating in discussions on UCP-SARnet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The moderators created a feeling of an online community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The moderators facilitated the discussions on UCP-SARnet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discussions on UCP-SARnet tends to be more impersonal than face-to-face discussions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Discussions on UCP-SARnet are more	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

impersonal than audio teleconference discussions	<input type="radio"/>				
Discussions on UCP- SARnet are more impersonal than video teleconference discussions.	<input type="radio"/>				
I felt comfortable interacting with other participants on UCP- SARnet	<input type="radio"/>				
I felt that my point of view was acknowledged by others on UCP- SARnet	<input type="radio"/>				
I was able to form distinct individual impressions of some participants even though we communicated only via UCP-SARnet	<input type="radio"/>				

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University of Toronto	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Waterloo	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Ottawa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Regina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Saskatchewan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Alberta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of British Columbia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Victoria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of New Brunswick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Northern British Columbia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Manitoba	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Saskatchewan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Alberta	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of British Columbia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Victoria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of New Brunswick	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Northern British Columbia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
University of Manitoba	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Relationships to External Organizations

In this section we are interested in how you might be connected to the UCP-SARnet partners.

Note: If you're unsure about whether the connection is Strong or Weak, choose Weak.

Strong Connection – you have met or communicated with someone from this organization (eg. met in person, sent or received a direct email, Facebook / LinkedIn contacts with someone, etc.)

Weak Connection – you have heard of the organization, but you have not had direct communication with anyone there (eg. CC'd in an email, overheard name in conversation, etc.)

Unaware – you have not heard of the organization.

What is your level of connection with the following UCP-SARnet Partners? *

	(met or communicated directly with)	(heard of, but have not met or communicated)	(have not heard of the organization at all)
	Strong Connection	Weak Connection	Unaware
AASRA For Community Transformation (ACT India)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
African Women and Child Feature Service	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ann Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Association for Welfare, Social Action and Research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beam Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CAPEC - Cameroon Association for the Protection and Education of the Child	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Canadian Forum on Civil Justice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Centre for Community Research and Action, Laurier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CURA - Community University Research Alliance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecuador Volunteer Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Global Thinking Women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Helping Loves International	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
India Vision Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
LUKMEF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NIF - Naviyoti India Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Network of East-West Women	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NYCC - Nigerian Youth Climate Coalition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pluribus Europe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SFS - Somali Family Services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
STAESA - Students Travel and Exposure South Africa	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TESA	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Unreasonable Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The Gambia	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CCBR - Centre for Community Based Research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coaching the Global Village	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CCPH - Community-Campus Partnership for Health	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Community Toolbox	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comunitaria	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GAID - Global Alliance for ICT and Development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GACER - Global Alliance for Community Based Research	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Global Interactions, Inc.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leadership Learning Community	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Orbis Institute	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sias International University	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
SoReCom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TIG - TakingITGlobal	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UN Millennium Campaign	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
United Nations Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Warsaw School of Social Sciences and Humanities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
WFWO - World for World Organization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Video Voice Collective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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Appendix C: Actor-Actor 'Know well' Connections Extended SNA

Table 32: Actor-actor SNA showing 'know well' connections for S1, S2, and S3 including non-base respondents. Note that S2 and S3 were taken after design changes to the UCP-SARnet social networking portal.

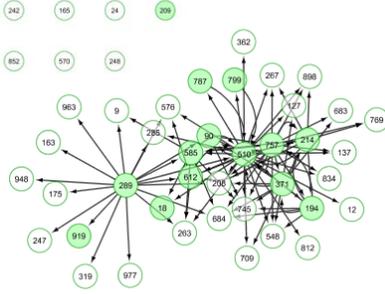
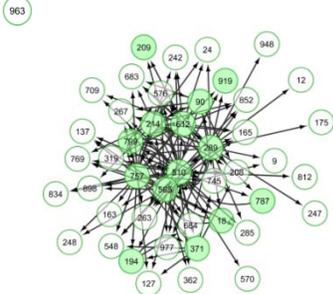
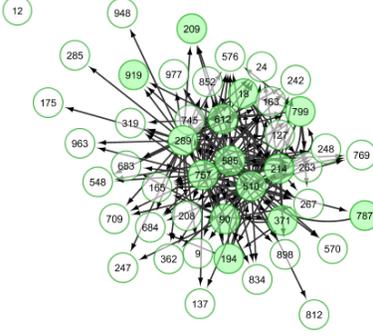
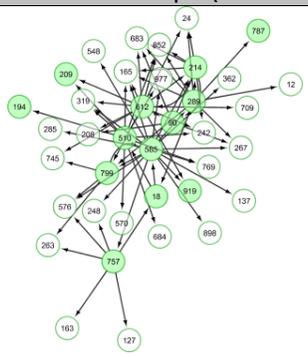
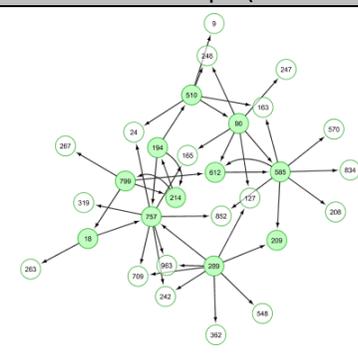
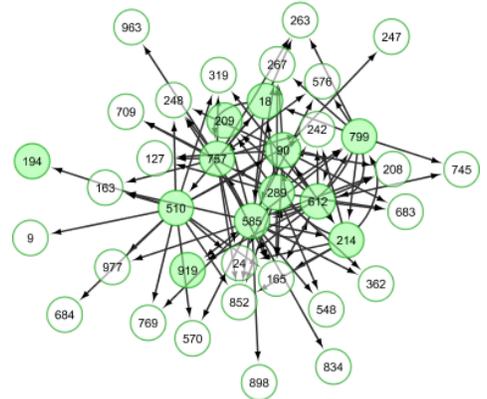
Survey 1		Survey 2		Survey 3	
					
Network Diameter	3	Network Diameter	5	Network Diameter	3
Avg. Number of Neighbors	4.41	Avg. Number of Neighbors	6.27	Avg. Number of Neighbors	6.14
Number of base nodes	14	Number of base nodes	14	Number of base nodes	14
Number of periphery nodes	32	Number of periphery nodes	32	Number of periphery nodes	32
Number of Edges	100	Number of Edges	160	Number of Edges	189
Network Density	0.09	Network Density	0.15	Network Density	0.17
Multi-edge Node Pairs	14	Multi-edge Node Pairs	19	Multi-edge Node Pairs	26

Table 33: Actor-actor difference SNA showing the difference in ‘know well’ connections between surveys including non-base respondents

S1S2 Difference Graph (S2 minus S1)		S2S3 Difference Graph (S3 minus S2)	
			
Network Diameter	8	Network Diameter	5
Number of base nodes	13	Number of base nodes	11
Number of periphery nodes	25	Number of periphery nodes	19
Number of Edges	74	Number of Edges	45
Multi-edge Node Pairs	3	Multi-edge Node Pairs	3
S1S3 Difference Graph (S3 minus S1)			
			
Network Diameter	5	Number of base nodes	12
Number of periphery nodes	26	Number of Edges	102
Multi-edge Node Pairs	7		

Appendix D: Actor-Actor 'Know Well' Connections Repeated

Measures Statistics

Table 34: Actor-Actor 'know well' connection data table used as input to SPSS repeated measures analysis shown below.

ID	Survey1	Survey2	Survey3
18	0	2	4
90	3	7	13
194	7	2	5
209	0	0	0
214	8	14	14
289	18	27	32
371	12	6	5
510	23	32	34
585	6	23	26
612	4	18	17
757	17	23	29
787	1	1	1
799	1	5	9
919	0	0	0

General Linear Model

Notes

Output Created		10-Oct-2011 16:57:10
Comments		
Input	Data	C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\ActorDegreeS123 (Know Well).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	14
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		GLM Survey1 Survey2 Survey3 /WSFACTOR=survey 3 Polynomial /METHOD=SSTYPE(3) /EMMEANS=TABLES(survey) COMPARE ADJ(LSD) /CRITERIA=ALPHA(.05) /WSDESIGN=survey.
Resources	Processor Time	00 00:00:00.032
	Elapsed Time	00 00:00:00.029

[DataSet1] C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\ActorDegreeS123 (Know Well).sav

Within-Subjects Factors

Measure: MEASURE_1

survey	Dependent Variable
1	Survey1
2	Survey2
3	Survey3

Multivariate Tests^b

Effect		Value	F	Hypothesis df	Error df	Sig.
survey	Pillai's Trace	.498	5.962 ^a	2.000	12.000	.016
	Wilks' Lambda	.502	5.962 ^a	2.000	12.000	.016
	Hotelling's Trace	.994	5.962 ^a	2.000	12.000	.016
	Roy's Largest Root	.994	5.962 ^a	2.000	12.000	.016

a. Exact statistic

b. Design: Intercept

Within Subjects Design: survey

Mauchly's Test of Sphericity^b

Measure:MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^a		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
survey	.274	15.535	2	.000	.579	.601	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept

Within Subjects Design: survey

Tests of Within-Subjects Effects

Measure:MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
survey	Sphericity Assumed	294.333	2	147.167	8.361	.002
	Greenhouse-Geisser	294.333	1.159	254.008	8.361	.009
	Huynh-Feldt	294.333	1.201	245.052	8.361	.008
	Lower-bound	294.333	1.000	294.333	8.361	.013
Error(survey)	Sphericity Assumed	457.667	26	17.603		
	Greenhouse-Geisser	457.667	15.064	30.382		
	Huynh-Feldt	457.667	15.614	29.311		
	Lower-bound	457.667	13.000	35.205		

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	survey	Type III Sum of Squares	df	Mean Square	F	Sig.
survey	Linear	282.893	1	282.893	10.031	.007
	Quadratic	11.440	1	11.440	1.633	.224
Error(survey)	Linear	366.607	13	28.201		
	Quadratic	91.060	13	7.005		

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	4800.024	1	4800.024	16.170	.001
Error	3858.976	13	296.844		

Estimated Marginal Means

survey

Estimates

Measure:MEASURE_1

survey	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	7.143	2.027	2.764	11.522
2	11.429	2.985	4.980	17.877
3	13.500	3.271	6.433	20.567

Pairwise Comparisons

Measure:MEASURE_1

(I) survey	(J) survey	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
1	2	-4.286 [*]	1.752	.029	-8.071	-.500
	3	-6.357 [*]	2.007	.007	-10.693	-2.021
2	1	4.286 [*]	1.752	.029	.500	8.071
	3	-2.071 [*]	.667	.008	-3.512	-.631
3	1	6.357 [*]	2.007	.007	2.021	10.693
	2	2.071 [*]	.667	.008	.631	3.512

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Pillai's trace	.498	5.962 ^a	2.000	12.000	.016
Wilks' lambda	.502	5.962 ^a	2.000	12.000	.016
Hotelling's trace	.994	5.962 ^a	2.000	12.000	.016
Roy's largest root	.994	5.962 ^a	2.000	12.000	.016

Each F tests the multivariate effect of survey. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Appendix E: Actor-Org ‘Strong’ Connections Repeated Measures Statistics

Table 35: Actor-org strong connection data table used as input to SPSS repeated measures analysis shown below.

ID	Survey1	Survey2	Survey3
18	7	9	12
90	3	30	7
194	3	18	2
209	2	0	0
214	7	0	4
289	10	7	11
371	9	10	14
510	27	24	33
585	1	6	41
612	5	7	11
757	11	13	15
787	0	0	0
799	4	2	2
919	1	2	4

General Linear Model

Notes

Output Created		10-Oct-2011 17:23:13
Comments		
Input	Data	C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\OrgDegreeS123 (Strong).sav
	Active Dataset	DataSet3
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	14
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		GLM Survey1 Survey2 Survey3 /WSFACTOR=survey 3 Polynomial /METHOD=SSTYPE(3) /EMMEANS=TABLES(survey) COMPARE ADJ(LSD) /PRINT=DESCRIPTIVE /CRITERIA=ALPHA(.05) /WSDESIGN=survey.
Resources	Processor Time	00 00:00:00.016
	Elapsed Time	00 00:00:00.070

[DataSet3] C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\OrgDegreeS123 (Strong).sav

Within-Subjects Factors

Measure:MEASURE_1

survey	Dependent Variable
1	Survey1
2	Survey2
3	Survey3

Descriptive Statistics

	Mean	Std. Deviation	N
Survey1	6.43	6.880	14
Survey2	9.14	9.289	14
Survey3	11.14	12.177	14

Multivariate Tests^b

Effect		Value	F	Hypothesis df	Error df	Sig.
survey	Pillai's Trace	.221	1.699 ^a	2.000	12.000	.224
	Wilks' Lambda	.779	1.699 ^a	2.000	12.000	.224
	Hotelling's Trace	.283	1.699 ^a	2.000	12.000	.224
	Roy's Largest Root	.283	1.699 ^a	2.000	12.000	.224

a. Exact statistic

b. Design: Intercept

Within Subjects Design: survey

Mauchly's Test of Sphericity^b

Measure:MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon ^a		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
survey	.807	2.570	2	.277	.838	.948	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept

Within Subjects Design: survey

Tests of Within-Subjects Effects

Measure:MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
survey	Sphericity Assumed	156.762	2	78.381	1.343	.279
	Greenhouse-Geisser	156.762	1.677	93.494	1.343	.278
	Huynh-Feldt	156.762	1.896	82.661	1.343	.278
	Lower-bound	156.762	1.000	156.762	1.343	.267
Error(survey)	Sphericity Assumed	1517.238	26	58.355		
	Greenhouse-Geisser	1517.238	21.797	69.607		
	Huynh-Feldt	1517.238	24.654	61.542		
	Lower-bound	1517.238	13.000	116.711		

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	survey	Type III Sum of Squares	df	Mean Square	F	Sig.
survey	Linear	155.571	1	155.571	2.750	.121
	Quadratic	1.190	1	1.190	.020	.890
Error(survey)	Linear	735.429	13	56.571		
	Quadratic	781.810	13	60.139		

Tests of Between-Subjects Effects

Measure:MEASURE_1

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3330.381	1	3330.381	20.160	.001
Error	2147.619	13	165.201		

Estimated Marginal Means

survey

Estimates

Measure:MEASURE_1

survey	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
1	6.429	1.839	2.456	10.401
2	9.143	2.483	3.780	14.506
3	11.143	3.255	4.112	18.174

Pairwise Comparisons

Measure:MEASURE_1

(I) survey	(J) survey	Mean Difference (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^a	
					Lower Bound	Upper Bound
1	2	-2.714	2.302	.260	-7.688	2.260
	3	-4.714	2.843	.121	-10.856	1.427
2	1	2.714	2.302	.260	-2.260	7.688
	3	-2.000	3.410	.568	-9.366	5.366
3	1	4.714	2.843	.121	-1.427	10.856
	2	2.000	3.410	.568	-5.366	9.366

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Multivariate Tests

	Value	F	Hypothesis df	Error df	Sig.
Pillai's trace	.221	1.699 ^a	2.000	12.000	.224
Wilks' lambda	.779	1.699 ^a	2.000	12.000	.224
Hotelling's trace	.283	1.699 ^a	2.000	12.000	.224
Roy's largest root	.283	1.699 ^a	2.000	12.000	.224

Each F tests the multivariate effect of survey. These tests are based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Exact statistic

Appendix F: User Experience Data Analysis

Table 36: Respondent responses to user experience questions used in SPSS statistical analysis.

	UE-Q1			UE-Q2		
	S1	S2	S3	S1	S2	S3
18	3	4	4	4	4	4
90	1	4	4	2	4	4
194	4	5	5	4	5	5
209	2	4	4	2	3	4
289	4	5	4	5	5	4
371	3	5	5	4	5	5
510	2	4	4	3	5	5
585	2	4	5	3	5	1
757	2	5	4	3	3	3
799	3	3	5	4	3	4
919	3	3	3	4	2	3
Mean	2.7	4.2	4.0	3.3	3.9	3.7
Median	2.5	4	4	3	4	4
Standard Deviation	1.1	0.8	1.0	0.9	1.1	1.2

NPar Tests

Notes

Output Created		18-Aug-2011 17:31:40
Comments		
Input	Data	C:\Users\Adam\Dropbox\UCP-SARnet\SPSS Files\FrontPage S123 (Matched).sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	14
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for all tests are based on cases with no missing data for any variables used.
Syntax		NPAR TESTS /FRIEDMAN=S1FrontPageSense S2FrontPageSense S3FrontPageSense /MISSING LISTWISE.
Resources	Processor Time	00 00:00:00.000
	Elapsed Time	00 00:00:00.000
	Number of Cases Allowed ^a	98304

Friedman Test

Ranks

	Mean Rank
S1FrontPageSense	1.68
S2FrontPageSense	2.14
S3FrontPageSense	2.18

Test Statistics^a

N	14
Chi-Square	2.976
df	2
Asymp. Sig.	.226

a. Friedman Test

Wilcoxon Signed Ranks Test

		Ranks		
		N	Mean Rank	Sum of Ranks
S2FrontPageSense - S1FrontPageSense	Negative Ranks	2 ^a	6.00	12.00
	Positive Ranks	8 ^b	5.38	43.00
	Ties	4 ^c		
	Total	14		
S3FrontPageSense - S2FrontPageSense	Negative Ranks	3 ^d	6.17	18.50
	Positive Ranks	5 ^e	3.50	17.50
	Ties	6 ^f		
	Total	14		
S3FrontPageSense - S1FrontPageSense	Negative Ranks	4 ^g	4.88	19.50
	Positive Ranks	7 ^h	6.64	46.50
	Ties	3 ⁱ		
	Total	14		

- a. S2FrontPageSense < S1FrontPageSense
- b. S2FrontPageSense > S1FrontPageSense
- c. S2FrontPageSense = S1FrontPageSense
- d. S3FrontPageSense < S2FrontPageSense
- e. S3FrontPageSense > S2FrontPageSense
- f. S3FrontPageSense = S2FrontPageSense
- g. S3FrontPageSense < S1FrontPageSense
- h. S3FrontPageSense > S1FrontPageSense
- i. S3FrontPageSense = S1FrontPageSense

Test Statistics^c

	S2FrontPageSen se - S1FrontPageSen se	S3FrontPageSen se - S2FrontPageSen se	S3FrontPageSen se - S1FrontPageSen se
Z	-1.628 ^a	-.073 ^b	-1.234 ^a
Asymp. Sig. (2-tailed)	.103	.942	.217

- a. Based on negative ranks.
- b. Based on positive ranks.
- c. Wilcoxon Signed Ranks Test

NPar Tests

Notes

Output Created		19-Aug-2011 13:28:26
Comments		
Input	Data	C:\Users\Adam\Dropbox\UCP-SARnet\SPSS Files\FrontPage S123 (Matched).sav
	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	14
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics for each test are based on all cases with valid data for the variable(s) used in that test.
Syntax		NPAR TESTS /WILCOXON=S1FrontPageRate S2FrontPageRate WITH S2FrontPageRate S3FrontPageRate (PAIRED) /MISSING ANALYSIS.
Resources	Processor Time	00 00:00:00.000
	Elapsed Time	00 00:00:00.005
	Number of Cases Allowed ^a	98304

a. Based on availability of workspace memory.

Wilcoxon Signed Ranks Test

Ranks

		N	Mean Rank	Sum of Ranks
S2FrontPageRate -	Negative Ranks	0 ^a	.00	.00
S1FrontPageRate	Positive Ranks	11 ^b	6.00	66.00
	Ties	3 ^c		
	Total	14		
S3FrontPageRate -	Negative Ranks	4 ^d	3.38	13.50
S2FrontPageRate	Positive Ranks	2 ^e	3.75	7.50
	Ties	8 ^f		
	Total	14		
S3FrontPageRate -	Negative Ranks	0 ^g	.00	.00
S1FrontPageRate	Positive Ranks	9 ^h	5.00	45.00
	Ties	5 ⁱ		
	Total	14		

- a. S2FrontPageRate < S1FrontPageRate
- b. S2FrontPageRate > S1FrontPageRate
- c. S2FrontPageRate = S1FrontPageRate
- d. S3FrontPageRate < S2FrontPageRate
- e. S3FrontPageRate > S2FrontPageRate
- f. S3FrontPageRate = S2FrontPageRate
- g. S3FrontPageRate < S1FrontPageRate
- h. S3FrontPageRate > S1FrontPageRate
- i. S3FrontPageRate = S1FrontPageRate

Test Statistics^c

	S2FrontPageRate	S3FrontPageRate	S3FrontPageRate
	-	-	-
	S1FrontPageRate	S2FrontPageRate	S1FrontPageRate
Z	-2.969 ^a	-.647 ^b	-2.719 ^a
Asymp. Sig. (2-tailed)	.003	.518	.007

- a. Based on negative ranks.
- b. Based on positive ranks.
- c. Wilcoxon Signed Ranks Test

Appendix G: Social Presence Survey Data Analysis

Table 37: Results of social presence measures for S1 used in SPSS data analysis.

ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
18	2	3	4	4	3	3	4	4	2	2	2	4	4	4
90	4	2	2	4	3	3	3	3	4	4	4	4	3	4
194	2	4	4	4	4	4	4	4	2	2	2	4	4	4
209	3	4	2	4	4	2	2	3	3	3	3	2	2	2
214	4	3	3	5	4	4	3	2	2	3	3	5	4	4
289	3	4	4	5	3	5	4	3	4	4	4	4	5	3
371	3	5	5	5	5	5	5	5	3	3	3	4	4	4
510	3	3	3	3	4	4	3	3	3	3	3	5	4	4
585	3	2	4	4	2	4	2	4	3	3	3	4	4	4
612	4	2	4	3	3	1	2	3	4	2	2	4	3	2
757	3	4	4	5	5	5	5	3	3	3	3	4	4	4
787	2	4	4	4	4	5	4	4	4	4	4	5	3	3
799	3	3	4	4	3	4	3	3	4	4	4	4	3	4
919	4	2	2	1	3	2	3	3	3	3	3	3	3	3

Table 38: Results of social presence measures for S2 used in SPSS data analysis.

ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
18	2	4	4	5	5	5	5	4	3	3	3	5	4	4
90	2	4	5	4	4	5	3	4	3	2	4	4	4	4
194	2	4	4	4	4	4	4	4	2	2	2	4	4	4
209	1	5	4	4	4	4	3	3	3	4	4	2	3	4
214	2	3	4	4	3	4	3	3	2	2	2	2	3	3
289	1	5	4	5	3	5	5	4	3	3	3	5	5	4
371	2	5	5	5	5	5	4	5	4	4	4	4	4	4
510	3	5	5	5	5	5	4	3	4	4	4	5	5	5
585	3	3	4	5	4	5	4	4	4	4	4	5	5	4
612	2	4	4	5	3	3	3	3	5	4	4	4	4	3
757	3	5	5	5	5	5	5	4	4	4	4	5	5	5
787	3	4	5	5	3	5	5	5	4	3	4	5	5	4
799	4	3	4	4	3	4	4	4	4	3	3	4	3	3
919	2	4	3	4	4	3	3	3	3	3	3	4	3	4

Table 39: Results of social presence measures for S3 used in SPSS data analysis.

ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14
18	2	4	4	4	4	4	4	4	3	3	3	4	4	5
90	1	3	5	4	3	4	5	4	2	2	3	4	4	4
194	2	5	5	5	5	5	5	5	2	2	2	5	5	5
209	2	4	3	4	4	3	3	3	2	2	2	4	4	4
214	2	4	3	4	3	4	3	3	3	3	3	3	3	3
289	3	5	5	5	5	5	5	5	2	3	3	5	5	5
371	2	4	4	4	4	4	4	4	2	2	2	4	4	4
510	1	5	5	5	5	5	5	5	3	3	3	5	5	5
585	3	5	5	5	4	4	4	4	4	5	4	4	4	4
612	4	3	4	4	2	4	2	2	5	4	4	2	4	3
757	1	5	5	5	4	4	4	4	3	3	3	5	3	3
787	2	5	5	5	3	5	4	4	4	3	3	5	5	3
799	4	3	4	4	4	4	4	3	3	3	3	4	4	4
919	4	3	3	3	2	3	3	3	3	3	3	3	3	4

Table 40: Summary of SPSS results for social presence measures. (Full data output from SPSS not provided due to size).

	Chi-Square	Asymp Sig	Mean Rank Z		
			S1	S2	S3
Q1	4.286	.117	2.36	1.82	1.82
Q2	12.605	.002	1.32	2.36	2.32
Q3	9.941	.007	1.46	2.25	2.29
Q4	5.034	.081	1.68	2.29	2.04
Q5	1.317	.518	1.89	2.21	1.89
Q6	7.824	.020	1.57	2.39	2.04
Q7	6.054	.048	1.57	2.29	2.14
Q8	5.097	.078	1.64	2.25	2.11
Q9	4.389	.111	1.89	2.36	1.75
Q10	1.077	.584	2.04	2.14	1.82
Q11	3.842	.146	1.96	2.32	1.71
Q12	2.214	.331	1.79	2.18	2.04
Q13	5.688	.058	1.61	2.18	2.21
Q14	4.514	.105	1.64	2.11	2.25

Table 41: P-values of Wilcoxon's Matched-Pairs Signed-Ranks Test results for social presence survey result conducted between Survey 1 and Survey 2, Survey 2 and Survey 3, and Survey 1 and Survey 3. (Full data output from SPSS not provided due to size).

Test Statistics ^d												
	S2Q2 - S1Q2	S3Q2 - S2Q2	S3Q2 - S1Q2	S2Q3 - S1Q3	S3Q3 - S2Q3	S3Q3 - S1Q3	S2Q6 - S1Q6	S3Q6 - S2Q6	S3Q6 - S1Q6	S2Q7 - S1Q7	S3Q7 - S2Q7	S3Q7 - S1Q7
Z	-2.739 ^a	.000 ^b	-2.812 ^a	-2.414 ^a	.000 ^b	-2.484 ^a	-2.428 ^a	-1.414 ^c	-1.732 ^a	-2.309 ^a	.000 ^b	-1.903 ^a
Asymp. Sig. (2-tailed)	.006	1.000	.005	.016	1.000	.013	.015	.157	.083	.021	1.000	.057

a. Based on negative ranks.

b. The sum of negative ranks equals the sum of positive ranks.

c. Based on positive ranks.

d. Wilcoxon Signed Ranks Test

Appendix H: Website Usage Data Analysis

Table 42: Web usage results by week and period used in SPSS data analysis.

Period	Week	Site Visits All	Site Visits Returning	Average Pageviews per Visit All	Average Pageview per Visit Returning	Average Time on Site All	Average Time on Site Returning
Period 1	Nov 7, 2010 - Nov 13, 2010	764	345	5.14	7.28	4.34	7.04
	Nov 14, 2010 - Nov 20, 2010	670	264	6.61	11.38	5.52	11.05
	Nov 21, 2010 - Nov 27, 2010	576	224	5.12	7.69	4.51	7.07
	Nov 28, 2010 - Dec 4, 2010	604	193	4.32	7.46	4.12	8.21
	Dec 5, 2010 - Dec 11, 2010	537	157	3.57	6.41	3.06	6.25
	Dec 12, 2010 - Dec 18, 2010	528	186	4.25	8.09	3.27	6.39
	Dec 19, 2010 - Dec 25, 2010	344	110	4.33	7.76	3.49	8.02
	Dec 26, 2010 - Jan 1, 2011	489	222	4.83	6.39	6.1	9.24
	Jan 2, 2011 - Jan 8, 2011	507	184	3.78	5.24	4.21	8.05
	Jan 9, 2011 - Jan 15, 2011	648	278	9.08	17.67	9.36	19.22
Period 2	Jan 16, 2011 - Jan 22, 2011	870	398	8.03	13.11	7.28	12.31
	Jan 23, 2011 - Jan 29, 2011	983	464	7.14	9.97	6.33	9.47
	Jan 30, 2011 - Feb 5, 2011	1,012	570	7.34	9.59	6.46	9.47
	Feb 6, 2011 - Feb 12, 2011	1,034	507	4.76	6.58	4.44	7.08
	Feb 13, 2011 - Feb 19, 2011	1,018	545	6.93	9.64	6.04	8.28
	Feb 20, 2011 - Feb 26, 2011	913	419	6.14	9.76	5.16	8.07
	Feb 27, 2011 - Mar 5, 2011	971	493	7.34	10.32	6.52	9.32
	Mar 6, 2011 - Mar 12, 2011	961	480	6.07	7.49	5.21	7.21
	Mar 13, 2011 - Mar 19, 2011	833	378	5.73	5.82	5.19	8.19
	Mar 20, 2011 - Mar 26, 2011	847	407	4.5	6.25	3.52	5.54
Period 3	Mar 27, 2011 - Apr 2, 2011	843	380	3.63	4.94	3.58	6.17
	Apr 3, 2011 - Apr 9, 2011	883	354	4.07	6.23	4.14	7.2
	Apr 10, 2011 - Apr 16, 2011	1,018	406	4.3	6.48	3.5	6.29
	Apr 17, 2011 - Apr 23, 2011	1,024	389	3.66	5.14	3.27	6.06
	Apr 24, 2011 - Apr 30, 2011	1,040	357	3.95	5.41	3.26	5.28
	May 1, 2011 - May 7, 2011	995	424	3.94	4.99	4.33	6.19
	May 8, 2011 - May 14, 2011	715	256	2.87	4	2.1	2.58
	May 15, 2011 - May 21, 2011	599	176	2.83	4.01	2.3	3.52
	May 22, 2011 - May 28, 2011	715	241	5.85	6.35	5.49	7.21
	May 29, 2011 - Jun 4, 2011	606	161	3.22	5.53	2.59	5.54

Table 43: Period definitions for web usage statistical analysis

	Start Date	End Date	Number of Weeks
Period 1	7-Nov-10	15-Jan-11	10
Period 2	16-Jan-11	26-Mar-11	10
Period 3	27-Mar-11	4-Jun-11	10

General Linear Model

Notes			
Output Created			28-Aug-2011 18:55:41
Comments			
Input	Data	C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\WeeklyWebMetricsData.sav	
	Active Dataset	DataSet2	
	Filter	<none>	
	Weight	<none>	
	Split File	<none>	
	N of Rows in Working Data File		30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.	
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.	
Syntax		GLM DailySiteVisits_Returning AveragePageViews_Returning AvgTimeOnSite_Returning BY Period /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /POSTHOC=Period(TUKEY) /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY /CRITERIA=ALPHA(.05) /DESIGN= Period.	
Resources	Processor Time		00 00:00:00.078
	Elapsed Time		00 00:00:00.123

Between-Subjects Factors

		N
Period	Period 1	10
	Period 2	10
	Period 3	10

Descriptive Statistics

	Period	Mean	Std. Deviation	N
DailySiteVisits_Returning	Period 1	30.9000	9.53072	10
	Period 2	66.5857	9.24900	10
	Period 3	44.9143	13.89452	10
	Total	47.4667	18.37352	30
AveragePageViews_Returning	Period 1	8.5370	3.58638	10
	Period 2	8.8530	2.27318	10
	Period 3	5.3080	.88378	10
	Total	7.5660	2.91413	30
AvgTimeOnSite_Returning	Period 1	9.0540	3.84574	10
	Period 2	8.4940	1.82091	10
	Period 3	5.6040	1.49315	10
	Total	7.7173	2.94534	30

Box's Test of Equality of Covariance Matrices^a

Box's M	26.706
F	1.861
df1	12
df2	3532.846
Sig.	.034

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Period

Multivariate Tests^d

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Intercept	Pillai's Trace	.962	209.089 ^a	3.000	25.000	.000	.962	627.267	1.000
	Wilks' Lambda	.038	209.089 ^a	3.000	25.000	.000	.962	627.267	1.000
	Hotelling's Trace	25.091	209.089 ^a	3.000	25.000	.000	.962	627.267	1.000
	Roy's Largest Root	25.091	209.089 ^a	3.000	25.000	.000	.962	627.267	1.000
Period	Pillai's Trace	1.002	8.695	6.000	52.000	.000	.501	52.169	1.000
	Wilks' Lambda	.213	9.721 ^a	6.000	50.000	.000	.538	58.326	1.000
	Hotelling's Trace	2.686	10.745	6.000	48.000	.000	.573	64.468	1.000
	Roy's Largest Root	2.235	19.374 ^c	3.000	26.000	.000	.691	58.121	1.000

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Period

Levene's Test of Equality of Error Variances^a

	F	df1	df2	Sig.
DailySiteVisits_Returning	2.620	2	27	.091
AveragePageViews_Returning	2.811	2	27	.078
AvgTimeOnSite_Returning	1.580	2	27	.224

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Period

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	DailySiteVisits_Returning	6465.071 ^a	2	3232.535	26.250	.000	.660	52.499	1.000
	AveragePageViews_Returning	76.978 ^c	2	38.489	6.138	.006	.313	12.277	.851
	AvgTimeOnSite_Returning	68.561 ^d	2	34.280	5.057	.014	.273	10.115	.772
Intercept	DailySiteVisits_Returning	67592.533	1	67592.533	548.884	.000	.953	548.884	1.000
	AveragePageViews_Returning	1717.331	1	1717.331	273.889	.000	.910	273.889	1.000
	AvgTimeOnSite_Returning	1786.717	1	1786.717	263.593	.000	.907	263.593	1.000
Period	DailySiteVisits_Returning	6465.071	2	3232.535	26.250	.000	.660	52.499	1.000
	AveragePageViews_Returning	76.978	2	38.489	6.138	.006	.313	12.277	.851
	AvgTimeOnSite_Returning	68.561	2	34.280	5.057	.014	.273	10.115	.772
Error	DailySiteVisits_Returning	3324.927	27	123.145					
	AveragePageViews_Returning	169.295	27	6.270					
	AvgTimeOnSite_Returning	183.014	27	6.778					
Total	DailySiteVisits_Returning	77382.531	30						
	AveragePageViews_Returning	1963.603	30						
	AvgTimeOnSite_Returning	2038.292	30						
Corrected Total	DailySiteVisits_Returning	9789.997	29						
	AveragePageViews_Returning	246.273	29						
	AvgTimeOnSite_Returning	251.575	29						

a. R Squared = .660 (Adjusted R Squared = .635)

b. Computed using alpha = .05

c. R Squared = .313 (Adjusted R Squared = .262)

d. R Squared = .273 (Adjusted R Squared = .219)

**Post Hoc Tests
Period**

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Period	(J) Period	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
DailySiteVisits_Returning	Period 1	Period 2	-35.6857*	4.96277	.000	-47.9905	-23.3809
		Period 3	-14.0143*	4.96277	.023	-26.3191	-1.7095
	Period 2	Period 1	35.6857*	4.96277	.000	23.3809	47.9905
		Period 3	21.6714*	4.96277	.000	9.3666	33.9762
	Period 3	Period 1	14.0143*	4.96277	.023	1.7095	26.3191
		Period 2	-21.6714*	4.96277	.000	-33.9762	-9.3666
AveragePageViews_Returning	Period 1	Period 2	-.3160	1.11984	.957	-3.0925	2.4605
		Period 3	3.2290*	1.11984	.020	.4525	6.0055
	Period 2	Period 1	.3160	1.11984	.957	-2.4605	3.0925
		Period 3	3.5450*	1.11984	.010	.7685	6.3215
	Period 3	Period 1	-3.2290*	1.11984	.020	-6.0055	-.4525
		Period 2	-3.5450*	1.11984	.010	-6.3215	-.7685
AvgTimeOnSite_Returning	Period 1	Period 2	.5600	1.16433	.881	-2.3269	3.4469
		Period 3	3.4500*	1.16433	.017	.5631	6.3369
	Period 2	Period 1	-.5600	1.16433	.881	-3.4469	2.3269
		Period 3	2.8900*	1.16433	.050	.0031	5.7769
	Period 3	Period 1	-3.4500*	1.16433	.017	-6.3369	-.5631
		Period 2	-2.8900*	1.16433	.050	-5.7769	-.0031

The error term is Mean Square(Error) = 6.778.

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

DailySiteVisits_Returning

Tukey HSD^{a,b,c}

Period	N	Subset		
		1	2	3
Period 1	10	30.9000		
Period 3	10		44.9143	
Period 2	10			66.5857
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 123.145.

- a. Uses Harmonic Mean Sample Size = 10.000.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used.
- Type I error levels are not guaranteed.
- c. Alpha = .05.

AveragePageViews_Returning

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 3	10	5.3080	
Period 1	10		8.5370
Period 2	10		8.8530
Sig.		1.000	.957

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 6.270.

- a. Uses Harmonic Mean Sample Size = 10.000.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
- c. Alpha = .05.

AvgTimeOnSite_Returning

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 3	10	5.6040	
Period 2	10		8.4940
Period 1	10		9.0540
Sig.		1.000	.881

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 6.778.

- a. Uses Harmonic Mean Sample Size = 10.000.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
- c. Alpha = .05.

Appendix I: Website Communication Data Analysis

Table 44: Results of communication analysis measures used in SPSS data analysis

Period	Week (Year 2010 - 2011)	Number of Blog Posts	Number of Comments	Number of Unique Users
Period 1	November 7th- November 13th	1	0	1
	November 14th-November 20	0	0	0
	November 21-November 27	1	2	3
	November 28-December 4th	1	0	1
	December 5- December 11	0	0	0
	December 12-December 18	0	0	0
	December 19-December 25	0	0	0
	December 26-January 1	0	0	0
	January 2-January 8	0	0	0
	January 9-January 15	1	2	1
Period 2	January 16- January 22	4	7	3
	January 23-January 29	8	17	5
	January 30- February 5	14	10	11
	February 6-February 12	17	74	10
	February 13- February 19	16	25	9
	February 20- February 26	22	5	12
	February 27-March 5	13	16	10
	March 6 - March 12	11	12	9
	March 13-March 19	6	3	4
	March 20-March 26	9	3	6
Period 3	March 27-April 2	5	2	5
	April 3- April 9	16	6	7
	April 10- April 16	13	3	9
	April 17- April 23	6	2	4
	April 24- April 30	11	3	7
	May 1 - May 7	4	2	2
	May 8-May 14	2	0	2
	May 15-May 21	2	1	2
	May 22-May 28	0	0	0
	May 29-June 4	1	0	1

General Linear Model

Notes

Output Created		28-Aug-2011 21:17:37
Comments		
Input	Data	C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\WeeklyWebMetricsData.sav
	Active Dataset	DataSet2
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		GLM BlogPosts Comments UniqueUsers BY Period /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /POSTHOC=Period(TUKEY) /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY /CRITERIA=ALPHA(.05) /DESIGN= Period.
Resources	Processor Time	00 00:00:00.062
	Elapsed Time	00 00:00:00.090

[DataSet2] C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\WeeklyWebMetricsData.sav

Between-Subjects Factors

		N
Period	Period 1	10
	Period 2	10
	Period 3	10

Descriptive Statistics

	Period	Mean	Std. Deviation	N
BlogPosts	Period 1	.4000	.51640	10
	Period 2	12.0000	5.49747	10
	Period 3	6.0000	5.49747	10
	Total	6.1333	6.48464	30
Comments	Period 1	.4000	.84327	10
	Period 2	17.2000	21.14395	10
	Period 3	1.9000	1.85293	10
	Total	6.5000	14.12933	30
UniqueUsers	Period 1	.6000	.96609	10
	Period 2	7.9000	3.14289	10
	Period 3	3.9000	2.99815	10
	Total	4.1333	3.91930	30

**Box's Test of Equality of
Covariance Matrices^a**

Box's M	140.475
F	9.788
df1	12
df2	3532.846
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Period

Multivariate Tests^d

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^p
Intercept	Pillai's Trace	.749	24.809 ^a	3.000	25.000	.000	.749	74.426	1.000
	Wilks' Lambda	.251	24.809 ^a	3.000	25.000	.000	.749	74.426	1.000
	Hotelling's Trace	2.977	24.809 ^a	3.000	25.000	.000	.749	74.426	1.000
	Roy's Largest Root	2.977	24.809 ^a	3.000	25.000	.000	.749	74.426	1.000
Period	Pillai's Trace	.692	4.582	6.000	52.000	.001	.346	27.489	.977
	Wilks' Lambda	.356	5.640 ^a	6.000	50.000	.000	.404	33.837	.993
	Hotelling's Trace	1.678	6.714	6.000	48.000	.000	.456	40.282	.998
	Roy's Largest Root	1.595	13.823 ^c	3.000	26.000	.000	.615	41.470	1.000

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Period

Levene's Test of Equality of Error Variances^a

	F	df1	df2	Sig.
BlogPosts	8.815	2	27	.001
Comments	5.427	2	27	.010
UniqueUsers	8.890	2	27	.001

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Period

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	BlogPosts	673.067 ^a	2	336.533	16.630	.000	.552	33.259	.999
	Comments	1728.600 ^c	2	864.300	5.747	.008	.299	11.493	.826
	UniqueUsers	267.267 ^d	2	133.633	20.247	.000	.600	40.495	1.000
Intercept	BlogPosts	1128.533	1	1128.533	55.766	.000	.674	55.766	1.000
	Comments	1267.500	1	1267.500	8.427	.007	.238	8.427	.799
	UniqueUsers	512.533	1	512.533	77.657	.000	.742	77.657	1.000
Period	BlogPosts	673.067	2	336.533	16.630	.000	.552	33.259	.999
	Comments	1728.600	2	864.300	5.747	.008	.299	11.493	.826
	UniqueUsers	267.267	2	133.633	20.247	.000	.600	40.495	1.000
Error	BlogPosts	546.400	27	20.237					
	Comments	4060.900	27	150.404					
	UniqueUsers	178.200	27	6.600					
Total	BlogPosts	2348.000	30						
	Comments	7057.000	30						
	UniqueUsers	958.000	30						
Corrected Total	BlogPosts	1219.467	29						
	Comments	5789.500	29						
	UniqueUsers	445.467	29						

a. R Squared = .552 (Adjusted R Squared = .519)

b. Computed using alpha = .05

c. R Squared = .299 (Adjusted R Squared = .247)

d. R Squared = .600 (Adjusted R Squared = .570)

**Post Hoc Tests
Period**

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Period	(J) Period	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
BlogPosts	Period 1	Period 2	-11.6000*	2.01182	.000	-16.5881	-6.6119
		Period 3	-5.6000*	2.01182	.025	-10.5881	-6.6119
	Period 2	Period 1	11.6000*	2.01182	.000	6.6119	16.5881
		Period 3	6.0000*	2.01182	.016	1.0119	10.9881
	Period 3	Period 1	5.6000*	2.01182	.025	.6119	10.5881
		Period 2	-6.0000*	2.01182	.016	-10.9881	-1.0119
Comments	Period 1	Period 2	-16.8000*	5.48459	.013	-30.3986	-3.2014
		Period 3	-1.5000	5.48459	.960	-15.0986	12.0986
	Period 2	Period 1	16.8000*	5.48459	.013	3.2014	30.3986
		Period 3	15.3000*	5.48459	.025	1.7014	28.8986
	Period 3	Period 1	1.5000	5.48459	.960	-12.0986	15.0986
		Period 2	-15.3000*	5.48459	.025	-28.8986	-1.7014
UniqueUsers	Period 1	Period 2	-7.3000*	1.14891	.000	-10.1486	-4.4514
		Period 3	-3.3000*	1.14891	.021	-6.1486	-.4514
	Period 2	Period 1	7.3000*	1.14891	.000	4.4514	10.1486
		Period 3	4.0000*	1.14891	.005	1.1514	6.8486
	Period 3	Period 1	3.3000*	1.14891	.021	.4514	6.1486
		Period 2	-4.0000*	1.14891	.005	-6.8486	-1.1514

The error term is Mean Square(Error) = 6.600.

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

BlogPosts

Tukey HSD^{a,b,c}

Period	N	Subset		
		1	2	3
Period 1	10	.4000		
Period 3	10		6.0000	
Period 2	10			12.0000
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 20.237.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used.

Type I error levels are not guaranteed.

c. Alpha = .05.

Comments

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.4000	
Period 3	10	1.9000	
Period 2	10		17.2000
Sig.		.960	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 150.404.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

UniqueUsers

Tukey HSD^{a,b,c}

Period	N	Subset		
		1	2	3
Period 1	10	.6000		
Period 3	10		3.9000	
Period 2	10			7.9000
Sig.		1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 6.600.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used.

Type I error levels are not guaranteed.

c. Alpha = .05.

Content Analysis

For the content analysis, the researcher followed the high level recommendations of Stemler (2001) in his overview of content analysis. Individual comments and blog posts were chosen as coding units and the content categories were chosen a priori based on the content-related practices that the UCP-SARnet site redesign was intended to support listed in Table 4. Two coders independent of the researcher were used to code the blog posts and comments over the three periods. To establish intercoder reliability both coders were trained on ten percent segments of the total number of blog posts until they reached a 70% agreement rate. During this time, the coders logged their decisions noting any subcategories. For example, for the finding idea and insights category, there were three subcategories: posting a link of interest, referencing a conference of interest, and posting a newsletter from another organization. Instances of content posts in those subcategories would mean that content would be coded in the corresponding main category. The coders then each coded half of the total number of blog posts with a 20% overlap to verify that the 70% agreement rate was maintained from training. The agreement rate was checked after the total number of blog posts and comments had been coded. If the agreement rate of 70% was not achieved, the coders were to look at the units where they disagreed and come to agreement on the code. They would then repeat the content analysis with a 20% overlap until they met the 70% agreement rate.

The percent agreement for the content analysis is 72.73%. This amounts to 12 differences out of 46 posts. This table describes the posts where we differed, the decision taken, and why.

Table 45: Summary of data and results of content analysis.

Total number of blogs and comments posted	Number of posts where Coder 1 and Coder 2 overlapped	Number of posts with agreement	Percent Agreement
460	46	12	72.73%

Table 46: Content analysis coding rubric.

COP Lifecycle elements that are content-based	Blog Subcategory	Comment Subcategory	Examples of instance
Build connections between the core group members	Making a statement of reference to other members.	Making a statement to another member (implicitly or explicitly). Establishing and making explicit a shared interest. Acknowledging the blogger or another commenter for the post they made.	Introduced the New Executive Team members on Sept. 7,2010 Mentioned other member's name(Sept. 13, 2010) Introduce oneself to others on a blog(Sept. 13, 2010) Implicitly stated,"Well done team..." (comments on Jan. 18, 2011) Chatting about a grad photos(March 4, 2010)
Find ideas insights and practices that are worth sharing	Referencing a conference of interest. Posting of newsletter of another organization. Posting a link.	Post a corresponding topic as a comment to the blog, which is worth sharing.	Conference of eLearning in Africa 2011(Sept. 26, 2010) Foundation for Sustainable Development from the Weekly Newsletter(Sept. 26, 2010) posting a youtube link about Global Warming(Jan 28, 2011)
Identify opportunities to provide value	Identifying a problem and making reference to UCP-SARnet as being able to help. Providing information of courses to enhance the learning experience. Posting workshop information.	Connecting content in blog post an issue that needs addressing.	MADE program in Warsaw(opportunity to provide a higher education for the UCP-SARnet members) (Sept. 26, 2010) registration of courses, PRIA Distance Learning Courses(Aug 12,2010) Professional Grant Development Workshop informations (Sept 28,2010)
Engaging stakeholders of the larger context	Reporting incidents of working with other organizations. Making connection with other program/organizations.	Reporting on collaborating with other groups/organizations. Sharing similar experience of working with other organizations	working, collaborating with TESA(March 22,2011) Global Alliance, connect women with ICT to help(March 20,2011) Participate in another program(NCCF)(March 25,2011) UCP-SARnet visited NCCF(March 25,2011)
Identifying gaps in the knowledge	Referencing where UCP-SARnet needs to improve. Acknowledging the improvement.	Confirming the improvement in a comment. Acknowledging the need to make the improvement.	CUExpo2011 to strengthening local community (Sept 5,2010) upgraded portal of UCP-SARnet (Jan 18, 2011)

Table 47: Content analysis summary of intercoder disagreement and resolution.

Post Date	Coder 1 Categories (Shelley)	Coder 2 Categories (Tim)	Decision	Reason
Blog August 11, 2010.	opportunities to provide value ideas and insights worth sharing	building connections ideas and insights worth sharing	opportunities to provide value ideas and insights worth sharing building connections	The post describes a “journey for upcoming change” . The members who go together will build bonds, the person who posted it was showing it as in idea worth sharing, and once there members can provide value to locals.
Comment on blog August 11, 2010	building connections	provide support to a fellow group member	building connections	Removed the “provide support” category, merged with “building connections”
Blog September 11, 2010.	opportunity to provide value	ideas insights and practices worth sharing	ideas insights and practices worth sharing opportunity to provide value	The post is about an opportunity to provide value, as it details how to submit a presentation to the changemaker seminar. It is also providing an insight worth sharing, as the ppster is sharing the opportunity with others.
Blog September 13, 2010.	gaps in knowledge	ideas and insights	ideas and insights gaps in knowledge	The post is someone asking how to use UCP-Sarnet to find value, and is also showing a gap in the accessibility of UCP-Sarnet to new users.
Blog September 28, 2010.	ideas and insights	opportunity to provide value	opportunity to provide value ideas and insights	The post details a tour for grad students. This is an opportunity to provide value (the tour brings you face-to-face with many different people from all over the world) and it is an idea worth sharing.

Table 48 and Figure 18 show the content statistics based on the category of posts to UCP-SARnet over P1, P2, and P3. A MANOVA was conducted with content categories as the dependent variables, and P1, P2, and P3 as independent variable. Box’s M Test for equality of covariance matrices was not significant at the $p < 0.001$ rejecting the null hypothesis that covariance matrices of web usage variables are equal across periods, which satisfies the assumption of homoscedasticity for MANOVA.

Table 48: Content statistics based on category of message in posts to UCP-SARnet web portal over P1, P2, and P3.

		Period 1	Period 2	Period 3
Building Connections	Mean	0.50	7.40	2.20
	Standard Deviation	1.08	5.50	1.99
Finding ideas and insights	Mean	0.20	9.80	4.20
	Standard Deviation	0.42	5.59	3.43
Identifying opportunities	Mean	0.10	3.00	2.10
	Standard Deviation	0.32	2.00	3.63
Engaging stakeholders	Mean	0.00	1.30	0.60
	Standard Deviation	0.00	1.34	1.07
Identifying gaps	Mean	0.00	0.60	0.10
	Standard Deviation	0.00	0.84	0.32

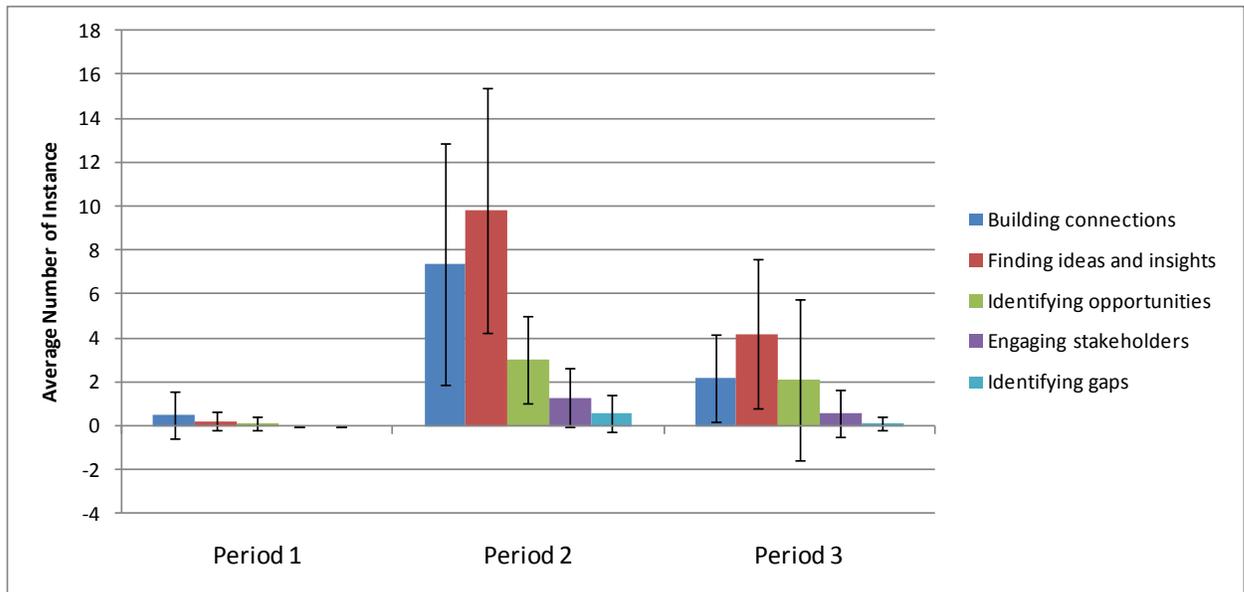


Figure 17: Content statistics based on category of message in posts to UCP-SARnet web portal over Period 1, Period 2, and Period 3 by week.

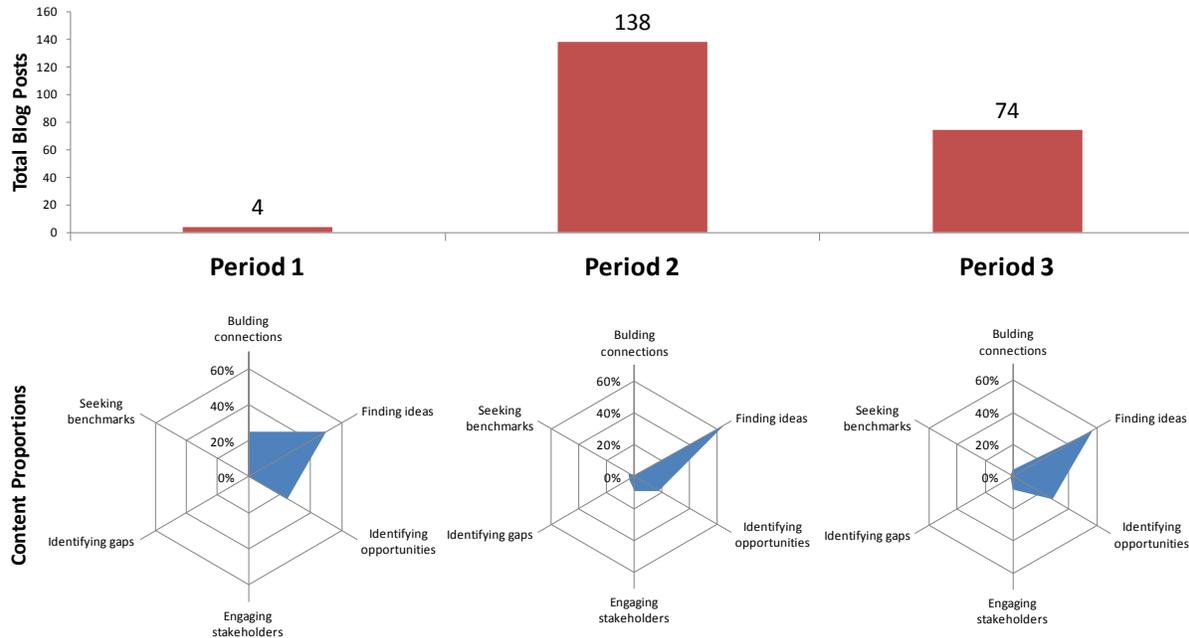


Figure 18: Distribution of types of blog content posted to UCP-SARnet over P1, P2, and P3.

The MANOVA showed that there was a statistically significant difference between periods with respect to the UCP-SARnet website usage statistic ($F(10, 48) = 4.090, p < 0.005, Wilks' \lambda = 0.280, partial \epsilon^2 = 0.471$).

Follow-up univariate ANOVA tests were conducted using the returning users data. The univariate ANOVAs showed that there was a significant effect over the three periods on content post in the category of building connections ($F(2, 27) = 10.95, p < 0.05, partial \epsilon^2 = .448$), finding ideas and insights ($F(2, 27) = 16.148, p < 0.05, partial \epsilon^2 = 0.313$), identifying opportunities ($F(2, 27) = 3.818, p < 0.05$), engaging stakeholders ($F(2, 27) = 4.313, p < 0.05$) and identifying gaps ($F(2, 27) = 3.822, p < 0.05$).

Table 49: Results of content analysis used in SPSS data analysis.

Period	Week	Building connections	Finding ideas and insights	Identify Opportunities	Engaging Stakeholders	Identify Gaps	Seek benchmarks
Period 1	Nov 7, 2010 - Nov 13, 2010	0	0	1	0	0	0
	Nov 14, 2010 - Nov 20, 2010	0	0	0	0	0	0
	Nov 21, 2010 - Nov 27, 2010	3	0	0	0	0	0
	Nov 28, 2010 - Dec 4, 2010	0	1	0	0	0	0
	Dec 5, 2010 - Dec 11, 2010	0	0	0	0	0	0
	Dec 12, 2010 - Dec 18, 2010	0	0	0	0	0	0
	Dec 19, 2010 - Dec 25, 2010	0	0	0	0	0	0
	Dec 26, 2010 - Jan 1, 2011	0	0	0	0	0	0
	Jan 2, 2011 - Jan 8, 2011	0	0	0	0	0	0
	Jan 9, 2011 - Jan 15, 2011	2	1	0	0	0	0
Period 2	Jan 16, 2011 - Jan 22, 2011	5	6	1	0	2	0
	Jan 23, 2011 - Jan 29, 2011	16	9	1	0	0	0
	Jan 30, 2011 - Feb 5, 2011	8	14	5	1	1	0
	Feb 6, 2011 - Feb 12, 2011	9	12	7	4	0	0
	Feb 13, 2011 - Feb 19, 2011	5	14	4	0	0	0
	Feb 20, 2011 - Feb 26, 2011	2	21	4	1	0	0
	Feb 27, 2011 - Mar 5, 2011	16	10	1	1	2	0
	Mar 6, 2011 - Mar 12, 2011	10	4	2	2	1	5
	Mar 13, 2011 - Mar 19, 2011	0	4	3	1	0	2
	Mar 20, 2011 - Mar 26, 2011	3	4	2	3	0	0
Period 3	Mar 27, 2011 - Apr 2, 2011	3	5	1	0	0	0
	Apr 3, 2011 - Apr 9, 2011	6	5	12	0	0	0
	Apr 10, 2011 - Apr 16, 2011	3	8	3	2	1	0
	Apr 17, 2011 - Apr 23, 2011	3	5	2	3	0	1
	Apr 24, 2011 - Apr 30, 2011	4	11	2	0	0	0
	May 1, 2011 - May 7, 2011	2	4	0	0	0	0
	May 8, 2011 - May 14, 2011	0	2	0	0	0	0
	May 15, 2011 - May 21, 2011	1	1	1	1	0	0
	May 22, 2011 - May 28, 2011	0	0	0	0	0	0
May 29, 2011 - Jun 4, 2011	0	1	0	0	0	0	

General Linear Model

Notes

Output Created		29-Aug-2011 11:26:14
Comments		
Input	Data	C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\WeeklyWebMetricsData.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	30
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.
Syntax		GLM BuildingConnections FindingIdeas IdentifyingOpportunities EngagingStakeholders IdentifyingGaps BY Period /METHOD=SSTYPE(3) /INTERCEPT=INCLUDE /POSTHOC=Period(TUKEY) /EMMEANS=TABLES(Period) /PRINT=DESCRIPTIVE ETASQ OPOWER HOMOGENEITY /CRITERIA=ALPHA(.05) /DESIGN= Period.
Resources	Processor Time	00 00:00:00.141
	Elapsed Time	00 00:00:00.250

[DataSet1] C:\Users\Adam\Documents\My Dropbox\UCP-SARnet\SPSS Files\WeeklyWebMetricsData.sav

Between-Subjects Factors

		N
Period	Period 1	10
	Period 2	10
	Period 3	10

Descriptive Statistics

	Period	Mean	Std. Deviation	N
BuildingConnections	Period 1	.5000	1.08012	10
	Period 2	7.4000	5.50151	10
	Period 3	2.2000	1.98886	10
	Total	3.3667	4.46043	30
FindingIdeas	Period 1	.2000	.42164	10
	Period 2	9.8000	5.59365	10
	Period 3	4.2000	3.42540	10
	Total	4.7333	5.42620	30
IdentifyingOpportunities	Period 1	.1000	.31623	10
	Period 2	3.0000	2.00000	10
	Period 3	2.1000	3.63471	10
	Total	1.7333	2.62525	30
EngagingStakeholders	Period 1	.0000	.00000	10
	Period 2	1.3000	1.33749	10
	Period 3	.6000	1.07497	10
	Total	.6333	1.09807	30
IdentifyingGaps	Period 1	.0000	.00000	10
	Period 2	.6000	.84327	10
	Period 3	.1000	.31623	10
	Total	.2333	.56832	30

Box's Test of Equality of Covariance Matrices^a

Box's M	57.269
F	2.643
df1	15
df2	1304.526
Sig.	.001

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Period

Multivariate Tests^d

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Intercept	Pillai's Trace	.765	14.949 ^a	5.000	23.000	.000	.765	74.743	1.000
	Wilks' Lambda	.235	14.949 ^a	5.000	23.000	.000	.765	74.743	1.000
	Hotelling's Trace	3.250	14.949 ^a	5.000	23.000	.000	.765	74.743	1.000
	Roy's Largest Root	3.250	14.949 ^a	5.000	23.000	.000	.765	74.743	1.000
Period	Pillai's Trace	.758	2.929	10.000	48.000	.006	.379	29.295	.950
	Wilks' Lambda	.280	4.090 ^a	10.000	46.000	.000	.471	40.897	.993
	Hotelling's Trace	2.432	5.351	10.000	44.000	.000	.549	53.508	.999
	Roy's Largest Root	2.375	11.399 ^c	5.000	24.000	.000	.704	56.994	1.000

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + Period

Levene's Test of Equality of Error Variances^a

	F	df1	df2	Sig.
BuildingConnections	10.385	2	27	.000
FindingIdeas	8.918	2	27	.001
IdentifyingOpportunities	3.380	2	27	.049
EngagingStakeholders	8.853	2	27	.001
IdentifyingGaps	21.154	2	27	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Period

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	BuildingConnections	258.467 ^a	2	129.233	10.955	.000	.448	21.911	.983
	FindingIdeas	465.067 ^c	2	232.533	16.148	.000	.545	32.296	.999
	IdentifyingOpportunities	44.067 ^d	2	22.033	3.818	.035	.220	7.637	.644
	EngagingStakeholders	8.467 ^b	2	4.233	4.313	.024	.242	8.626	.700
	IdentifyingGaps	2.067 ^f	2	1.033	3.822	.035	.221	7.644	.644
Intercept	BuildingConnections	340.033	1	340.033	28.825	.000	.516	28.825	.999
	FindingIdeas	672.133	1	672.133	46.676	.000	.634	46.676	1.000
	IdentifyingOpportunities	90.133	1	90.133	15.620	.001	.366	15.620	.968
	EngagingStakeholders	12.033	1	12.033	12.260	.002	.312	12.260	.921
	IdentifyingGaps	1.633	1	1.633	6.041	.021	.183	6.041	.659
Period	BuildingConnections	258.467	2	129.233	10.955	.000	.448	21.911	.983
	FindingIdeas	465.067	2	232.533	16.148	.000	.545	32.296	.999
	IdentifyingOpportunities	44.067	2	22.033	3.818	.035	.220	7.637	.644
	EngagingStakeholders	8.467	2	4.233	4.313	.024	.242	8.626	.700
	IdentifyingGaps	2.067	2	1.033	3.822	.035	.221	7.644	.644
Error	BuildingConnections	318.500	27	11.796					
	FindingIdeas	388.800	27	14.400					
	IdentifyingOpportunities	155.800	27	5.770					
	EngagingStakeholders	26.500	27	.981					
	IdentifyingGaps	7.300	27	.270					
Total	BuildingConnections	917.000	30						
	FindingIdeas	1526.000	30						
	IdentifyingOpportunities	290.000	30						
	EngagingStakeholders	47.000	30						

	IdentifyingGaps	11.000	30						
Corrected Total	BuildingConnections	576.967	29						
	FindingIdeas	853.867	29						
	IdentifyingOpportunities	199.867	29						
	EngagingStakeholders	34.967	29						
	IdentifyingGaps	9.367	29						

a. R Squared = .448 (Adjusted R Squared = .407)

b. Computed using alpha = .05

c. R Squared = .545 (Adjusted R Squared = .511)

d. R Squared = .220 (Adjusted R Squared = .163)

e. R Squared = .242 (Adjusted R Squared = .186)

f. R Squared = .221 (Adjusted R Squared = .163)

Estimated Marginal Means

		Period			
Dependent Variable	Period	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
BuildingConnections	Period 1	.500	1.086	-1.729	2.729
	Period 2	7.400	1.086	5.171	9.629
	Period 3	2.200	1.086	-.029	4.429
FindingIdeas	Period 1	.200	1.200	-2.262	2.662
	Period 2	9.800	1.200	7.338	12.262
	Period 3	4.200	1.200	1.738	6.662
IdentifyingOpportunities	Period 1	.100	.760	-1.459	1.659
	Period 2	3.000	.760	1.441	4.559
	Period 3	2.100	.760	.541	3.659
EngagingStakeholders	Period 1	.000	.313	-.643	.643
	Period 2	1.300	.313	.657	1.943
	Period 3	.600	.313	-.043	1.243
IdentifyingGaps	Period 1	5.551E-17	.164	-.337	.337
	Period 2	.600	.164	.263	.937
	Period 3	.100	.164	-.237	.437

Post Hoc Tests

Period

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Period	(J) Period	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
BuildingConnections	Period 1	Period 2	-6.9000 [*]	1.53599	.000	-10.7084	-3.0916
		Period 3	-1.7000	1.53599	.518	-5.5084	2.1084
	Period 2	Period 1	6.9000 [*]	1.53599	.000	3.0916	10.7084
		Period 3	5.2000 [*]	1.53599	.006	1.3916	9.0084
	Period 3	Period 1	1.7000	1.53599	.518	-2.1084	5.5084
		Period 2	-5.2000 [*]	1.53599	.006	-9.0084	-1.3916
FindingIdeas	Period 1	Period 2	-9.6000 [*]	1.69706	.000	-13.8077	-5.3923
		Period 3	-4.0000	1.69706	.065	-8.2077	.2077
	Period 2	Period 1	9.6000 [*]	1.69706	.000	5.3923	13.8077
		Period 3	5.6000 [*]	1.69706	.007	1.3923	9.8077
	Period 3	Period 1	4.0000	1.69706	.065	-.2077	8.2077
		Period 2	-5.6000 [*]	1.69706	.007	-9.8077	-1.3923
IdentifyingOpportunities	Period 1	Period 2	-2.9000 [*]	1.07428	.031	-5.5636	-.2364
		Period 3	-2.0000	1.07428	.169	-4.6636	.6636
	Period 2	Period 1	2.9000 [*]	1.07428	.031	.2364	5.5636
		Period 3	.9000	1.07428	.683	-1.7636	3.5636
	Period 3	Period 1	2.0000	1.07428	.169	-.6636	4.6636
		Period 2	-.9000	1.07428	.683	-3.5636	1.7636
EngagingStakeholders	Period 1	Period 2	-1.3000 [*]	.44305	.018	-2.3985	-.2015
		Period 3	-.6000	.44305	.379	-1.6985	.4985
	Period 2	Period 1	1.3000 [*]	.44305	.018	.2015	2.3985

		Period 3	.7000	.44305	.271	-.3985	1.7985
	Period 3	Period 1	.6000	.44305	.379	-.4985	1.6985
		Period 2	-.7000	.44305	.271	-1.7985	.3985
IdentifyingGaps	Period 1	Period 2	-.6000*	.23254	.040	-1.1766	-.0234
		Period 3	-.1000	.23254	.903	-.6766	.4766
	Period 2	Period 1	.6000*	.23254	.040	.0234	1.1766
		Period 3	.5000	.23254	.099	-.0766	1.0766
	Period 3	Period 1	.1000	.23254	.903	-.4766	.6766
		Period 2	-.5000	.23254	.099	-1.0766	.0766

Based on observed means.

The error term is Mean Square(Error) = .270.

*. The mean difference is significant at the .05 level.

Homogeneous Subsets

BuildingConnections

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.5000	
Period 3	10	2.2000	
Period 2	10		7.4000
Sig.		.518	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 11.796.

- a. Uses Harmonic Mean Sample Size = 10.000.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
- c. Alpha = .05.

FindingIdeas

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.2000	
Period 3	10	4.2000	
Period 2	10		9.8000
Sig.		.065	1.000

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 14.400.

- a. Uses Harmonic Mean Sample Size = 10.000.
- b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.
- c. Alpha = .05.

IdentifyingOpportunities

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.1000	
Period 3	10	2.1000	2.1000
Period 2	10		3.0000
Sig.		.169	.683

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = 5.770.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

EngagingStakeholders

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.0000	
Period 3	10	.6000	.6000
Period 2	10		1.3000
Sig.		.379	.271

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = .981.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

IdentifyingGaps

Tukey HSD^{a,b,c}

Period	N	Subset	
		1	2
Period 1	10	.0000	
Period 3	10	.1000	.1000
Period 2	10		.6000
Sig.		.903	.099

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square(Error) = .270.

a. Uses Harmonic Mean Sample Size = 10.000.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.