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Custom-built environments for Communities of Online Informal Learning: an exploratory study of tools, structures, and strategies

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CUSTOM-BUILT ENVIRONMENTS FOR COMMUNITIES OF ONLINE INFORMAL LEARNING: AN EXPLORATORY STUDY OF TOOLS, STRUCTURES, AND STRATEGIES

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DEDICATION

This study is dedicated to my husband, parents, and children:

My husband, Jason Velez, offered the patience, love, and resources to support this project, including a hundred back rubs and a skilled ability to format graphs.

My parents, Hope and Terry Welch, inspired the learner in me. My father can rarely be seen without a book in hand, and my mother always wanted to continue her education.

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My children's teachers and the school room mothers had to take care of a great deal of my children's education.

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ABSTRACT

This qualitative, exploratory study grouped together and explored custom-built environments for communities of online informal learning (COILs) with a special lens on the socio-technical relationship of platform tools, structures, and strategies that lead to social learning. The study was conducted through a three-phase process. First, a list of possible candidate sites was analyzed for appropriate fit based on the defining terms of a custom-built COIL environment. Second, an observational content analysis was implemented on 10 of the sites to aggregate a list of the tools, structures, and strategies used in the sites. Lastly, the same 10 sites and the lists of tools, structures, and strategies were researched through both pre-established codes for sociability, usability, and community-building designs and an open exploratory observation of their uses with a focus on the way these features support COILs. Social learning and informal learning were also purposefully scrutinized while themes regarding personalized learning and sustainability also emerged from the exploration. All design themes were found represented within the sites, as were social learning, informal learning, personalized learning, and efforts toward sustainability.

Keywords: social learning, socio-technical systems, informal learning, self-directed learning, usability

Chapter One: Introduction

Learning has never been as easy as it is currently for the hundreds of millions of people with Internet access around the world. A person with the motivation to learn nearly any subject can merely type the word in her or his browser and find others who have written about, discussed, posted a video about, or somehow addressed the topic. If a self-determined learner (Knowles, 1975; Ryan & Deci, 2000a) is interested in more than just a one-time experience with the topic, she or he might look for a learning community that has been built around the subject. Many of these subject-specific learning communities have become large and established entities of learning that house thousands and even millions of members congregating around a learning topic.

In order to make informal learning successful in online community environments, the sites are often constructed in a specific way so that the collective intelligence (Lévy, 1997) of the massive group can inspire learning for the right person at the right time (Riel, 1998). These custom-built learning communities are not typically tied to formal educational settings and are not structured around instructor-led methods (Hager & Halliday, 2007), so the model is different from the online formal educational environment. These custom-built communities are designed for social interaction around a learning purpose. The individuals in these communities are typically self-directed in their learning efforts and can learn in this manner by using the specific tools, structures, and strategies of the community environment or platform. The platforms and environments that are custom-built to serve as the foundation for communities of online informal learning are the subjects of this research.

As indicated by socio-technical (Bijker, 1995) and design studies (Norman, 2013), the study of online platforms and environments is important because the affordances of the tools, functions, structures, and strategies in technologies combine together as the architecture within which society must interact. Although various studies have been conducted regarding singular types of communities of online informal learning or singular phenomena within a community (B. Gray, 2004; Pfister, 2014; Pisa, 2013; Rheingold, 1993), these communities are not typically grouped together for a collective exploration, and even fewer have been analyzed for the common and unique elements in the platforms that support these communities (Owens, 2014; Sackey, Nguyen, & Grabill, 2015). These communities are relatively new phenomena due to the recent emergence of the technological and social advances that help them exist (Ala-Mutka, 2010). However, these communities are not often as tied to the research agenda of institutions like formal education (Hager & Halliday, 2007; Livingstone, 2001; Schwier & Seaton, 2013), so these specific learning environments have not received the same research scrutiny of their more formal counterparts (Sackey et al., 2015). This makes the study of the custom-built environments of communities of online informal learning important for the purpose of investigating the building blocks of a relatively recent learning phenomenon.

Communities of online informal learning have become powerful and massive houses of knowledge that are beginning to change the way people learn online—enough so that formal education environments are beginning to take note of the differences in structure and type of learning that take place within their walls (Hustad & Artnzen, 2013; Sackey et al., 2015). Design recommendations for these community

platforms differ in important ways from the more studied formal culture of learning in online education environments, especially in areas of sociability, collaboration, and autonomy. Literature regarding social design, usability design, and online community building has become increasingly ubiquitous since the beginning of the latest millennium (Preece, 2001).

This research used both content analysis and exploratory observation to understand the emerging phenomenon of the custom-built environments used in large communities of online informal learning (what this research refers to using the acronym COILs for easier discussion). It investigated the current tools, structures, and strategies used in these custom-built environments to see if they followed literature design recommendations or if they relied on unique platform choices, and to see how they supported COILs. Due to the fact that COILs is a new term, this chapter clarifies the definition of *communities of online informal learning*, describes the importance of studying these custom-built environments, and introduces the guiding purpose and research questions for the study.

What Are Communities of Online Informal Learning?

COILs are online spaces where people form communities around specific learning interests in order to learn without being expressly tied to the prescriptive teachings that are typical of formal learning environments. These COILs are changing the way we learn. Prior to the Internet, an aspiring chess player like Bobby Fischer would have needed to find a teacher or a book and someone in the community who had a desire to play chess (Brady, 1973). If this person had wanted to become good at chess, this individual may have had to relocate closer to hubs of other chess players

who had like-minded aspirations. Now, however, through the connective nature of the Internet and the advent of chess sites like www.chessacademy.com, www.learningchess.net, and www.Chess.com, an individual with chess-playing aspirations can learn chess in the comfort of home.

Due to the affordances of current technologies, the creative teams behind sites like those pertaining to chess have been able to choose specific tools, structures, functions, and community-building strategies to create a custom-built environment that helps chess-playing hopefuls learn through functions such as playing on a digital play board, building relationships, watching video tutorials, asking questions of other chess players, and several other platform-based capabilities. Chess.com (2016) currently boasts over 13 million users with tens of thousands on the site at any given time.

Chess is not an anomaly in the COIL realm. Online learning communities have been built for subjects as varied as art (http://www.deviantart.com/), book-writing (www.writerscafe.org), 3-D printing (www.thingiverse.com), citizen science (http://www.zooniverse.org), genealogy research (www.ancestry.com), traveling practices (www2.WAYN.com), and myriad other topics. These types of sites have several commonalities; for example, they all focus on community learning for a specific learning topic or purpose, they all create a custom-built space for people to share, and they all allow for self-directed, informal learning within a social setting.

As an example of the impact of these types of communities, at a recent conference luncheon the researcher mentioned the online knitting community of Ravelry (https://www.ravelry.com). One of the conference members said,

> I don’t know what I’d do without Ravelry.com. I used to have to go to my local knit shop and hope a worker there knew how to use certain types of yarn or could

> show me new knitting tricks. Now, I can get on Ravelry and find pictures and videos of people doing exactly what I want to learn.… I don't have to depend on one person at a local shop; I have a community of knitters to turn to.

Similar to other informal learning community sites, Ravelry (https://www.ravelry.com) has specific tools, functions, and strategies to ensure that millions of knitters (Pisa, 2013) from around the world have ready access to learn exactly what they want at the time they want it (Riel, 1998). Other hobbyist sites, such as Lumberjocks (https://www.lumberjocks.com) for woodworkers and Craftsy (www.craftsy.com) for more generic crafts, also have specific tools that create community environments around their specific purpose of learning.

Why Study COIL Environments?

COIL environments are becoming powerful learning spaces for learners from all over the world with various learning desires. A 1998 report from New Approaches to Lifelong Learning (NALL) indicated that 95% of the adults sampled in their study engaged in lifelong learning they felt was important, be it work-related, home-related, volunteer-related, or of general interest (Livingstone, 2001). A 2008 study indicated that 79% of adults used the Internet to learn in informal ways without the learning being tied to formal-institution or workplace-curriculum learning (Hague & Logan, 2009). If these individuals have specific learning interests—such as knitting, chess, science, or languages—they can search the Internet to find these community spaces in which people join together to build knowledge both as a community and as individuals (Wenger, White, & Smith, 2009). The difference between the model and availability of this type of learning versus that of formal education makes these COILs a worthwhile study for various audiences (Sackey et al., 2015).

Custom-built COIL environments differ from the formal education model.

An interesting aspect of custom-built COIL environments is that they are structured in ways that differ from typical formal educational environments (Sackey et al., 2015). The difference could be explained by different philosophies of learning. Papert (1993) noted a difference between Instructionism and Constructionism. Instructionism is the top-down hierarchical model that typifies much of formal education. In Instructionism, an instructor determines the curriculum and learning path. Papert borrowed from Illich's (1971) book, *Deschooling Society*, to elaborate on the idea of Instructionism. Illich explained that school teaches students that they need to be taught formally in order to learn. The online instruction for formal education has taken this social construct of Instructionism and embodied it in its learning platform (Hannafin, Hill, Oliver, Glazer, & Sharma, 2003). Studies on socio-technical systems (Bijker, 1995) indicate that our technical systems are created by culture, which, in the case of formal education, has made online formal learning management systems—such as Blackboard, Canvas, and Moodle—areas in which instructors dictate what is to be learned and how the learning will take place. Indeed, even the collaborative aspects of online formal learning are typically dictated by instructors who prescribe the number of discussion forum posts and amount of words in each post.

Constructionism, in contrast, is a more collaborative environment in which students learn by directly experiencing the learning through self-directed means of experimentation in open settings where a learner creates an artifact, and the artifact itself can give the learner feedback along with the social audience that views the artifact (Jonassen & Land, 2012; Papert, 1993). Papert (1993) described this latter form of

learning through construction as a more natural learning experience that allows for learning at a deeper level, such as that associated with Dewey's (1938) experiential learning theories. Custom-built COIL environments embody this ideal of Constructionism by offering a public space for self-directed learners to openly share and construct knowledge together. The social ideals of Constructionism (whether explicitly or not) have informed the technologies that help to shape the learning experience of the individuals who use these environments. The difference in the type of learning that these environments afford makes the study of these custom-built learning environments an important area of research. Moreover, although this was not a comparative research, formal education can be served by gaining a better understanding of the possibilities of different learning architectures (Hustad & Artnzen, 2013; Sackey et al., 2015).

COILs are generally available to the masses. Another important element of custom-built COIL platforms is their availability to anyone with an Internet connection and the multitude of available community learning purposes. COILs are often free or low-cost, whereas their higher formal education counterparts are creating major loan debts (Johnson, Van Ostern, & White, 2012). Moreover, higher education only has the resources to offer a certain amount of course curricula within a set time limit, whereas COILs serve what is often called the *long tail* (J. S. Brown & Adler, 2008), or a plethora of learning purposes with relatively few time limitations on learning to meet the demands or needs of various people.

In a time when formal institutions have come under fire for their authoritarian control over individual learning (Watters, 2014) and cost-prohibitive learning models (Christensen & Eyring, 2011), an investigation of alternative learning methods could

help to create a *flatter* world with more access to learning (Darling-Hammond, 2010) and more individual choice (Falk, Heimlich, & Foutz, 2009) of learning subjects.

The intended audience for this study. A study of this type can meet the needs of those who want to be informed about the construction of custom-built COIL environments. Various groups would have different reasons to read such a study. This research was intended for:

1. Consumers of learning who want more choices in their learning opportunities,
2. Individuals who want to emulate the practice of building COIL environments,
3. Creators of formal education environments who want to understand a different set of tools for learning,
4. Learning scientists who want to understand the current platforms for social constructivist learning (Jonassen & Land, 2012), and
5. Formal education administrators who are curious about alternative methods of learning (Mazoué, 2012).

Who Builds Environments for COILs?

The ability to create a large online environment for COILs involves an understanding of community building (Preece, 2001), some sense of the learning needs of the individuals in the community, and the ability to steward the appropriate technologies (Wenger et al., 2009). This might involve a group of people, as in the case of Informal Science (www.informalscience.org), or it might be one or two people, as in the case of Ravelry (Pisa, 2013). This research gives an overarching term for these individuals by calling them the *creative team*, while the exact titles might include founders, creators, developers, designers, and builders among others. The creative

team behind these platforms has had to make important decisions in order to support the learning, technologies, and community building for their specific learning interest, and each learning interest requires its own unique supports (Wenger et al., 2009).

What Did This Study Examine and How?

Due to the emerging nature of the phenomenon of COILs and the lack of collective exploration of custom-built COIL environments, this study sought to build a basis for understanding the design of COILs. By analyzing the functional traits of several online community platforms built specifically for a learning purpose that was not tied to formal settings, this research sought to reify the phenomenon of these communities and establish them as a collective group.

Purpose statement. Accordingly, the purpose of this study was to reify the concept of COILs as a collective study and to determine (a) what types of environments could be considered custom-built COIL environments; (b) the common and/or unique functional elements, meaning the common and/or unique tools, structures, and strategies, used in custom-built COIL environments; and (c) the way these tools, structures, and strategies supported COILs.

Research questions. To investigate these COIL environments, the following research questions were used in this study:

1. What current types of online platforms are custom-built to host a community of informal learners for a specific learning purpose?
2. What tools, structures, and strategies are evident in these custom-built environments?

3. How do these tools, structures, and strategies appear to support the community of online informal learners?

Using online searches and other leads, several online platforms were vetted to ascertain whether they fit the definition of an environment custom-built for an online community of informal learners with a specific learning purpose. The tools, structures, and strategies used in a small number of these environments were analyzed and explained through the lens of current sociability, usability, and community-building design literatures. Finally, an open exploration ensued regarding the observable support these tools, structures, and strategies offered the specific COILs.

Assumptions of this study. This study came from a pragmatist worldview with an underlying assumption that an inspection of the social and cultural elements of environments that support social learning was an important area of focus, which had a connection to the social constructivist value (Creswell, 2007). An assumption of this study was that there is value in socially constructed, informal learning (Hager & Halliday, 2007; Knowles, 1975; Vygotsky, 1980). Another assumption was that the online environments custom-created to support this type of learning were important to study from both a social constructivist and a pragmatic perspective for future designers (Howard, 2010; Wenger et al., 2009), learners, learning scientists, and individuals in formal education (Sackey et al., 2015).

Methodology. For this study, two preliminary stages of content analysis set the stage for the final qualitative exploratory study. The first stage of content analysis used a broad definition of custom-built COILs in order to distinguish custom-built COIL environments from different online environments (more explanation of this in Chapters

Two and Three). Based on the findings of the first stage along with added criteria for the study, 10 custom-built COILs were located and chosen for further inquiry. The second stage of content analysis focused on these 10 chosen custom-built COIL environments by quantifying the specific tools, structures, and strategies used in the environments. An explanation of some of the design elements used in this quantitative aspect of the exploration can be found in Chapter Two. The final stage of the process was an exploratory review of the observable way in which these tools, structures, and strategies supported the COIL environments.

Delimitations and Clarification of Terms for COIL Environments

In order to best understand the phenomenon of COILs and custom-built environments, it was important to clarify the terms used in this paper and the exact focus of this research. The following gives a brief description of the elements of a COIL environment.

For the purpose of this research, the terms of custom-built COIL environments can be parsed in the following way:

- *Community of learners*: A social group of individuals gathered together around a common learning interest (A. J. Kim, 2000) and participating in activities, rituals, and shared learning culture (Preece, 2001).
- *Online learning*: Learning that is mostly or fully online.
- *Informal learning*: Learning that is self-directed and not tied to predominantly prescribed or formal education (Hager & Halliday, 2007; Livingstone, 2001).
- *Custom-built environment for COIL:* A platform custom-built specifically for the learning interest and needs of the community of online informal learners.

The term *environment* in this study referred to the complex system (Jacobson & Kapur, 2012) of tools, structures, and strategies encapsulated in an online space to house the community (Wenger et al., 2009) and its online informal learning practices. This research sought out custom-built environments that show evidence of a suite of tools facilitating community needs for learning (Howard, 2010; Wenger et al., 2009) and a navigable platform that helped learners to more easily access each other and the intended learning purpose (A. J. Kim, 2000; Preece, 2001). Further criteria for choosing these environments are discussed in Chapters Two and Three.

For clarification's sake, there are certain phenomena that might seem similar to the custom-built COIL environments included in this study, but certain elements are missing; therefore, these environments were excluded from the scope of this study. For example, this study did not include groups that form solely for emotional or other support detached from any learning object (A. J. Kim, 2000). Likewise, this was not a study of purely social networking, which is more focused on a user's interaction with other individuals rather than an individual or community's interaction with learning (Howard, 2010; Wenger, Trayner, & de Laat, 2011). Certainly, social networking and emotional support may take place within COILs, but if the main intention of purposive learning of a specific topic or learning object was missing from the development of these sites, the phenomenon was not included in this study. Another type of online social learning that was not studied is the question-and-answer events that often take place on sites such as Quora. Finally, this study did not delve into community platforms that were built for more generic purposes and adopted by communities, such as many bulletin board community structures or communities that used third-party platforms that were

not custom-built for their needs (e.g., Facebook communities). Although these sites constituted viable venues and/or communities for social learning of several topics, they did not explicitly create a custom-built space for a specific learning community with a unique purpose (A. J. Kim, 2000) wherein the foundational structures of the site led to the social rites, policies, and culture (Preece, 2001) that form the community around the learning interest.

Limitations of this Study

This study had certain limitations. First, by the nature of this exploratory research, this study was meant to extract information about a new phenomenon through observation of its characteristics (Marshall & Rossman, 2006) that could be aggregated into large categories and themes related to the unit of analysis, or custom-built COIL environments; however, it did not delve into descriptions beyond a general foundation for understanding custom-built COIL environments, such as may be done in ethnographic studies or phenomenological studies of the lived experiences of individuals who inhabit custom-built COIL communities. Another limitation was that this study did not measure or assess the learning that was happening within the studied environments. Although elements of learning were observed, this study was not designed to qualify or quantify the levels of learning within the environments. Also, although this study could inform some aspects of formal education, exact parallels should not be drawn between formal education and informal education environments since the motivations and learning goals are not exactly equal in purpose. The intent of this research was to begin to lay a foundation for future research on COILs and their

environments. Future research can focus on aspects that were considered limitations in this current study.

Summary

Custom-built COIL environments have an exciting potential to offer information about the way people learn with no scripts or prescribed regulations (Hager & Halliday, 2007; Livingstone, 2001). These spaces have been formed by a creative team of individuals who have chosen to create a custom-built learning environment that gathers together collective intelligence (Lévy, 1997) around a learning object and promotes sharing within that environment. The tools, structures, and strategies used for these environments create the important space within which the informal learning can take place in a socially constructed way instead of a formulaic learning path (Jonassen & Land, 2012). This study focused on these learning environments through a three-stage design of content analysis and qualitative exploratory research. This study can inform aspiring creators of future COIL platforms and learners of the type of learning environment that supports self-direction and community involvement in learning, it can inform social constructivists about platforms that facilitate social learning, and it can inform formal education of a different construct for learning.

Chapter Two: Review of Literature

As stated in Chapter One, the purpose of this research was to determine the functional elements used in custom-built COIL environments while exploring manifestations of these features as they supported the needs of the learning community. This chapter defines foundational elements of these environments and presents some of the contemporary and historical literature about social and informal learning, socio-technical systems, Web 2.0, social design, usability design, and online learning community design. This chapter will outline the criteria used to guide the researcher toward choosing the sites of study. From the criterion-based selection of sites, the units of analysis, namely custom-built COIL environments, were located. This chapter also reviews recent studies of COILs and their environments, although not yet reified with that specific name, while offering the argument that this specific study is important based on gaps found in the literature.

Defining COIL Environments

The meaning of the term *environment* in this literature is greatly inspired by the ecological sense of the term as a metaphor for technology. For example, Wenger et al.'s (2009) idea of *digital habitats* is akin to living habitats wherein a species interacts with the physical and social structures of the environment in order to create its living space. In the authors' comparison to digital habitats, the species is the user and the physical and social structures are the tools and functions that together make up the environment. Clark (2011) explained a similar perspective in his description of *cognitive niches.* According to Clark, cognitive niches mimic biological niches of species that manipulate their surroundings to fit their needs for living, such as spiders that create

webs for eating, rabbits that create burrows for safety, and beavers that create dams to increase the capacity of their living conditions. Humans who choose to join online cognitive niches use the tools and functions within the environment to create their own learning habitats. For this study's online environments of informal learning communities, these users need to interact within the environment created for them in order to inhabit and create their own learning space.

It is important to remember that an online environment is designed by a creative team that has certain ideologies that inspire their use of designs, tools, and functions for these habitats. In fact, Trevor Owens (2014) of George Mason University devoted his entire dissertation to analyzing 22 years of literature that would inspire these ideologies for the creative team of these types of environments. He acknowledged, however, that the literature is only part of the story, and an actual study of the design choices of both the tools and community management in online community environments would be beneficial.

Whether purposefully or inadvertently, the represented underlying learning theories and visible features within custom-built COIL platforms distinguish them from other online gathering places. This chapter starts by explaining the theoretical framework of informal, self-directed, and socio-cultural learning that represents the basic purpose for exploring COIL environments. The second part of this chapter explains socio-technical systems theory along with the functional description of the literature that advises creative teams on social design, usability design, and community-building design principles with their associated tools for online communities. Many of these concepts were used in the analysis described in Chapter Three. They served as

either an a priori code for the exploration of the environmental design elements or the focus of the open exploration of functions that supported the community needs, such as the needs for informal, self-directed, and socio-cultural learning. This description serves as the introduction for this exploratory research of custom-built COIL environments.

Learning Theory and COIL Environment Participants

In order to understand the important supports that underlie COIL environments, it is important to comprehend the individuals who participate in these environments and the learning theories that describe the type of learning these individuals undertake. This section gives a broad view of the participatory culture that is made up of informal, self-directed learners who engage in social learning.

Current popular literature on convergence and participatory culture. Since 2000, multiple popular books have been written about the revolutionary phenomenon of the new participatory culture, or the type of culture that helps people to learn, develop, create, and play together (Itō, 2010). The concepts in these books give an indication of the types of users involved in COILs, underscoring the important changes society has made in recent decades in order to create an Internet capable of hosting online informal learning environments. They also express the important force these collaborative environments can instigate and foster.

In the popular book, *Convergence Culture: Where Old and New Media Collide*, American media professor Henry Jenkins (2006) described the democratizing powers of a participatory media that allows individuals to participate and have a voice in ways not previously afforded by a one-way media. Jenkins cited Tim O'Reilly, who used the term Web 2.0 to describe the ability to create peer-shared, user-generated content that can

be produced collaboratively and iterated within large groups, changing individuals from consumers to producers. He used examples such as a Harry Potter fan club to show how writing structures that have typically been taught in creative writing courses can now be created and learned within a community. In these fan club cultures, literacies once taught mostly in formal educational settings were made available via socially-facilitated learning, a phenomenon Gee (2005) and Lankshear and Knobel (2011) have since studied in depth in regard to the literacy and engagement of these types of learners.

Clay Shirky (2008b), another popular professor and author who has studied the cause and effect relationships of Internet and society, further described the democratizing power of social media that has removed power structures from a one-to-many medium to a many-to-many media. Through multiple stories, he illustrated the effects of this on major institutions, from the way in which businesses run differently with collaborative production to how social media in China released information that would have otherwise been suppressed by the government (Shirky, 2009). Shirky (2008b) related the innate human desire to be a part of groups to the phenomenon of social media and indicated that with our new technological capacity to grow these groups in massive scale, a new force has arisen.

In the book *Hanging Out, Messing Around and Geeking Out: Kids Living and Learning with New Media,* Mizuko Itō (2010), a professor from the University of California, Irvine, delved into the lives of adolescents who formed groups online. Itō scaled their different online interactions from merely socializing to a more involved and focused learning of media creation such as web design, shared code, and shared

YouTube channels. She remarked that more formal settings were not positioning themselves to help these adolescents to learn; rather, the adolescents' self-directed desire to learn and ability to find the right online group supports helped them to advance in media-making knowledge beyond what formal settings would have been able to accomplish.

Finally, Yochai Benkler (2006), a professor of Entrepreneurship and Legal Studies at Harvard, discussed the economic importance of these types of groups that form together as individuals learn, leading to a peer-production model that can offset the inadequacies of the typical market model. According to his studies, a large group of volunteers with a devoted interest in a learning object can create outputs that are as accurate as an expert could create. Although not all researchers agree that people in groups think better (Keen, 2007; Lanier, 2010), Benkler's type of research is replicated in Reagle's (2010) description of the outputs of Wikipedia, which were deemed to be nearly as accurate as the market-created encyclopedia and to include more up-to-date information than their market-created counterpart.

These thought leaders recognize the important recent move society has made from consuming information and goods produced by authoritative others to an ability to create and produce information, ask questions, and democratize previous authority structures (H. Jenkins, 2006; Shirky, 2008b). Through the transition from Web 1.0, a more market-led creation of information as a product, to Web 2.0, the user-generated model of sharing (Benkler, 2006; H. Jenkins, 2006; O'Reilly, 2007; Shirky, 2008b), society has created an environment in which quality learning can take place through active peer-sharing in communities instead of authority-driven instructional models.

Before understanding the tools and functions created for peer-sharing, further explanation of the types of users who form these COILs will help set the stage for an exploration of the types of tools necessary to support these individuals in their learning pursuits.

Informal learners. Much of the literature on participatory culture, such as that from Itō (2010) and H. Jenkins (2006), has described a connected type of learning that can occur without a set curriculum or instructor. In order to understand the community of learners in the participatory environments that make up COILs, it is important to explore the concept of informal learning.

Online informal learning has become a normal everyday activity for many people. A 2008 survey summarized by Hague and Logan (2009) indicated that of 1,971 adult respondents, 94% had learned through self-directed, intentional means outside of a formal setting within the 3-month period prior to the survey. Out of these individuals, 79% used technology to do so. According to the authors, the average time spent on this type of learning was 8 hours per week, and 96% of this learning was done from the comfort of home. Three-quarters of these individuals felt that informal learning had great benefits. Although not all of this informal learning happened in full-fledged learning communities, the Internet has clearly become a space where people turn to learn informally.

As stated in Chapter One, this research explains informal learning using Livingstone's (2001) definition: "any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria" (p. 5). Even within this seemingly benign definition, however, there are certain

questions about how intentional this type of learning might be (Hager & Halliday, 2007). Also, some authors describe a spectrum of formality of learning and question where in that spectrum this definition might fall. The history of the study of informal learning and the ensuing differences in thought show these spectrums.

First studies of informal learning. In the mid-20th century, studies of informal learning began to appear in the academic mainstream. Educators such as Josephine Macalister Brew (1947) wrote books on informal education, noting the difference between learning with a scripted formal education and the learning that took place in less-scripted and more social settings, like clubs and organizations. In 1950, Malcolm Knowles, one of the primary theorists for adult learning, continued with this theme by focusing on the informal learning of adults, also noting the self-directed ability of adults to join associations and organizations for the purpose of learning. Malcolm Knowles' mentor, Eduard Lindeman (1925), similarly wrote books on adult learning in socialized environments and esteemed highly the works of Dewey (1916) on democratic learning and experiential education.

Studies of informal learning have advanced since the early works by Brew, Knowles, Lindeman, and Dewey. The most prominent research on informal learning has come from workplace learning (Billett, 2004; Evans & Kersh, 2004; Marsick, 2009; Marsick & Watkins, 2001; Solomon, Boud, & Rooney, 2006), those interested in informal learning as an extension of formal education (Lohman & Woolf, 2001), and lifelong learning (Jarvis, 2009). Within the research, there is an ongoing argument about the exact meaning of the term *informal learning*. Namely, there is debate about the

spectrum of formality that houses informal learning and the level of intention an individual must have in order to learn informally.

Spectrum of thought in level of formality of learning. When speaking of informal learning, several researchers distinguish the following three levels of formality: (a) formal, meaning directed by an authority and tied to an institution; (b) non-formal, meaning sought out by an individual but directed by a teacher or coach and many times used for the purpose of gaining work-related knowledge or professional development; and (c) informal, meaning purposeful, or implicit learning that does not rely on a fixed curriculum; rather, it is socially based and self-directed (Hague & Logan, 2009; Livingstone, 2001; Schwier & Seaton, 2013). These descriptions indicate that formal learning is found in or through credential-bearing education, and non-formal learning is often found in workplace settings or for explicit work enhancement. However, informal learning is not necessarily given a specific location or breed of authorizing organization.

The location of informal learning is a point of debate for some researchers. Colley, Hodkinson, and Malcolm (2003) and Marsick and Watkins (2001) described informal learning as a phenomenon that happens all of the time, even as an incidental experience within more formal settings, so attaching informal learning to a separate occasion or location from the incidental learning that happens as a part of everyday living, in their opinions, would not be a viable method of study. Hager and Halliday (2007), however, asserted that this type of broad definition of informal learning obfuscates the meaning of the term to a level that would make it impossible to research. They argued that most individuals would be able to differentiate between the types of learning that happen in a classroom and informal, unscripted learning that could happen

in other locations. The Hager and Halliday (2007) distinction between formal and informal learning included formal learning as a prescribed, explicit, teaching-focused, decontextualized study of concepts, whereas informal learning is an often unscripted, less explicit, learner-focused, more collaborative, contextually-situated study of know-how. By viewing informal learning through the lens of Hager and Halliday, it is easier to decipher the different tools that need to be available for an environment created explicitly for informal learning. Namely, the environment would need to take advantage of the collaborative nature of Web 2.0 tools.

Self-directed learning. The level of intention in informal learning is a disputed concept. This paper's use of Livingstone's (2001) definition only slightly alludes to the pursuit of learning, which would put it further on the side of intentional learning. Certainly, however, informal learning happens in ways more delimited by Schugurensky (2000) as not only the purposeful, self-directed quest for learning, but also the incidental and socialized learning that come from being in groups of people. This incidental learning is also described as *tacit learning* (Marsick & Watkins, 2001) that comes from observation of others. This paper recognizes that learning of social behaviors and unintended learning occurrences will be a part of the learning experience. However, the main point of this research was to study community environments that learners seek out and join, which entails some level of intention. For this reason, it is important to explore a specific type of informal learner: one who is self-directed.

Malcolm Knowles (1975) wrote an entire book on self-directed learning that described a self-directed learner as one who is motivated by an internal purpose to seek out answers to questions stemming from curiosity or some other inner drive. The type of

learning pursued by these self-directed learners, according to Knowles, springs from a solution-oriented problem- or task-based goal. Other researchers indicate that self-directed learners tend to have higher levels of motivation (Ryan & Deci, 2000b), self-efficacy, meaning the ability to set goals and persist to the point of achieving them (Bandura, 1977), and self-regulation (Pajares, 2008), or the ability to think at a metacognitive level and self-reflect.

As technologies improve, self-directed learning is easier to undertake. Studies of self-directed learning experiences have suggested that current technologies and projected future improvements in technology are serving and will serve to make self-directed learning more accessible (Lai, Shum, & Tian, 2014; Zander et al., 2012). This being said, the tools, structures, and strategies used in COIL environments would have to be designed for the different needs of self-directed learners and create a space for them to get their learning needs met.

Communities and social learning in learning science literature. With the absence of a single teacher or overarching curricular authority, self-determined informal learners need to resort to other learning mechanisms. In COILs, the conduit for learning becomes the social interactions and learning episodes that individuals experience through tools such as forums, shared artifacts, blogs, wikis, messages, collaborative problem solving, or other sharing and publishing functions (Wenger et al., 2009). Social learning theorists explain the phenomenon of shared and collaborative learning, which inform the usage of tools, structures, and strategies that support this style of learning. This section describes some of the more salient social learning theories.

***Social learning theory as a response to behaviorism*.** Social learning theories became popular in the last half of the 20th century. Albert Bandura (1971) introduced a theory of social learning in response to the behaviorist theory of stimulus-response reward systems. In Bandura's theory of learning, he expressed that people learn through cognitive processes of observing people's behaviors and either adopting or not adopting these behaviors. This ability to observe others is an important component of designing social learning environments (Jonassen & Land, 2012) since the typical behaviorist model of drilled memorizations and rewards is not how learning occurs in these settings.

Socio-cultural learning theory. Earlier in the 20th century, although not recognized in the Western hemisphere until much later in the century, the Russian developmental psychologist Lev Vygotsky (1980) conducted multiple studies that investigated socio-cultural learning, or learning of signs, symbols, language, and other cultural elements. His main premise was that individual cognition is intricately linked to the social observances and experiences of an individual. He established the idea of the Zone of Proximal Development (ZPD), or the zone in which one's personal learning capacity reaches its limits but can be expanded through interactions with another person who knows more. Tools that facilitate the functions of observing others' behaviors and finding more knowledgeable individuals are thus important items in an online social learning space.

Constructivist theories. Functions that aid the individual construction of learning within the COIL environment are also important, but somewhat more discrete than their formal learning counterparts since they are not typically attached to any

authoritative structure or assessments (Hager & Halliday, 2007). Constructivist theories, such as experiential learning put forth by Dewey (1938) and developmental theories from Piaget (Piaget, Cook, & Norton, 1952), indicated the need for leveled construction of knowledge. Piaget described the adaptive learning habits of assimilating, or connecting new information to existing knowledge, and accommodating, or making room in the mind for new information. Dewey expressed the need for authentic experience to help us cement knowledge in our minds. These ideas were foundational for Wood, Bruner, and Ross's (1976) explanation of scaffolding as an instructional model of creating leveled learning. Scaffolding, however, is typically a more formal model of instruction, so informal environments would need to employ specific tools to create leveled learning for users within the highly collaborative environment of a COIL while allowing for a great deal of experiential discovery since most of the learning is self-directed.

***Social constructivist theories and situated learning*.** Whereas Dewey (1938) and Piaget et al. (1952) focused more on the individual nature of constructed cognition, social constructivists, such as Vygotsky (1980), focused on the social nature of constructing knowledge. Vygotsky along with social constructivists, such as J. S. Brown, Collins, and Duguid (1989) and Lave and Wenger (1991), also focused on the social nature of learning as it pertains to the participation in activities and resulting thought processes done in the context of authentic environments whereby one learns experientially, otherwise called *situated learning*. These studies were revolutionary in that they raised the question of the quality of a formal education that decontextualized instruction enough that when a learner was put in a real context, she or he could not

function. J. S. Brown et al. (1989) illustrated this concept by describing a person who knows that an old-fashioned pocket knife has a tool for removing stones from horses' hooves, and that person may even be able to explain the procedure to remove the stones, but that same person, having never removed a stone, may not understand both the implicit and explicit steps necessary to actually remove a stone if called upon in an authentic equine environment. Authentic activities situated within an appropriate context, then, would be an important design feature for informal learning community environments, but due to the unscripted nature of informal learning, it would have to come from the types of tools, structures, and strategies used in the social environment.

***Communities of practice*.** Along with situated learning, Lave and Wenger's (1991) descriptions of communities of practice (CoPs), and the additional description of CoPs by Wenger in 1998, further the social constructivist mindset by demonstrating the trajectories of individuals within a community practicing a shared craft or profession. According to Lave and Wenger, levels of participation vary within a CoP, and each individual has an identity within a community, such as a newcomer, visitor, active member, expert, or other role. All members are legitimate and important in a CoP, regardless of their roles, and even newcomers can start with smaller tasks and work their way into fuller participation. Apprenticeship, closely allied to Vygotsky's (1980) ZPD, takes an important role in a CoP as more knowledgeable individuals either implicitly or explicitly help those who know less to understand how to participate more fully (Lave & Wenger, 1991). Although not all learning communities constitute a full-fledged practice, the foundational ideas of these CoPs can certainly help designers

understand the important functions of identity, participation, and apprenticeship within a COIL environment (Wenger et al., 2009).

***Interest-driven communities*.** Due to the rather limited scope of what a true CoP entails based on Wenger's (1998) explanation of it being a joint enterprise of practice, some researchers and theorists shy away from explaining every learning community as a CoP (Hill, 2012). Indeed, James Paul Gee (2004, 2005), a linguist and game theorist, argued that many of the groupings that people try to deem CoPs are really affinity spaces in which people share a common interest. Within these affinity spaces, Gee (2004) indicates that the central focus is the affinity, while the space includes the shared semiotic domains, or shared artifacts, words, rituals, cultural norms, and other symbols, that create a culture around the affinity (Gee, 2006).

One of Gee's (2006) main themes in his research is the different types of literacy necessary to comprehend the semiotic domains within affinity spaces. Previously, sociologist Herbert Blumer (1969) offered a similar explanation of the social effect on individual interpretation of the world. Blumer defined it as symbolic interactionism, or the ways in which individuals symbolize the things and circumstances in the environment and their reaction to these things and circumstances based on the symbols given to them. According to Blumer, these symbols are shaped into meaning through a process of socialization and experience. Gee offered a real-life explanation of this type of semiotic domain and symbolic interactionism by describing a scenario in which a *guard* dribbles a ball and makes a symbol with his fingers before passing the ball. According to Gee, understanding the symbols held within this simple story about basketball requires a certain semiotic literacy about the meaning of a guard's role, the meaning of the word

dribbling, and the symbolic representation of a hand gesture while playing basketball. Gee (2003, 2004, 2005) would contend that each affinity space has its own socially-created semiotic domain that requires a certain level of literacy for anyone desiring to be a member.

Due to the valid arguments on either side of this spectrum of CoP versus affinity spaces, the researcher has chosen the term COIL (community of online informal learning) to encompass both possibilities. For example, just as not all learning communities form around a practice, not all communities form around an affinity. At the same time, for any online interest-driven community, paying attention to semiotic domains and the literacy necessary to understand the symbolic representations along with the identities and apprenticeship formed within the community are important components that individuals in charge of creating the platforms would need to support. The exploration of the supports for semiotic domains and literacy, identity, and apprenticeships would help further the understanding of the cultural and social aspects of COIL environments.

***Studies of COILs*.** COILs, although not called by this name elsewhere, have been receiving increasing recognition on an individual basis. Communities from various subjects—such as music, language, computer science, genealogy, and even heraldry—have been examined for a range of social constructivist and situated learning topics. Studies have included topics such as levels of participation in online music-learning communities (Partti & Karlsen, 2010; Waldron, 2011, 2013; Waldron & Veblen, 2008); identity and democracy in music communities (Partti & Karlsen, 2010; Partti & Westerlund, 2012); identity, culture, and situated learning in a CoP in heraldry (Boven,

2014); moderator roles in a knitting community (Pisa, 2013); and information sharing in a genealogy community (Fulton, 2009). Although the underlying systems and tools within these environments were not studied, these studies help describe the various social phenomena pertaining to COILs.

Collective Intelligence and Socio-technical System Research

Interest-driven communities, with all of their idiosyncratic literacies, are inspired by the individual desire to gather together in spaces that allow for the production of collective intelligence. French cultural theorist Pierre Lévy (1997) initiated the conversation about the type of collective intelligence facilitated by online environments. In Lévy's description, collective intelligence occurs as an interest-driven community that allows for mutual sharing and consistent growth or enhancement based on the participants' efforts. The idea is that humans are smarter as a collective than as individuals, which has been the impetus for an entire body of literature about distributed cognition and socio-technical research, as explained further in this section.

Distributed cognition. Distributed cognition, a term similar to collective intelligence, also looks at the representations of shared cognition among participants, but adds a more socio-technical approach to its study, as it adds research in the way cognition is shared in systems, artifacts, and the environment (Hollan, Hutchins, & Kirsh, 2000; Hutchins, 2001; Salomon, 1997). With a strong tie to socio-cultural research, distributed cognitivists branch away from the typical cognitivist idea of an individual as the sole subject of study for cognition; rather, they look at the tools used by individuals in a social context to study the distributed nature of cognition (Hutchins, 2001). The premise is that cognitive processes can be spread across different people in

a social group, different tools and environmental structures, and different time periods, meaning earlier processes that affect later processes (Hollan et al., 2000).

Researchers have described what distributed cognition is in laymen's terms. Hutchins (1995a, 1995b) illustrated the interactions representative of distributed cognition by explaining the intricate ways in which the crew of a ship interacts with the various technologies on the ship to avert a crisis at sea or the ways a pilot and a co-pilot interact with each other and the technologies in the cockpit to guide a plane. Hutchins's driving point is that it is impossible to understand cognition without understanding first the culture, technologies, and environment through which individuals interact; there is an internal aspect to cognition based on the individual, as well as an external aspect based on social and technical factors. Clark (2011) made similar points clear as he examined the way in which people are capable of cognitive extension, or extending their minds, through the environment, including technology. Clark argued that humans limit themselves when explaining cognition as something that happens only in the mind:

> It matters that we recognize the very large extent to which individual human thought and reason are not activities that occur solely in the brain or even solely within the organismic skin-bag. This matters because it drives home the degree to which environmental engineering is also self-engineering. In building our physical and social worlds, we build (or rather, we massively reconfigure) our minds and our capacities of thought and reason. (p. xxviii)

Bijker (1995) focused more on the way in which society uses their distributed cognition to form technologies to meet their needs. Bijker stated, "Technological development should be viewed as a social process, not an autonomous occurrence. In other words, relevant social groups will be the carriers of that process" (p. 48). From this social constructivist perspective, Bijker explained how simple technologies such as the bicycle and the light bulb had several iterations as different actors made amendments to

these items, or what he termed *artifacts*, in order to make the artifacts function better for their different needs.

Activity theory. A theoretical framework devised to piece together the different individual, social, environmental, and tool-based constituents of socio-technical systems is known as *activity theory*. Although this research does not intend to use activity theory as an underlying measurement, it is worthwhile to make note of the interrelationship of individuals, tools, and the socio-cultural environment in which they interact in order to increase understanding of the important relationships that can affect COIL platforms.

Activity theory comes from the socio-cultural lineage of Vygotsky, starting through his colleague Leont'ev, to an expanded version from Engeström (Engeström, 1987; Engeström, 2001; Engeström & Sannino, 2010; Young, 2001). Engeström used the basic ideas of Leont'ev's design and created an easy graphic to explain the concepts. In Figure 1, the top half of the triangle shows the most basic aspect of activity theory. According to Nardi's (1996) oft-cited explanation of the players involved in the activity theory triangle, the subject is an actor (or group of actors) that desires an object or goal, the object being the physical or conceptual product that motivates the actors to act. The action often requires a mediating tool (the very top of the triangle) in order to best achieve the object. The object leads to a projected outcome (meaning, was the goal achieved or not?), which can then lead to other actions and an entirely new triangle (Engeström, 2001; Young, 2001). Nardi (1996) used the socio-technical cockpit example from Hutchins (1995b) to describe the actors as the pilots, the object as flying a plane, and the mediating tools as cockpit technologies that help the pilots fly the plane.

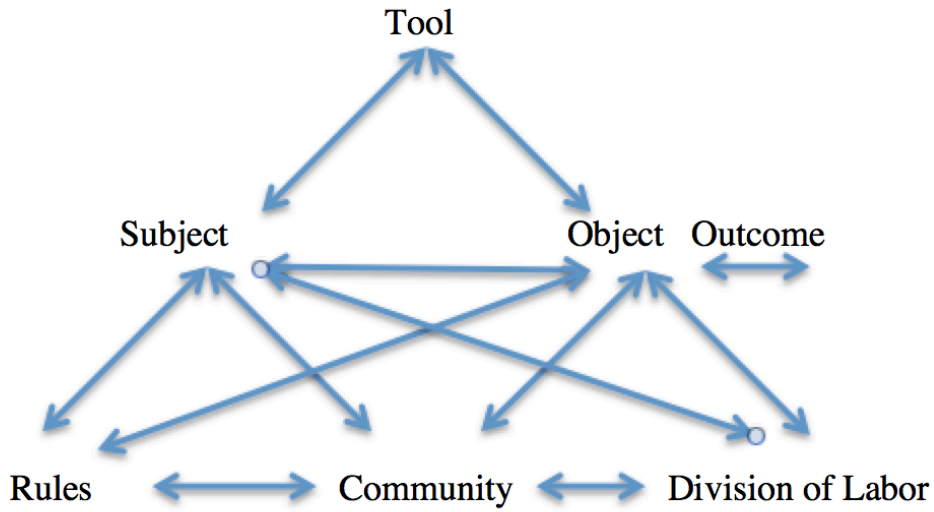

Figure 1. A re-creation of Engeström's (1987) activity theory diagram. From *Learning by Expanding* (p. 78), by Y. Engeström, Helsinki, Finland: Orienta-Konsultit. Copyright 1987 by the author. Reprinted with permission.

The lower part of the larger triangle shows the complexities that feed into the system: namely rules, community, and the division of labor. The arrows within the system show the important interrelations and mutual effects each aspect of the system has on the other variables. For example, the underlying social rules can affect the subject and the object, whereas the object can affect the social rules along with the tool, the subject, the community, the division of labor, and even the ultimate outcome (Engeström, 2001; Young, 2001). To continue with the cockpit reference, but drawing from a story of a Korean airline crash from a popular book, *Outliers: The Story of Success*, by Gladwell (2008), the rules, community, and division of labor aspects of the triangle might best illustrate where an issue of Korean pilots' social hierarchies would have made the object of flying the plane fail because inferior pilots were not able to question their superiors' cockpit usage. In other words, the actors, object, and mediating

tools were all present, but the underlying part of the activity theory triangle became their failure point, leading to their ultimate demise.

Socio-technical studies of online environments. Socio-technical studies of online environments tend to be fairly focused. For example, Hester (2012) studied the importance of aligning perceptions of technology with the social needs of the learners using a wiki in order to balance the relationship of social and technical actors in an online information management system. Ruhi (2010) researched the sociological and technical functions that increase participation in members of virtual communities. Newman (2010) designed and evaluated the complexities of a cyber-system for crowd-sourced citizen science. M. Kim and Chai (2012) took a socio-technical lens to knowledge contribution in sites created for social networking. These contributions and more have increased awareness about the important implications of technical functions in online social systems.

Tools, Structures, and Strategies in COIL Environments

As socio-technical systems theories imply, certain tools are chosen to help individuals move toward achieving a specific goal. On a large scale, one could imagine that a COIL environment in its totality is a tool that helps an individual move toward the goal of learning a specific concept. At the same time, the smaller steps that are included in the learning process can be broken down into very specific tools that lead toward the larger-scale goal. Again, this research is not fundamentally based on activity theory; however, the concept that individual tools are designed to lead toward certain objects or goals serves as a helpful catalyst to understand the need for an investigation of these individual tools. For the purpose of this research, the socio-technical term *tools* is

parsed more specifically as tools, structures, and strategies that support the community needs within these environments. This section describes these terms through the lens of literature on design for sociability, usability, and community building, serving as the guide for the second phase and the a priori code of the third phase of this research that explored the tools, structures, and strategies that supported the needs of the studied COILs.

Basic tools for sociability. Web tools have evolved from a top-down model to a more sociable, peer-sharing model of Internet use. Prior to Web 2.0, tools and functions for online communication, or what we now deem Web 1.0, typically followed a consumer model in which one person or authority posted or sent information that others would receive (Lin, Li, Deng, & Lee, 2013). These included websites or emails where one entity would create the product that others would then consume. At its inception, this was an important move for producers in that their material could reach more massive audiences. However, this model did not allow for much peer sharing and community gathering; rather, it relied on authorities such as market or educational institution experts.

***Transition from Web 1.0 to Web 2.0*.** What is now known as Web 1.0 is the original suite of tools that made up the web. By nature, these tools created a producer-consumer culture through their functions and control structures, but this changed with the introduction of tools that helped users to create content (O'Reilly, 2007). For example, Tim O'Reilly (2007) explained it as an evolution from market-driven publishing to user-generated content, from content management systems to wikis, and from taxonomies of directories to *folksonomies*, or community-created tag structures.

The earliest move from the authority-driven Web 1.0 to the peer-sharing functions of Web 2.0 came as need-driven creations from learning communities involved in programming and studying computers (Wenger et al., 2009). As per Wenger et al. (2009), the transition started with tools and functions, such as bulletin boards that turned into discussion forums for question and answer capabilities, tagging tools that fulfilled the need for pinpointing problems with code, and chat capabilities that allowed programmers to work together better. Emails became email lists that enhanced capacity for group dialogue, and ARPANET, Usenet, and The Well (Rheingold, 1993; Wenger et al., 2009) facilitated communal gathering spaces for computer and academic professionals. The tools and functions created by these communities were later adopted by the masses, including other COILs, in order to support their various needs. Current COIL environments are strong users of these Web 2.0 tools since they do not follow the typical formal education hierarchies of one teacher to many students; instead, members could all be considered teachers and students, necessitating the many-to-many Web 2.0 tools.

Inspiration from social design literature. Crumlish and Malone (2015) indicated the need to have not just user-generated content or artifacts but also tools that allow for a social conversation about the artifacts. Thus, a COIL environment would need to have tools that allow for conversations around the artifacts on top of the artifact sharing and storage.

Design literature for sociability suggests several tools that help people to create and store artifacts and have ensuing conversations. For example, Crumlish and Malone (2015) suggested using tools that allow all members to broadcast artifacts like

discussion posts, blogs, podcasts, and videos, while also allowing individuals to save artifacts on an online personal page, signify the artifacts as personal favorites, tag them with common words for future searches, display them on walls that can be viewed by others, and converse about the artifacts. They suggested several ways to converse about the artifacts by using tools such as ratings, promotional voting, recommendations, comments, and forum discussions. If delving further into the collaborative aspects of communities, Crumlish and Malone added the important participatory tools of mutually editable wikis, crowd-sourced environments, and even project management tools.

***Inspiration from social networks and media*.** Social networking and media sites have inspired many of the functions that allow for easier sharing of user-generated content today (O'Reilly, 2007). Examples of social networking sites that have created social conversations around posted artifacts include Facebook, LinkedIn, YouTube, Flickr, and Del.icio.us. These sites have inspired social connections, media-sharing, and social bookmarking (Gunawardena et al., 2009) by using specific tools that show artifacts in the form of text, images, audio, and video. In addition to the artifact placement, each piece of content has one or several modes of conversation such as text descriptions, rating buttons, sharing mechanisms, and tagging features, some of which were, in turn, inspired by other social media such as Amazon's user-generated ratings, Flickr's folksonomies, and Wikipedia's trusted user content (O'Reilly, 2007). The list of tools is long and may include the ability to use hyperlinking, RSS feeds, and multiple forms of ranking, etc., all of which have created an atmosphere in which participation can reign supreme. These tools often become the mechanisms through which other individuals can filter through the importance of specific concepts based on

individual needs and affinities. This research investigated the types of tools that were designed to promote user-generated material and sharing in 10 COIL environments, including those tools inspired by social networks and media.

***Social tools specific for communities*.** In addition to the artifacts and conversations around those artifacts, cohesive communities need specific tools that deal with people, identities, roles, and relationships within the community. In the absence of a single authority figure who guides the learning, such as in more formal learning, people need to be able to find others within the community who have answers to their questions and similar interests to their own. According to social design literature, special tools need to be in place to support building profiles, supporting identities, assigning roles, and building relationships (A. J. Kim, 2000; Wenger et al., 2009).

Profiles. A. J. Kim (2000) described the importance of allowing individuals to build public profiles. According to Kim, these profiles can be as self-chosen and simple as a name and picture or avatar. Crumlish and Malone (2015) added that self-chosen contextual markers, such as a favorite book choice in a book club or tags that indicate specific learning interests, can give added information to the community. For a more robust profile description, a representation of recent posts, an indication of other members' impressions of their interactions with the individual, and a clear indication of roles and amount of time within the community can be offered through the appropriate tools according to Kim. These profiles can be used to support identity-building (A. J. Kim, 2000; Kraut et al., 2012; Wenger et al., 2009), as well as to clarify the roles individuals play within the community. The following list of questions gives an example of the explorations regarding profiles done within the chosen COIL environments.

- Are there visible profiles on the site?
- Do members have control over their own profile creation?
- Are pictures or avatars used for the profiles?
- What attributes can be shown through the profiles?
- How can individuals personalize their profiles?
- What other phenomena related to profiles occur within the COIL environments?
- What are the similarities and differences related to profiles in the various COIL environments?

Identities. As explained in the section on social learning, Wenger (Lave & Wenger, 1991; Wenger et al., 2009) described identities such as *lurker*, *newcomer*, *visitor*, *active member*, or *expert*. A. J. Kim (2000) explained these identities in a membership lifecycle, which includes *visitors*, *novices*, *regulars*, *leaders*, and *elders*. Each of these identities potentially needs support within the community environment in order to help the identity to reach its goals. For example, a novice may need extra tools to help her or him to navigate the site (Wenger et al., 2009) and learn the culture of the community (Riel & Polin, 2001). Elders and experts may need tools that help to spread their wisdom while protecting them from an overabundance of requests from other members of the community. The following questions served as a guide in the exploratory research of identities within COIL environments.

- Is it easy to see the different identities of the membership lifecycle? If so, how?
- Is there navigational support for the newcomers to the site?
- How does one learn the culture of the site?

- Are experts labeled within the site and are they protected or available?
- What other phenomena occur related to identities within the COIL communities?
- What are the similarities and differences between the ways the different COIL environments deal with identities?

Roles. Roles are closely attached to identities, but they can also include the tasks that community members perform, such as the roles A. J. Kim (2000) listed as greeters, hosts, support, rule helpers, event helpers, etc., or the moderators and mediators that Preece (2001) suggested as important for community governance. According to Kim, these roles can be organized by a community designer and individuals within the role may be given manuals that explain what the role does within the community. Preece suggested that some roles come from the organic nature of personalities within the community. Their importance to governance will be explained more in the topic of policies and procedures within a community. The following list of questions guided the exploratory research of roles within the 10 studied COIL environments.

- Are there individuals with clear roles within the communities? If so, how are they marked?
- Are the roles created by leaders, or do they seem to grow organically?
- What other phenomena occur relating to the roles of individuals within the community?
- What are the similarities and differences in the way the different COIL environments treat roles within the communities?

Relationships. Tools that support profiles, identities, and roles are the important social building blocks of helping people find and follow others in order to build relationships of learning with those who may have similar interests within the community. Tools that support the ability of members to search for other members in the community with similar interests (based on, for example, profiles and tags described previously), *friend* each other, and socially tag each other within posts will support the crucial relationship-building within the community (Crumlish & Malone, 2015) that allows for cohesiveness and social learning. This research investigated if the COIL environments were indeed using tools that supported profiles, roles, identities, and relationships as advised in social and community-building design literature. Example questions that guided the exploratory research of relationships within COIL environments include:

- Can people search and find other people based on name or preferences?
- Can people *friend* other people to form relationships?
- Can individuals *tag* other individuals in order to share interests?
- What other relationship-building tools, structures, and strategies exist in the COIL environments?
- What are the similarities and differences in the way relationships are managed in the various COIL environments?

Summary of tools used for sociability. To summarize this section on tools built for sociability, there is currently a high representation of web tools shared between various online platforms. Many of these tools are conducive to creating better sociability in COIL environments. Specific tools are typically chosen to support the distinct needs

of creating the social structures to support learning. Although an a priori exhaustive list of tools will not be used, examples of these tools exist in current literature. For example, Figure 2 shows an example taken from the book *Digital Habitats* (Wenger et al., 2009) that illustrates various possible needs and how they can be met by using specific tools.

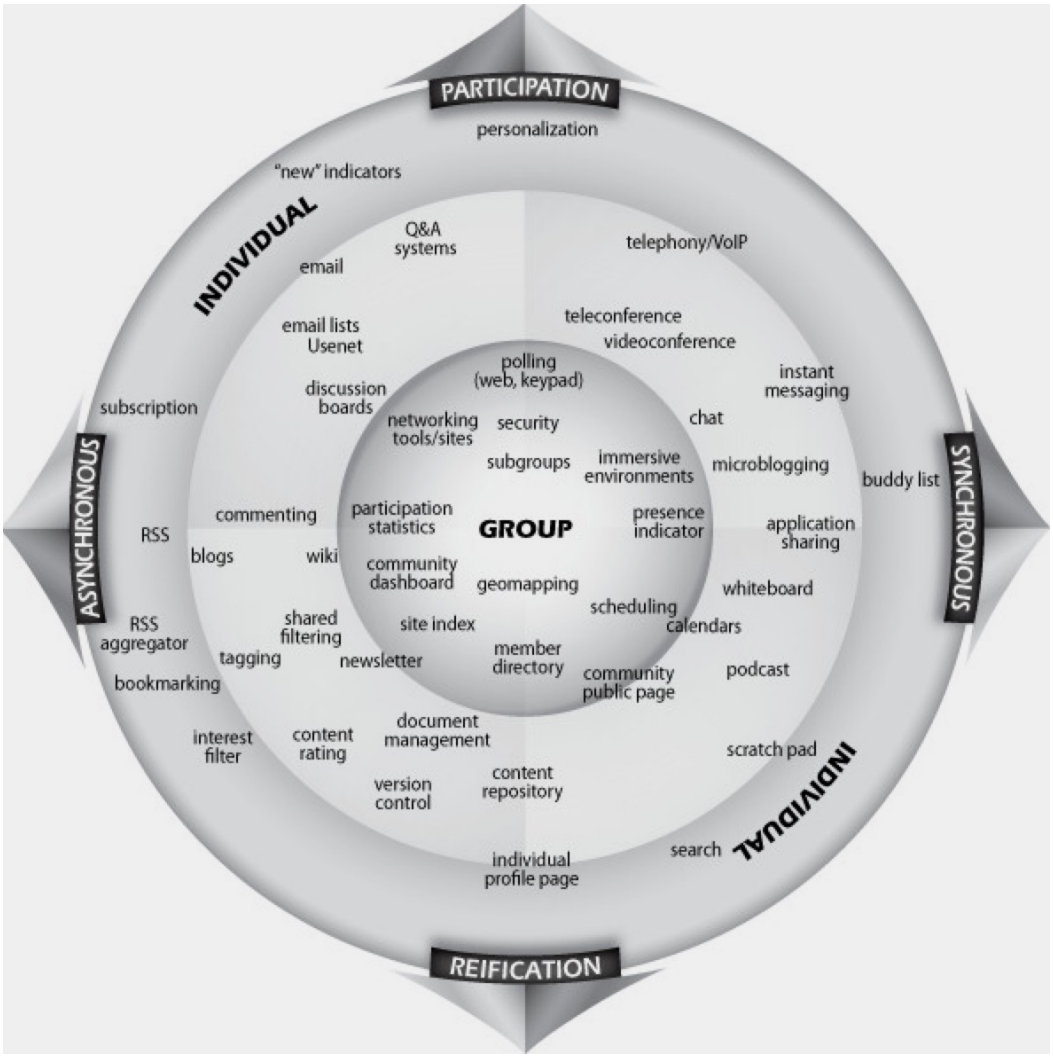

Figure 2. Image of tool use in context of the three polarities, rhythms, interactions, identities. Reprinted from *Digital Habitats: Stewarding Technology for Communities* (p. 80), by E. Wenger, N. White, and J. D. Smith, 2009, Portland, OR: CPsquare. Copyright 2009 by the author. Reprinted with permission.

As mentioned previously, one aspect of this research investigated the specific tools used for sharing artifacts and having conversations about these artifacts. This exploratory research undertook a content analysis by quantifying the specific tools used

in each of 10 COIL environments in order to compare shared tools and make mention of unique distinctions.

Tools, structures, and strategies for usability. Beyond the tools used for sociability, a certain set of tools, design structures, and strategies must be employed so that informal, self-directed learners can easily locate the answers to their learning questions and the fulfillment of their other needs without having to rely on a singular learning guide, as is done in formal environments (Sackey et al., 2015). Many individuals who research socio-technical systems focus specifically on the technical elements of usability in their research (Newman, 2010; Ruhi, 2010). These studies confirm the need for particular strengths in the usability of the environment. Usability design includes studies and design strategies from user experience design, user interface design, human-computer interaction, information architecture, and other user-centered fields (Krug, 2014). As Preece (2001) expressed, “Good usability supports people’s creativity, improves their productivity, and, simply, makes them feel good…. It is consistent, controllable, and predictable, making it pleasant and effective to use” (p. 133). Although there are several facets of research on usability, this study focused on three main categories of the more observable aspects of usability, namely observable support for navigational conceptual models, mobile device support, and support for accessibility.

***Navigational and conceptual models*.** Don Norman (2013), an authority figure on human-computer interaction and professor, stated the following regarding usability: “Designers should strive to minimize the chance of inappropriate actions … by using affordances, signifiers, good mapping, and constraints to guide the actions” (p. 67).

These elements, along with giving users appropriate feedback, make up the key components of giving individuals the appropriate conceptual model to navigate a site. Steve Krug (2014) gave similar advice in his popular design book, *Don't Make Me Think*, as he expressed a need to make the navigation of a site easy enough that people do not have to waste cognitive resources on figuring out how to make the site work. Mayer and Moreno (2003) also wrote about the importance of decreasing cognitive load through site navigation in formal learning environments so that users would not be cognitively overwhelmed before even arriving at the learning tasks and would, therefore, be able to focus on the actual learning instead. This section will describe the building blocks of these conceptual models and how they can be used in a website to ease navigation. As with tools for sociability, this does not include an exhaustive list of the various tools, structures, and strategies available, but it gives a general understanding of how the exploratory research looked for manifestations of these design principles.

Signifiers and affordances. Norman (2013) clarified the design terms (and some of the misunderstanding behind the terms) of signifiers versus affordances. A *signifier* is a construct that gives an indication of where a behavior should happen or what is to happen if an object is used, whereas *affordances* are the actions that one can do with an object that may or may not be intended by the designer. Humans use signifiers in much of what they do in order to deduce the use and meaning of the objects around them. Signifiers can be produced on a site in the form of text, graphics, images (Krug, 2014), and even by visual cues such as groupings (or chunking) by proximity, color, or shape (Loranger, 2015). Some designers prefer to use *skeuomorphic* designs, meaning

designs that show icons that are related to physical objects (Budiu, 2015); others choose to use text to clarify the purpose of links and functions.

Examples of signifiers and affordances abound. Krug (2014) gave an example of the common signifier of an underlined word that invites users to click in order to be linked to another webpage. Underlined words have come to signify this linking. Krug also suggested that certain signifiers have more success than others; for example, a blank space on a form that requires input would be better signified by a box around the space so that people know where to click (inside the box) versus an unboxed blank space. Some signifiers are also unintentional, such as a dated forum post with no replies, which might indicate to a user that the space is inactive and best left alone. Signifiers are the symbols and representations that serve as basic building blocks for navigation. An affordance, in contrast, may be exactly what a designer intended for a tool to do, or it could allow for unintended actions like a discussion forum that is overtaken by political or business propaganda. This research investigated the use of signifiers and affordances for the most common functions on the various sites. The following list of questions guided the exploratory research of signifiers and affordances within COIL environments.

- Are the signifiers clear for the purpose of navigation?
- Do the designers use text, graphics, colors, or some other mechanism to signify functions of a tool?
- Do the signifiers and affordances seem to match up (meaning are there functions that observably allow for affordances which may be different from the intention)?

- How are the signifiers and affordances similar or unique between different COIL environments?

Mapping and constraints. According to Norman (2013), the term *mapping* explains the relationship between two objects. If a person is in one place on a site, it will be important to know how it relates to other aspects of the site and what physical controls will do going forward and backward. At the same time, Norman explained that *constraints* are physical, cultural, semantic, or logical limitations that should be applied carefully to better guide individuals through a site. A careful pairing of mapping and using constraints can make a website more navigable.

There are several suggested ways to both map and constrain within a site for easier navigation. For example, Krug (2010) described *persistent* or *global navigation* as visual structures on a site that consistently lead to some of the most important pages, such as tabs that lead to a home page and a help menu. Another popular mapping technique that Krug mentioned is the breadcrumb trail that helps people to understand where they are and how they got there, an important strategy for multi-leveled hierarchies of information. Loranger (2015), a human-computer interaction (HCI) specialist, suggested giving a clear indication of links that had been clicked previously for people who return to a site so that they can easily return to a desired page. Krug (2014) advised designers to use constraints and conventions to their advantage. Constraints may be as simple as keeping the design less cluttered from complex navigations, or it can mean using pre-established schema of where to find things on a site for quicker adaptation (Loranger, 2015). For example, Krug described how individuals are accustomed to seeing certain navigations in specific places, such as a

left sidebar menu or tabs on the top. By using the structures typical of people's previous Internet experience, a site can be made easy to navigate (Krug, 2014; Loranger, 2015). The current study reviewed the use of mapping and constraints within the COIL environments. The following list of questions guided the exploratory research of mapping and constraints within COIL environments.

- What type of mapping mechanisms do the COIL environments employ?
- What observable constraints exist in the COIL environments based on pre-conceived schema of other sites?
- Are there other ways in which constraints are used to make navigation easier?
- What are the similarities and differences in mapping and constraints between the COIL environments?

Feedback. Norman (2013) emphasized the importance of feedback as being crucial for people to understand if they are on target for their goals. For example, an individual might fill out an online form several times if feedback regarding a successful submission isn't given. Not only is feedback important, but also Norman suggested giving feedback in less than one-tenth of a second or people may get frustrated. Feedback for websites can be given visually or through audible signals.

Various types of feedback can be helpful on a website. For example, a simple progress bar can help decrease frustration for people navigating a site (Budiu, 2015). If a progress bar isn't necessary, an indication of missing form information or a simple signal that a person is almost at the end of a process can also be helpful. Crumlish and Malone (2015) also stated the need for more information if there is an error, such as

what type of error it is and how users can avoid the error in the future. This research examined the types of navigational feedback given within the sites. The following list offers types of questions that guided the exploratory research of feedback within COIL environments.

- What types of feedback do the COIL environments employ in order to help users understand if they're achieving their goals?
- What are the similarities and differences in the way the different COIL environments give feedback?

Mobile device support. Technically, all of the same building blocks for conceptual models in navigational support apply to mobile devices. Mobile devices are included in the study because they can increase usability by adding the ability of use anywhere. However, if no mobile version of a site exists, or if a mobile version is poorly done, it becomes more of an impediment to use a site through a mobile device (Krug, 2014).

Special care needs to be taken to increase usability on a mobile device. Due to the decreased screen size, informational constraints need to be considered. If information is too complex, studies have shown that comprehension is considerably worse than on laptop versions (Pernice, 2015). Krug (2014) explained that building a separate application specifically for a mobile device is one way to take care of the constraints of the smaller screen. This should be done with care to create easy navigation through appropriate signifiers and affordances when possible. Also, Krug suggested offering links to the website for those items that are not usable through mobile apps. If the resources are not available on a mobile app, Krug recommended an

allowance for zooming and links that work in the browser version of mobile devices. This research examined the use of mobile devices for the sites. Some useful questions as shown in the following list guided the exploratory research of mobile support within COIL environments.

- Is there a separate app created for the COIL environments?
- If so, what types of signifiers and affordances do the apps offer that are distinctly for the mobile device?
- If not, is the navigation made easier through zooming and easy linking on the browser version of a site used through the mobile device?
- What are the similarities and differences between mobile functions of COIL environments?

Support for accessibility. Since the passage of the Americans with Disabilities Act in 1990, discussions of usability issues for people with disabilities have become a frequent topic of both physical and online architecture (U.S. Department of Justice, Civil Rights Division, 2016). Formal learning environments have been examining the topic of accessibility of their online learning spaces (Bastedo, Sugar, Swenson, & Vargas, 2013; Linder, Fontaine-Rainen, & Behling, 2015; Pittman & Heiselt, 2014; Riley-Huff, 2012). However, due to the disparate nature of informal learning environments, accessibility strategies are implemented on an ad hoc basis and less likely to have the guidance of institutional standards. Many designers, however, have learned the important design elements for online accessibility (Krug, 2014). Although this study could not address the scope of accessibility within the COIL environments, certain basic accessibility features

were explored that helped people with important sight, hearing, mobility, and cognition issues (WebAIM, 2016).

Basic accessibility for sight and mobility. Pernice (2015) defined some of the most basic accessibility design strategies for individuals with sight and mobility issues. These include attention to size and font of text, consideration of colors and contrast, and coding for screen readers that can help people who can't read or who need keyboard navigation.

Text in a site should be large enough to read, or at least capable of being enlarged for those with eyesight issues. Krug (2014) suggested that designers who understood accessibility needs would be more likely to add a feature that allows users to increase the size of the type rather than rely on zoom mechanisms built into the computer that increase the size of everything on the page. Font styles should also be clean without too much cursive or overlapping letters. As for colors and contrast, there is a specified ratio of 3:1 contrast between background and foreground colors in order to help sight- and color-impaired individuals (The World Wide Web Consortium [W3C], 2015) to see information. Finally, to create a more fully accessible site, it is important to put the appropriate headers and tags that a common screen reader would be able to read so that sight-impaired individuals and mobility-impaired individuals would be able to navigate the site using simple keyboard strokes (Krug, 2014). Verbal screen readers can also help individuals who have reading disabilities.

In order to run rudimentary tests for these items, it is helpful to rely on authorities that have created accessibility standards and guidelines. In fact, some websites have been dedicated to helping designers build and test for accessibility. This research took

advantage of these websites in order to assess the COIL environments' use of accessibility design. One such site by the WebAIM (2016) group, http://webaim.org/resources/contrastchecker/, searches for color contrast in sites and specifies how large the text must be for the color ratio. Another site by the same group, http://wave.webaim.org/, investigates the use of headers and labels that would be captured through screen readers, giving alerts for items that might be missing or that might impede usability for those needing screen readers. This study investigated COIL environments with the lens of accessibility for sight and mobility impairments through these helpful sites. A sample of questions that guided the exploratory research of accessibility for sight and mobility impairments in COIL environments follows.

- Based on the results of WebAIM, is the color contrast of the site of a sufficient ratio?
- Can the text size be manipulated?
- Based on the results of WebAIM, are there appropriate headers and navigational indicators for those with sight and mobility issues?
- How do the different COIL environments compare in their basic accessibility for sight and mobility?

Basic accessibility for hearing and cognition. Accessibility for hearing-impaired individuals in its most basic form entails the act of supplying captioning or transcripts of audio artifacts for the hearing impaired (WebAIM, 2016). Doing so can also help those who need cognitive support, as the double input of both the visual components of captioning and the auditory components can help with cognitive processing (Mayer & Moreno, 2003); it can also help those with linguistic barriers, as they are able to choose

the appropriate inputs for their needs (WebAIM, 2016). This study searched for the use of accessibility design for the hearing and cognitively disabled. The following list offers questions that guided the exploratory research of accessibility for hearing and cognition impairments in COIL environments.

- Are there transcripts or captions for audio and audio-visual material?
- How do the different COIL environments compare in their basic accessibility for hearing and cognition?

Information architecture in online communities. The final indicator of usability is the discoverability of the information within the site through its information architecture. According to U.S. Department of Health and Human Services (2016), the definition of information architecture includes the ability to label, tag, and categorize information in a manner that can allow for easy information searches. The large amounts of information in strong Web 2.0 sites have the disadvantage of being overwhelming if they do not have appropriate organizational elements. For example, much of the sharing in an online community would not be possible as a social instrument without fundamental searching mechanisms, such as word and tag searches. These are crucial due to what Benkler (2006) and others have described as the *Babel objection*, or people's inability to sift through large amounts of information from an overabundance of sources. Tools such as tagging, labels, categorizations, and search mechanisms are typically helpful for overcoming the volume of information passed between individuals. Tagging can be done by site designers or the community. This research investigated the use of tagging, labels, categorizations, and search

mechanisms in COIL environments. The following questions guided the exploratory research of basic information architecture in COIL environments.

- Are tags, labels, and categories clear?
- Can community members create tags and labels?
- Is there a search engine within the community?

Online community-building design. Lastly, design for community is crucial for COILs due to the fact that these are not merely sites for social and individual interactions; rather, they are sites built to form communities. The bulk corpus of literature used in this section about building online communities comes from popular books by authors such as A. J. Kim (2000), who focused mostly on business models of community building, Preece (2001), who wrote for business, education, and health sectors, Wenger et al. (2009), who explained the online community from the vantage point of the technology steward, Howard (2010), who focused on the general functions for helping people to find and stay in a community, Kraut et al. (2012), who used National Science Foundation-funded researched-based evidence of social community design from three universities, and Bacon (2012), who focused on the open source community. This literature on community building is also supported by books on design for sociability and usability from individuals such as Krug (2010, 2014), Crumlish and Malone (2015), Norman (2013), Preece (2001), and Sierra (2015). This part of the literature review begins by defining community in general, then explaining the most salient strategies of community building as suggested by the literature.

Definition of online community. Communities require specific strategies to promote cohesion. An initial definition of what communities are can lead to an

understanding of the types of tools used to support them. Many authors acknowledge Preece's (2001) definition, cited from an Association for Computing Machinery (ACM) workshop, as a standard:

1. Members have a shared goal, interest, need, or activity that provides the primary reason for belonging to the community.
2. Members engage in repeated, active participation; often, intense interaction, strong emotional ties, and shared activities occur among participants.
3. Members have access to shared resources, and policies determine the access to those resources.
4. Reciprocity of information, support, and services among members is important.
5. There is a shared context of social conventions, language, and protocols. (p. 13)

The ideas of Preece's (2001) definition support the socio-cultural literature about the need for social conventions, or rules, and semiotic domains. Even more, however, it explains some of the necessary elements of a community, namely shared purpose, emotional connections, and support or service. A. J. Kim (2000) shared a similar definition; "A community is a group of people with a shared interest, purpose, or goal, who get to know each other better over time" (p. 1).

Purpose of the community. The purpose of the community is the important launching point when creating a community because newcomers and members need to know the reason and goals for their participation (Preece, 2001). This is the basis upon which individuals choose to join a community, as well as the reason they stay, if it suits

their needs. According to Preece (2001), if the purpose of the community is ill-defined, it leads to an audience that is too broad and less likely to have similar interests. This, in turn, can lead to disputes and arguments between community members about what is important to do or share within the community.

Howard (2010) indicated that a community could be differentiated from a typical social network because a typical social network would have the person as the center of the relationship, whereas a community would hold the purpose as the central point of the relationships and the individual relationships as secondary to the purpose. Crumlish and Malone (2015) explained this concept as a social object that people congregate around in order to converse. As Howard stated, community members have a common interest and work toward the community purpose and goals through a set of established structures, rules, rituals, and other means. Crumlish and Malone associated this process with choosing a noun (purpose) as the object, indicating that the activities around the noun are the verbs.

Other authors take a similar stance on the need for clarity of purpose, while adding some of the strategies for outlining the purpose. A. J. Kim (2000) explained that a clearly stated purpose would entice new members to join and keep them there when they saw their needs being met. Kim also extended a more granular sense of the strategies and functions necessary for this task by outlining the important questions that a community builder must first ask him or herself about the type of community, the audience, and the reason the audience would join this specific community.

Once the community builders have a clear purpose, the literature has indicated they need to make the purpose visible in order to attract the right people and build the

rest of the community and environments around the purpose (Bacon, 2012; Howard, 2010; A. J. Kim, 2000; Krug, 2014). This may be done with a tagline, a story of the history of the community, or special branding (A. J. Kim, 2000; Krug, 2014). Design literature indicates that visible taglines or short summary statements of the community's purpose are a vital source of information about the purpose of a community and should be conveyed prominently (Krug, 2014). Bacon (2012) also explained that the tone of the community can be represented to indicate if it is a fun-loving community, an academic community, or any other type of community that fits the needs of the purpose. A sampling of questions that guided the exploratory research of purpose within COIL environments can be seen here.

- Is there a clearly stated purpose for the community?
- Does the site show a tagline?
- What is the tone of the purpose?
- How do the different statements of purpose in the COIL environments compare with each other?

Building thriving communities. Having a community purpose and the identities within the community are already pivotal aspects of community building, but community building comprises much more. Kraut et al. (2012) explained that the *build it and they will come* model does not work for online communities. In fact, they indicated that one popular community-building open-source site had thousands of community projects, but only around 10% actually had more than three members in their community.

In order to make a community thrive, specific thought needs to go into gathering the community, helping members feel part of the community, and inspiring the

community to co-create and share. Much of the literature on community building discusses the concepts behind what Howard (2010) designated in a heuristic he called RIBS—remuneration, influence, belonging, and significance—factors that he deemed crucial to thriving communities.

Remuneration. The basic tenet of remuneration is that people who visit or join a community will feel remunerated the first time they come and consistently thereafter. Howard (2010) suggested that without remuneration, the community will not thrive. Indeed, Kraut et al. (2012) even created a mathematical equation around the concept of remuneration by stating that if an individual's investment of time, and perhaps money, into a community is less than the reward, the individual will not stay.

Although many of the authors agreed on the concept of remuneration, the method of remuneration was quite different. Howard (2010) and Kraut et al. (2012) made it clear that this remuneration was better if done in a non-monetary form such as a psychological or emotional reward. In fact, Howard and Preece (2001) felt that a good user experience would be a prominent method of remunerating individuals along with increasing the sociability. A. J. Kim (2000), however, explained that the information found within the community would be the reward along with fulfilling the unmet needs of the user. Kraut et al. also focused on the needs of new users, indicating that increased benefits for early adopters and value-added content specials can help to gather and solidify new users. Although some elements of remuneration are admittedly personal to the user, an effort toward remuneration within these communities was investigated during the course of this research. Here are some of the questions that guided the exploratory research of remuneration within COIL environments.

- What steps do the communities take to try to remunerate users?
- How do the different COIL environments compare in their efforts to remunerate their members?

Influence. The second letter of Howard's (2010) RIBS heuristic is influence, which means the amount of control an individual or group feels over the environment. One side of the definition of influence is about members feeling like they matter to the community. The other side of the definition is their ability to control their environment (Howard, 2010; Preece, 2001). These are interesting concepts when compared to typical formal classrooms where an individual characteristically has very little choice in the environment and learning paths (J. S. Brown & Adler, 2008). Indeed, these are the very characteristics that allow for self-directed learning. For online informal communities, Howard indicated that if he had to choose the most important heuristic for long-term success, it would be influence.

Many of the authors of community-building design literature wrote about the capacity for individual autonomy and control introducing several ways that individuals could feel they had influence on their personal learning environment as well as the community as a whole. The personal control of being able to choose to join is a foundational feature of these environments (Preece, 2001). A. J. Kim (2000) also indicated that individuals feel a sense of control and power when making their own profiles. This idea was expressed previously in regard to identity, but the added component of power through identity-making is important. Crumlish and Malone's (2015) ideas on allowing personal autonomy centered around creating a personal

dashboard that would give users capabilities of manipulating what they see in the environment. They recommended the following for a personal dashboard:

- Provide a way for users to select what elements they want displayed in their dashboards. Give them a reason to come back repeatedly.
- Don't hide important social aspects to make room for editorial advertising.
- Give users the ability to supplement their network's onsite activity from other sites.
- Provide the ability to create a status update directly in the dashboard if status is an important part of the site.
- Provide easy access to the profiles of people in the user's network.
- Provide easy access to the user's own profile for review and editing. (p. 136)

Howard (2010) suggested creating transparency in communication in order to help the creators to understand the needs of the members and cater the site to them. Howard offered strategies for flattening hierarchies by suggesting that creators be responsive in a personal way, have dedicated problem reporting on every page, and conduct regular surveys. A. J. Kim (2000) saw the broader view of how a flattened hierarchy would affect the longer organizational structure, so she added the principles of designing for change, opening feedback loops, and empowering members as time progresses. Preece (2001) emphasized this important need for control by saying, "Users want to be in control; they want software that supports, not takes over. They want to be able to do what they want, when they want, and not be constrained by the software" (p. 134). This research searched for the ways that COILs offered a sense of

influence and control to their members. Questions that guided the search regarding influence for the exploratory research within COIL environments follow.

- What types of controls do users have within the community?
- How do the different COIL environments compare in their allowances for personal and community control of the environment?

Belonging. Just as Howard (2010) felt that influence was the most important aspect of his RIBS heuristic, Bacon (2012) described belonging as the most important consideration for building a thriving community to the point that he wrote, “It is that nine-letter word that you should write out in large letters and stick on your office wall” (p. 5). Belonging can be constructed into a system through creating social capital, community rituals, and shared language, signs, and symbols.

Bacon (2012) explained belonging as the conglomeration of both the group and the interactions within the group that make one feel connected. He called this the social economy that is necessary to feel the sense of belonging, economy not measured in terms of money, but in terms of social capital. Bacon described social capital as “the collective family of positive interactions between two or more people. When you affect someone positively (this could include being generous, helping someone, sympathizing over a problem, or something else), it has ripple effects on the community” (p. 6). Social capital is foundational to the community experience.

A. J. Kim (2000) realized the difficulty of promoting social capital and belonging within such large environments, so she outlined the need for building subgroups within the space to “sustain a sense of intimacy and familiarity within the larger setting” (p. 309). Kim explained this action as something similar to building neighborhoods

within larger communities. These subgroups help people feel more committed to each other with a heightened sense of belonging due to the relationships made, which is helpful for promoting social capital. This research investigated the types of groupings available in the studied communities.

Previously in the section regarding affinity spaces and social learning, the ideas of language, symbols, and rituals were mentioned as important shared literacies within a group. Gee (2006) called these aspects of a community *semiotic domains*, writing:

> "Semiotic" here is just a fancy way of saying we want to talk about all sorts of different things that can take on meaning, such as images, sounds, gestures, movements, graphs, diagrams, equations, objects…All of these things are signs (symbols, representations, whatever term you want to use) that "stand for" ("take on") different meanings in different situations, contexts, practices, cultures, and historical periods. (p. 233)

This propensity for communities to create their own language, signs, and symbols for meaning is an important aspect of belonging to a group. This research will investigate whether languages, signs, and symbols are being used within the communities.

Howard (2010) described many possible rituals that could occur within a community to build a culture that offers a sense of belonging, such as initiation rites, storytelling, badging, protocols, and routine events. Preece (2001) explained that the typical cultural rituals such as the American "handshaking, hugging, and eating are social activities that don't translate well online" (p. 381). For this reason, it is necessary to create online rituals that represent the same social togetherness. A. J. Kim (2000) added that regular calendared events such as meetings, guest presenters, and friendly competitions can help keep members returning regularly to check in with the community. This research searched for rituals within the COILs. Questions that guided

the exploratory research of belonging within COIL environments are listed subsequently.

- What types of cultural practices, including events, language, and rituals are involved in the learning?
- How do the different COIL environments support these cultural practices?

***Significance*.** The last of Howard's (2010) heuristics, significance, describes the way in which a community might brand itself and promote recognition so that it is deemed important. Howard stated that significance is marked by whether a community is:

- Well-recognized
- Established as the "go-to place" for accomplishing [the] users' goals
- Valued by people [the] users respect
- Populated by people who are serious and passionate in their field
- Distinguished as a reputable brand to [the] users (p. 168).

Some of the methods of building significance make certain that there are ways for members of the community to share learning experiences outside of the community on their other social networking sites (Kraut et al., 2012). Kraut et al. (2012) explained that activity within the community and sharing this activity outside of the community help members and outside individuals feel that the site is important because people they know and trust are benefitting from community membership. According to the authors, word of mouth recruitment ranked far superior than any other measures for getting members to join.

Another method of promoting significance is to make sure prominent people in the field are members and respected for their expertise within the community (Howard, 2010; A. J. Kim, 2000; Preece, 2001). This could mean having these leaders give presentations or giving them a space to create content for others to view. Respect for these leaders will create an atmosphere of importance around the community. Howard (2010) felt that the significance of housing important people and being able to connect to these important people is the elevated privilege of social capital in online communities. This research looked for indications of community significance of the researched sites. The following sample questions helped to guide the exploratory research of significance for COIL environments.

- Are these COIL environments easy to search for on basic Google search engines?
- Are there conversations about these COIL environments outside of the COIL environment in popular social networking sites such as Facebook and Twitter?
- Are prominent people in the field showcased within the COIL environments?
- How do the different COIL environments create the feeling of significance within their environments?

Rules, policies, and behavior. As people congregate in communities, the literature states that it is important to establish guidelines so that interactions are safe and effective for everyone involved (Bacon, 2012; Howard, 2010; A. J. Kim, 2000; Kraut et al., 2012; Preece, 2001). These guidelines might come in the form of more authoritative governance (Preece, 2001) or they can be created by the community

members themselves (Bacon, 2012; Wenger et al., 2009). They can be as simple as unwritten norms of the community (Kraut et al., 2012), as standardized as prescribed *netiquette* (Preece, 2001), or as enforced as governing policies (A. J. Kim, 2000). Successful communities typically have rules of conduct, but there are multiple different methods of establishing, conveying, and enforcing the rules in order to make the environment a place of mutual trust and understanding. A verification that COIL environments had rules, policies regarding behavior, was conducted through this research. The following list of questions were guiding examples through this exploratory research of rules, policies, and behavior within COIL environments.

- Is there a clear outline of the rules, or netiquette, of the COIL environment?
- How is the netiquette enforced?
- How do the different COIL environments support rules, policies, and behavior?

Summary

In summary, COILs are a natural extension of the current technologies available that have increased the participatory and collaborative abilities for social learning. It is important to conduct a study on the use of COILs at this time, as individuals are finding it increasingly easier to learn in an informal, self-directed manner outside of formal education environments. COILs have the potential to expand the ability for social learning through balancing appropriate technologies with participants' learning goals around specific learning topics. Site design often takes into consideration the important aspects of sociability, usability, and community building. This study grouped custom-built COIL environments together and explored their use of design for Web 2.0,

sociability, usability, and community in order to determine the basic building blocks of the structures that supported informal, self-directed, and social learning within COILs and to investigate how these structures supported these communities.

Chapter Three: Methods

The purpose of this study was to explore the custom-built environments that support COILs as a collective group. For the purposes of this study, the term *environments* for COILs included tools, structures, and strategies that supported the inherent needs in these unique community learning spaces. This study researched what types of sites fit the definition of COILs; what tools, structures, and strategies were used within them; and how these tools, structures, and strategies supported the studied COILs. The specific method of study for this research was an exploratory research design, which falls under the umbrella of qualitative research (Creswell, 2013), with foundational aspects of the exploratory study built on content analysis of items within the sites.

The choice of the exploratory research method was important due to the lack of literature regarding custom-built COIL environments. Although literature of suggested online community design had been analyzed in a text-based method (Owens, 2014) and community and social design literature was plentiful, locating literature on COILs as a collective unit of analysis was difficult. Indeed, both Owens (2014) and Sackey et al. (2015) pointed to a general dearth of literature on communities within digital informal learning environments. At the same time, the environments within which these communities interact have a great consequence on the functions and learning tasks that can be performed. The importance of this research can be summed up with a quote (often attributed to Marshall McLuhan, but as per Logan [2011] actually coined) by Marshall McLuhan's friend, John Culkin, "We become what we behold. We shape our tools and thereafter our tools shape us" (p. 45).

This chapter explains the specific aspects of the qualitative exploratory study, including the nature of the study, a discussion of the methodology, sources of data, human subject research information, data collection and analysis strategies, and the presentation of this data. Biases and limitations will also be explained.

Methodology

Creswell (2013) explained that each researcher brings a specific worldview to the research that embodies a "philosophical orientation about the world" (p. 6). For this study, the researcher worked from a pragmatist worldview, meaning that no one simple methodology would be sufficient to provide the groundwork for understanding COIL environments. Instead, both content analysis and exploratory approaches served to establish these environments as an object worthy of collective study. According to Creswell, the pragmatist worldview considers more than one aspect of data in order to gain a broader understanding of the subject. This pragmatist worldview was chosen as a worthwhile vantage point for this research since it supports the research inquiry through both numerical data and exploratory considerations that would lead to a broader picture of the commonalities of these environments. Further explanation of the research questions and choice of methodology can be found in this section.

Research questions. The research questions for this study, introduced in Chapter One, were in accordance with a pragmatist worldview. These research questions were:

1. What current types of online platforms are custom-built to host a community of informal learners for a specific learning purpose?

2. What tools, structures, and strategies are evident in these custom-built environments?
3. How do these tools, structures, and strategies appear to support the community of online informal learners?

Qualitative exploratory research as driving methodology. Although some quantitative information was involved in the content analysis portion of this study, the quantitative analysis builds the exploratory aspect of this study, which is considered a qualitative method. For this reason, qualitative research was considered the driving methodology for this research. Qualitative research is often used in the social and health sciences—including sociology, psychology, health, and education—as a means to explore a more holistic and rich set of experiences that cannot be summarized in a purely quantitative method (Creswell, 2007; D. E. Gray, 2009). According to Marshall and Rossman (2006), exploratory studies are used for the following purposes:

- "To investigate little-understood phenomena
- To identify or discover important categories of meaning
- To generate hypotheses for further research" (p. 34).

In other words, exploratory studies are used to understand subjects that have received minimal prior research. They do so by finding overarching themes regarding the subject through a rigorous coding process (Creswell, 2013; D. E. Gray, 2009). Exploratory research best fit this nature of study since very little research has been done on the custom-built environments that support COILs (Owens, 2014; Sackey et al., 2015), so formalizing a definition for these spaces and the environments that supported them was intended to create a foundational stage for future research.

The content analysis portion of this study added a quantitative aspect to this qualitative exploratory research by quantifying the use of specific contextual icons, text, tools, structures, and strategies that might lead to a better distinguishing definition of the custom-built environments built for COILs. A frequency distribution was created from the quantitative analysis in order to inform the exploration of the sites (Dane, 2011). Although content analysis is considered quantitative by some (Berelson, 1952), Krippendorff (2012) critiqued the distinction of content analysis as purely quantitative, and other researchers indicated that numerically-driven content analysis can be used to inform qualitative research (Creswell, 2013; Marshall & Rossman, 2006) without being considered a mixed methods study (Drisko & Maschi, 2015). Indeed, it has been recommended by some authors as a practical method of qualitative research based on the ability to count certain aspects instead of listing them in prose (Krippendorff, 2012). As stated by Marshall and Rossman (2006), content analysis can be used for text as well as visual representations, techniques, and other symbols that add meaning. Marshall and Rossman indicated that content analysis needs to be strategic in order to vet the appropriate items for the study. Creswell (2013) added that content analysis must be objective and systematic through the use of clear coding measures and a clear explanation of the objective method of creating categories and themes.

The exploratory aspect of this study used a coding process to create categories and themes out of the observed design tools, structures, and functions within each studied site. Strict coding measures were put in place to verify the validity of the categories and themes from the sites.

Limitations of methodology. Although this study sought to benefit from the situational and contextual experiences extracted through qualitative research, the limitations inherent in this design included the fact that this was purely an observational study. There were no interview questions that asked designers about their intentions and inspirations for using certain tools, structures, and strategies, and there were no interviews of participants, so this research was limited to the examinations of the tools, structures, and strategies that were evident through observation. Another limitation of this qualitative methodology is that qualitative studies with their small samples are not generalizable and representative of larger populations (Marshall & Rossman, 2006).

While the researcher is aware of the limitations of this methodology, the intent of this research was to start the conversation about these environments. The researcher hopes that this research will spark further studies, both quantitative and qualitative, to further the understanding of the important structures of COIL environments. This research can serve as a stepping stone for future research in this area of understanding.

Methodology options not chosen. Other possible ways to study custom-built COIL environments were explored before choosing this specific exploratory study. For example, the researcher considered a phenomenological approach of understanding the various tools, structures, and strategies used within various environments. With this in mind, the researcher actually began with the idea of doing phenomenological semi-structured interviews of the creative teams of various COIL environments for their description of their experience in building the platforms; however, a review of the extant literature indicated that these environments had not yet been grouped together in most

studies, so the phenomenological description needed more foundational basis, which is what this research tried to provide. Although a phenomenological approach might still be a method of studying COILs for future research, the researcher found it worthwhile to explore a more basic pairing of these environments to see if they could truly be grouped for their inherent similarities.

Research Design

This qualitative exploratory research was conducted in three parts. Following the inductive approach used in many qualitative studies, it focused on the smaller details first in order to build a stronger case about larger themes (Creswell, 2007). First, the defining characteristics of custom-built environments for COILs were used to distinguish these environments from other environments. Second, 10 of the vetted environments were chosen to undergo an exploratory content analysis based on literatures from social design, usability design, and community-building design. Third, further exploration was conducted in order to understand the observable support these tools, structures, and strategies gave to their COILs. The following sections explain the specific sample selection process of this study along with information about data collection, the instrument for content analysis, the exploratory methods used in this research, and human subject research considerations.

Data sources and sample selection process. As stated earlier, communities chosen as subjects of research for the purpose of this study were scrutinized for their fundamental characteristics before undergoing a more exploratory process. The units of analysis for this study were the environments that supported COILs. The process for

delimiting these environments started by researching online community spaces for the following characteristics (as indicated in Chapter One):

1. *Community of learners*: A social group of individuals gathered together around a common learning interest (A. J. Kim, 2000) and participating in activities, rituals, and shared learning culture (Preece, 2001).
2. *Online learning*: Learning that is mostly or fully online.
3. *Informal learning*: Learning that is self-directed and not tied to predominantly prescribed or formal education (Hager & Halliday, 2007; Livingstone, 2001).
4. *Custom-built environment for COIL:* A platform custom-built for the specific learning interest and needs of a community of online informal learners.

The initial group of online community spaces was chosen based on guided online searches for specific communities, as well as more general searches for types of communities. Due to the fact that the design literature underlying this study was biased to western, English-speaking design, the researcher focused on English sites. These sites were searched for using Google search, Quora, word-of-mouth, and other online search mechanisms. During these searches, the researcher focused on different possible learning topics in order to explore a variety of potential learning subjects as custom-built COIL environments. These topics included typical academic topics such as writing, sciences, languages, mathematics, art, and music. Other topics typically outside the realm of academics were part of the search, such as crafts, skills, games, and learning interests that were not typically found in academic programs.

From the online spaces, the communities that fit into the category of custom-built COIL environments were pooled, and 10 of these COILs were chosen for further

scrutiny. Specific COILs were chosen based on a variety of traits in order to ensure (a) diversity of subject matter (e.g., if two art communities were possible candidates, only one was chosen, and an effort was made to have diverse learning topics as units of analysis), (b) a large number of users (e.g., COILs with larger numbers were more likely to be candidates), (c) a fair length of time of use (the longer the site had been available, the more established it may have been and thus more desirable to be studied) or a recent spike in use (indicating an emerging interest), (d) an ability to research while observing the terms of use of the community (e.g., if a community specifically states that research of this sort was not acceptable, the researcher abided by the community terms), and (e) an indication of some thought toward usability (e.g., ease of initial navigation, font size, color distinction, accessibility, and appropriate signifiers). For this reason, the sampling for this research was considered purposive sampling, not random sampling. These selected custom-built COIL environments were the sample population for the remainder of the study.

Data collection. In order to collect the data used for this study, the researcher used unobtrusive methods known as *nonreactive research* (Marshall & Rossman, 2006). This means that the researcher did not participate in the activities being analyzed; instead, the researcher acted as an observer of the platforms. Site investigations included artifacts such as discussion boards, blog posts, images, videos, wikis, tool usage, analytics, and other observable characteristics or interactions on the site.

The data collection had three phases. In the first phase of data collection, candidate sites were chosen based on the search methods described in the sample

selection section. Many of these sites required a simple registration process, which the researcher used for entry. After the initial grouping, 10 of the sites that fit the definition of custom-built COIL environments were then chosen to undergo further content analysis and exploratory research. The choice of these sites required a purposive sampling of the vetted sites. The purposive sampling of these sites necessitated collecting data on the following:

- Type of subject matter,
- Number of participants,
- Length of time the site had been available,
- Evidence of recent and consistent use,
- Terms of use set forth by the communities,
- English as main language, and
- Basic usability features.

In the second phase, a content analysis was done based on the tools, structures, and strategies used as described in Chapter Two. This part of the analysis investigated the clear tools, structures, and strategies that were manifest, or visibly apparent (Babbie, 1992). The output consisted of a simple list of tools, structures, and strategies encountered in the COIL environment. In order to gather these data, the researcher needed to register for the site (if this was not already done in phase I). Once access was gained, the researcher reviewed the tools, structures, and strategies available to members on the site, starting with an analysis of the landing page and continuing by clicking the various links and tabs available on the site. The researcher (and the

secondary coder) kept a running tally of the types of tools, structures, and strategies found on the site.

Once the content analysis portion of the study was complete, the final phase explored the way the tools, structures, and strategies appeared to support the COILs. Data collection for this phase required a more in-depth view of the profiles, documents, Web 2.0 tools, forums, and other artifacts constituted in the tools, structures, and strategies of the COIL environment. This was done through an unobtrusive, observable view of these items.

Protection of human subjects. Protection of human subjects is an important aspect of any research. This research posed minimal risk to human subjects since the actual unit of analysis was the design structure of the environment. The U.S. Department of Health & Human Services' Secretary's Advisory Committee on Human Research Protections (SACHRP) acknowledged that the onslaught of accessible data on the web has made guidelines for human subject research less clear in the online and mobile realm (U.S. Department of Health and Human Services, 2013). They recommended that material that is easily, or relatively easily, accessible through Internet searches be given less stringent demands for human subject research protocol than data that would only be offered to vetted individuals. If a site is password protected, but no particular vetting process is in place apart from a simple registration, the SACHRP (2013) suggests that the Terms of Use and protocols within each environment be used as a guide. The Terms of Use for each of the 10 sites receiving the in-depth study were thus followed.

Although this was considered a study with minimal risk to human subjects, the researcher acknowledged that the studied constructs were created by humans, hence the reason this is considered social research. This study sought to protect both the sites and any individuals who were members of these COIL environments or who had designed these environments. For this reason, the researcher used the necessary precautions to ensure that proper protocols were in place for any humans that were involved in the creation of or as members of the studied sites. The following protocols were followed for the protection of human subjects in this research.

First, the researcher passed human subjects research training offered by the Collaborative Institutional Training Initiative prior to the study. This training covered topics regarding human subjects research, including assessment of risk, privacy, Internet research, and confidentiality. A copy of the researcher's certificate can be found in Appendix A. This training helped the researcher place the appropriate safeguards for any data that could relate to human subjects.

Second, the procedures of the study depended upon acceptance by Pepperdine's Institutional Research Board (IRB). Pepperdine University (2016) states,

> It is the policy of Pepperdine University that all research involving human participants must be conducted in accordance with accepted ethical, federal, and professional standards for research and that all such research must be approved by one of the university's Institutional Review Boards (IRBs). (para. 1)

Approval of the IRB was requested based on information given to them about the population and procedures of the research. A copy of the IRB approval letter can be found in Appendix B.

Third, all data were obtained in a way that was respectful of the members of the online communities and the designers of the communities. This research did not include

names of members, and information gathered about their use of the site was kept as generic as possible. The terms of agreement of membership for each of the communities undergoing in-depth studies were followed and data were safeguarded through password-protected computer programs.

Data Analysis

Once initial data were collected and organized, data analysis required a protocol of interpretations, classifications, and ultimate representations of the data (Creswell, 2007). The protocol for this research consisted of a three-phase analysis. Each phase focused on specific aspects of the three following research questions:

1. What current types of custom-built online platforms are built to host a community of informal learners for a specific learning purpose?
2. What tools, structures, and strategies are evident in these custom-built environments?
3. How do these tools, structures, and strategies appear to support the community of online informal learners?

Phase I: Data analysis. The first phase of data analysis used a prefigured/a priori coding process to focus on the research question pertaining to the current types of custom-built online platforms built to host COILs. The a priori code consisted of a focus through content analysis on the definition of custom-built COIL environments, namely:

1. *Community of learners*: A social group of individuals gathered together around a common learning interest (A. J. Kim, 2000) and participating in activities, rituals, and shared learning culture (Preece, 2001).
2. *Online learning*: Learning that is mostly or fully online.

3. *Informal learning*: Learning that is self-directed and not tied to predominantly prescribed or formal education (Hager & Halliday, 2007; Livingstone, 2001).
4. *Custom-built environment for COIL:* A platform custom-built specifically for the learning interest and needs of the community of online informal learners.

As explained in the section on data collection, sites were searched and chosen as candidates for further research as custom-built COIL environments. A codebook of a priori code was established and tested based on the definitions of custom-built COIL environments. The researcher vetted these sites through these codes in order to understand which sites could truly be considered custom-built COIL environments. A second coder was trained and independently reviewed over 20% of these sites with the same codebook in order to diminish researcher bias and maintain a standard of validity and reliability. Both a percentage agreement and Cohen's kappa were used to analyze the intercoder reliability coefficient. Only those sites with complete agreement of the areas were considered viable custom-built COIL environments for further study. Data from the initial phase was included in the study in a list format, which included the delimiters such as the example in Table 1.

Table 1

Example Format of List of Websites and Main Delimiters of Study

	Community of learners	Online	Informal learning	Custom-built
Website 1	X	X	X	
Website 2		X	X	X

Phase II: Data analysis. The second phase of this research focused on the second research question, namely the question of which tools, structures, and strategies were used in custom-built COIL environments. As Babbie (1992) suggested,

this part of the research could be considered the manifest, or easily observable items, in a content analysis. This analysis consisted of an exploratory open-coding process of a list of tools, structures, and strategies within a select group of chosen custom-built COIL environments. Open coding design was best used for this exploratory research since it allowed for exploration; however, certain aspects of the code were based on the literature, so some focal points were available to the coders, especially in regard to Web 2.0, sociability, usability, and community-building tools, structures, and strategies. Apart from a review of observable Web 2.0 tools, see Table 2 for a brief indicator of known themes from design literature that were used as a focus for this research as explained in Chapter Two.

Table 2

Themes from Sociability, Usability, and Community-Building Design

Themes	Categories
Social design literature	Profiles Identities Roles Relationships
Usability literature	Signifiers and affordances Mapping and constraints Feedback Mobile support Accessibility Information architecture
Community-building literature	Purpose Remuneration Influence Belonging Significance Rules, policies, and behaviors

See Table 3 for an example representation of the format in which the data were gathered. Each environment was then examined for the same or similar tools, structures, and strategies, and a frequency chart (Dane, 2011) was created to determine the similarity and variation between tools used in the sites.

Table 3

Example List Structure of Collected Tools, Structures, and Strategies

Tools/Structures/Strategies	Environ 1	Environ 2	Environ 3	Environ 4	Environ 5
Tool 1	X			X	X
Tool 2					
Structure 1					
Etc.					

Phase III: Data analysis. The third and final phase of this research was an open-ended, exploratory inquiry into the observable support these tools, structures, and strategies offered the COILs. This area focused on what Babbie (1992) suggested as the more latent aspects of the observations, meaning the underlying themes. This aspect of the research was comparatively open-ended. However, the researcher and secondary coder needed to be knowledgeable in aspects of participatory culture, informal learning, self-directed learning, social learning, CoPs, and other themes present in the Chapter Two literature review in order to have some focus in the analysis. The researcher chose and trained a secondary coder on the open-coding process with these areas of focus in mind. The researcher and the secondary coder worked independently on two of the sites to establish a percentage of agreement on a coding protocol. This protocol was then expanded as the researcher worked on all 10 sites.

Validity. An awareness of research validity served to help the researcher consider the larger questions of generalizability, appropriateness of measurements based on desired concepts of study, or construct validity, and the content validity of the measurements compared to the overall scope of the study (Neuendorf, 2002). This research intended to treat the issues of measurements based on desired concepts and measurements regarding the scope of the study through triangulation of its observed data as explained in this section. At the same time, only some aspects of the research findings are generalizable, which will also be explained in this section.

Validity, especially in qualitative research, is best ensured through triangulation of methods and data gathering. If a combination of quantitative and qualitative methods can be combined together in the analysis of the research, otherwise known as triangulation (Golafshani, 2003), this serves as a good indicator of validity of research. This research triangulated the observations of these COIL environments by (a) looking at the over-arching definition of COIL environments and searching for sites that fit the definition; and (b) using both quantitative measurements of tools as well as qualitative, exploratory observations of the aspects of COIL environments to gather in-depth information about 10 of these COIL environments. Creswell (2007) suggested using both a priori, or prefigured codes, and open coding measures in order to analyze data from a focused set of constructs as well as an open-minded vantage point of phenomena. The analysis of these environments entailed an initial a priori codebook of the over-arching definition of COIL environments for phase I. Phase II allowed for an observable accounting of manifest, or easily observable (Babbie, 1992), functions, while Phase III allowed for both an a priori and an open coding process. The researcher

hoped to answer the standards of triangulation, construct validity, and content validity through this coding process.

This study cannot be considered generalizable due to its narrow focus on a relatively small number of sites. However, the researcher hopes that this exploratory study will serve as a stepping stone to future research that will be generalizable.

Reliability. Whereas validity measures the general nature of the study, reliability means that the same test can be conducted with the same subject by multiple researchers multiple times, yielding similar results (Creswell, 2007). Certain steps were taken to ensure reliability of the observational methods of the data used in this study. Reliability infers an amount of trust that can be had in the research data (Golafshani, 2003). This was especially viable for the quantitative content analysis aspect of this study, but was also consistent with the standards of the over-arching qualitative exploratory research involved in this study.

In order to fulfill the standards of reliability in an observational study of this nature, the researcher used the strategy of multiple coders to reduce the effects of researcher bias and ensure that the results were consistent and replicable as much as would be possible with a qualitative study. A secondary coder was trained on the coding process for each of the phases of this study. In each phase, an appropriate measurement of intercoder reliability was used (Lombard, Snyder-Duch, & Campanella Bracken, 2002). The following section explains the intercoder reliability process and measurement for each phase.

Pilot study and secondary coder training. Each of the three phases of this research required a pilot study and training for the secondary coder performing the

research. The pilot study ensured that the coding process was clear and that prefigured and open codes were created in a manner that fit the scope and breadth of the research (Lombard et al., 2002). As Neuendorf (2002) indicated, a pilot study can capture problems in measurements and coders before the true study begins. These issues can then be reconciled before the study. The pilot can also serve as the training ground for the researchers so that the process and codes are understood.

Phase I: Reliability. In phase I, several sites were analyzed for their alignment with the definition of environments custom-built for COILs. For this phase, both a simple percentage agreement of intercoder ratings and a Cohen's kappa coefficient were used (Lombard et al., 2002). The researcher and one other coder used over a 20% sample of the sites, i.e., 20% of the overlapping sites found online, to code for the specific definition of custom-built COIL environments. Reliability was measured based on the simple percentage agreement of the codes for these sites as well as the Cohen's kappa coefficient, which recognizes a possible error based on the amount of overlap due to chance (Neuendorf, 2002). Recommendations for the percentage of agreement in a reliable study range between a minimum of 75-90% agreement for this type of analysis (Lombard et al., 2002; Neuendorf, 2002).

Phase II: Reliability. In phase II of the study, the researcher listed the types of tools, structures, and strategies used within a chosen subset of 10 custom-built COIL environments. In order to verify that an adequate list of these items was captured, the secondary coder investigated two of the environments with the list of tools, structures, and strategies, adding any missed items. The lists were compared and discussed in order to verify that an appropriate, complete list was created. Again, both the

percentage agreement and the Cohen's kappa coefficient were used as indicators of reliability.

Phase III: Reliability. Finally, in Phase III of the study, an exploratory coding process was conducted. Driving themes from the a priori code—namely themes from sociability, usability, and community-building design literature—were used to guide the exploration along with ideas from social and social constructivist learning and informal learning theories. Again, the secondary coder was trained on the ideas involved in both the a priori and open code. Although these ideas served as focal points, other ideas surfaced from the tools, structures, and strategies within the sites. These codes were shared between the coders, and reporting focused on the codes, categories, and themes that had a high percentage of agreement between the coders. In each phase of the study, more than one coder was used to review at least 20% of the content and a percent agreement and a Cohen's kappa coefficient was used to verify reliability of the data.

Statement of Personal Bias and Limitations of Study

Moehrer-Urdahl and Creswell (2004) pointed out the impossibility of removing all personal bias from qualitative research. This research was based on a specific pragmatist worldview (Creswell, 2007) bias on the part of the researcher. For this reason, this specific research was chosen as a point of interest along with its fundamental purpose, research questions, and intent, which were all guided by the researcher's worldview; therefore, personal bias influenced this research at a foundational level. Apart from the intrinsic limitations that sprouted from personal bias, other limitations are also present in this research.

Due to the exploratory nature of much of this research, it cannot be considered generalizable. An in-depth study of 10 sites was merely the beginning of the research into custom-built COIL environments. This could be considered a limitation of this research type.

Another limitation of this research was the non-random choice of the studied sites and environments. Although online searches have some aspect of randomness, search engine optimization and other mitigating factors may have led to certain sites being chosen over others. Also, the criteria chosen to limit the study to 10 specific sites—namely diversity, size, time, English language, and terms of agreement—made the choice of sites less random.

Other limitations may have included the restrictions put upon this study and temporal limitations. For example, this study could not provide an in-depth assessment of learning, and the temporal limitations of the time of study limited it from understanding any functions future platforms are certain to have due to an ever-expanding set of tools available to them.

Summary

This research used an exploratory analysis of online sites in order to find (a) which sites fit the definition of custom-built environments for COILS; (b) what tools, structures, and strategies were used in 10 of these custom-built COIL environments; and (c) how the tools, structures, and strategies of these sites supported the needs of the 10 COILs. The exploratory research was conducted in three phases consisting of some content analysis using a priori code, some content analysis using an open-coding process, and some open exploration. Measures were taken to establish a coding

protocol for the research as well as a standard of protection for units of analysis of the research, namely the custom-built COIL environments, and any human subject outputs observed through the exploration.

Chapter Four: Results

This study used a qualitative exploratory research method, supported by content analysis, to investigate the designs of custom-built environments developed for the needs of COILs. Through a three-phase approach, this research investigated (a) the different types of environments that could be considered custom-built spaces for COILs; (b) the tools, structures, and strategies that these environments had in common as well as those that were distinct from each other; and (c) the way these tools, structures, and strategies supported the COILs. This chapter presents the methods used to gather and analyze the data along with the findings of each of the three phases.

Data and Findings for Phase I

Phase I of this study was designed to answer the first research question as stated in Chapter One: *What current types of online platforms are custom-built to host a community of informal learners for a specific learning purpose?* Phase I had a three-part approach. First, a list of possible fields and subject matter was created in order to ensure that a diverse spectrum of appropriate candidate sites was collected. Second, an initial search was conducted in order to find potential environments for further study. Third, each candidate site was vetted based on the definition of a custom-built environment for COILs. The following section represents the data collection, analysis, and findings for phase I.

Data collection for phase I. The principal investigator began phase I by listing various subject possibilities for online learning environments. The list was inspired by first looking at common programs in several institutions of higher education and then

expanding to non-academic subjects. The initial list of academic programs and non-academic pursuits are included in Table 4.

Table 4

Academic and Non-Academic Topics Used to Vary Types of COILs

Academic programs	Non-academic topics
Business	Crafting
Music and Art	Fashion
Language Arts	Do It Yourself (DIY)
Architecture	
Mathematics	
Science	
Technology	
Behavioral and Social Science	
Humanities and Political Science	
Communication	
Health and Nutrition	
Law	

The researcher tried to use these terms in a preliminary search of possible candidate sites; however, a search based solely on these terms, especially some of the academic terms, was not fruitful. Instead, the researcher had to specify practical subtopics of many of the academic terms, enveloping some of the non-academic topics into possible academic correlating terms. For example, the following practical subtopics shown in Table 5 were paired with their academic counterparts as seen in Table 4 in order to continue to the second part of phase I, which required a search for specific communities.

The second part of phase I required a list of possible websites based on preliminary searches for communities of online learners. To acquire this list, a variety of search engines and sites were used to accumulate potential candidates for COIL

environments. Google Search and Quora gave the strongest leads for candidate environments with search prompts such as those shown in Table 6.

Table 5

Description of Actual Terms Used for COIL Environment Topic Search

Academic Term	Subtopic
Business	Finance and Investment, Entrepreneurship
Music and Arts	General arts, Graphic Design, Painting, General Music, Photography
Language Arts	Creative Writing, Language Learning, Reading
Architecture	Building Design, Home Building
Math	Brain Teasers/Puzzles, Chess, Analytics
Technology	Code/ Web Developers, 3D Printing, Programming, Robotics
Science	Citizen Science, Environmental Sustainability, Entomology, Antibody Engineering, Green living
Behavioral and Social Science	History, Spirituality, Meditation
Humanities and Political Science	Genealogy, Travel, Debate
Communication	Journalism and Current Events, Video and Video-Making
Health and Nutrition	Fitness, Yoga, Food
Law	Rights groups, Police, Activism

Table 6

Words Used in Searches

Google Search Terms	Quora Search Terms
"Online community for learning _____ [insert subtopic]"	What is/are the best online community/ies for _____ [insert subtopic]?"
"_____ [insert subtopic] online community"	"_____ [insert subtopic] community"
"_____ [insert subtopic] online learning community"	"Where can I find the best online communities for _____ [insert subtopic]?"
"Online community website for _____ [insert subtopic]"	"Online community for _____ [insert subtopic]"
"Best online communities for "_____ [insert subtopic]"	"Online learning community for _____ [insert subtopic]"
"Online _____ [insert subtopic] community"	
"What are the best _____ [insert subtopic] communities"	
"_____ [insert subtopic] community websites"	
"Learn _____ [insert subtopic] online community"	
"Online community websites _____ [insert subtopic]"	

Although not every search led to existing community websites, Google and Quora search engines led to a group of 75 sites that were found as possible candidates for further study. Some sites were direct responses to the search, whereas others were a result of informational articles found through the Google or Quora search, and the articles directed readers to communities. However, several articles had dated information regarding sites that once existed but were no longer available. This seemed to indicate that not all custom-built COILs were successful; indeed, at least two sites held apologetic notes to communities indicating that the sites could no longer be maintained. In the end, 75 sites were noted as sites that initially represented the concept of a COIL site. Appendix C shows the list of sites by topic in phase I.

Data analysis for phase I. In order to find 10 sites for further review, data analysis for Phase I consisted of giving an initial screening to the 75 sites found during the data collection stage (a) for their appropriate fit based on the definition of custom-built environments for COILs, and (b) for their compliance with other delimiting standards that will be explained subsequently. The definitions of terms used for the first part of the screening were stated in Chapter One as follows:

1. *Community of learners*: A social group of individuals gathered together around a common learning interest (A. J. Kim, 2000) and participating in activities, rituals, and shared learning culture (Preece, 2001).
2. *Online learning*: Learning that is mostly or fully online.
3. *Informal learning*: Learning that is self-directed and not tied to predominantly prescribed or formal education (Hager & Halliday, 2007; Livingstone, 2001).

4. *Custom-built environment for COIL:* A platform custom-built specifically for the learning interest and needs of the community of online informal learners.

Pilot for phase I. As a pilot, four of the sites listed in the initial part of phase I were analyzed by both the principal investigator and a second reviewer in order to verify that the definitions offered enough distinction of terms. Based on the review of four sites, both reviewers agreed that the initial terms had enough distinction to continue.

Analysis of terms for phase I*.* The principal investigator then continued the analysis with the remaining sites. Appendix D shows the types of websites and the fulfillment of the definition of terms. Website names were removed to safeguard any users or designers in the process of this research. In all, 53 of the 75 sites were passed as candidates for further review.

Inter-rater reliability for phase I. The second reviewer did a separate study of 17, or 23%, of the sites to establish inter-rater reliability in the analysis. In all, the comparison of the fulfillment of terms (marked with an *X* for *yes,* or left empty for *no* in Appendix D) was agreed upon 96% of the time when using a simple percentage. However, the number of *yes* responses created a much lower indicator when adjusted for Cohen's Kappa coefficient of possible random agreement, the overall coefficient rating giving a 0.36 possibility of random agreement regarding the 17 sites. This coefficient is quite low due to the number of *yes* responses in this section, which Cohen's Kappa indicates as a high level of random choice of *yes*.

Results for Part I, phase I. Overall, the primary investigator found 53 of the 75 sites (71% of the sites) were seen as appropriate matches for the definition of custom-built environments designed for COILs. Sites that did not match the definition were most

commonly excluded because (a) the term *community* was used differently for these sites than the definition as set forth by Preece (2001) and A. J. Kim (2000); (b) the learning sided on a scripted model instead of an unscripted, informal model; or (c) the environment was little more than a forum without customized tools for learning.

Overall, the types of custom-built environments for COILs spanned the spectrum of diverse topics and fields. It may be noted that some fields seemed to lend themselves better to COIL environments, such as fields within the visual arts, whereas some fields did not fulfill the requirements as often—such as business, languages, and law—or were difficult to find at all, such as history, math, and algebra.

Added delimiters for phase I. After the initial vetting of phase I, more scrutiny was required. In order to obtain a list that served the desire for a variety of subjects with evidence of thriving communities, the 53 custom-built COIL sites were further examined based on the following terms:

- Variation in subject matter,
- High numbers of participants,
- The length of time the site had been in use,
- Evidence of recent/consistent use,
- Adequate permissions for access based on the terms of use,
- English as the main language medium, and
- Basic usability features.

Based on these delimiters, 10 sites were chosen for further review. In accordance with the delimiters, none of the sites had statements in their terms of use that would oppose this type of research, and all sites fulfilled the English language and basic usability

components. In order to protect the identity of the sites in case of any information that could be regarded as negative, generic topics of the sites were listed instead of site names. Table 7 lists the relevant delimiting demographic data of the sites based on information gathered from the sites between April and May 2016 unless otherwise indicated.

Table 7

Two Delimiting Demographic Statistics of the 10 Chosen Sites

Subject Matter	Number of Participants	Year of Inception
Finance and Investment	400,000+	2006
Graphic Design	450,000+	2009
Reading/Writing	50 million+	2007
Logic/Games	14 million+	2007
Programming/Web Development	14 million+	2007
Travel	20 million+	2002
Debate	350,000+	2007
Citizen Science	1 million+	2007
Crafts	6 million+[1]	2007
DIY	1 million+	2005

Note. Information in this table was derived from sources that would compromised the anonymity of the websites studied. Therefore, the sources have been omitted deliberately.

Ten sites, ranging from 350,000 members to over 50 million and initiated between 2002 and 2009, were chosen as the main sites of interest based on all described delimiters. Of special note is the number of sites founded in 2007, within a year after Facebook's public debut and within a small timeframe from O'Reilly's (2007) popularization of the term Web 2.0. The 10 listed sites were then given further review through phase II.

Summary of findings for phase I. The results of phase I show the types of sites that were consistent with the defining terms of *custom-built environments* for *communities of online informal learning*. Namely, 53 of 75 sites spanning a variety of topics were consistent with each of the defining terms. Some topics seemed more likely

to have thriving communities, such as the visual arts, whereas other topics proved more difficult to locate—such as history, humanities, behavioral science, and algebra—or less likely to fulfill the defining requirements of this research, such as sites dedicated to business, languages, and law that did not fulfill one or more of the terms. See Appendix D for more information on the types of sites and their fulfillment of terms. Also, some searches led to what may have been considered COILs previously, but were extinct at the time of investigation. The 75 existing sites were those vetted for the fulfillment of the terms, leading to the final number of 53 custom-built environments designed for COILs.

Data and Findings for Phase II

Phase II sought to answer the second research question as stated in Chapter One: *What tools, structures, and strategies are evident in these custom-built environments?* This required that each of the 10 sites be scoured for tools, structures, and strategies. The terms of agreement in most sites prohibit the use of special technologies for this type of digital scanning of the entire environment, so this process required personal access and review of each site. The following sections represent the data collection, data analysis, and findings for phase II.

Data collection for phase II. In order to accomplish the data collection for phase II, the principal investigator signed up for membership to access each of the sites. Each site was then analyzed for evident tools, structures, and strategies. Since the terms *tools, structures*, and *strategies* may have some overlap, a brief set of examples is given here. Clear examples of *tools* for this research included functions such as buttons for giving ratings and an upload for personal profile pictures or avatars. Clear examples of *structures* for this research included top menu links and left-side

menu links. Clear example of *strategies* for this research included the use of outside partners and experts for podcasts. However, since many of these functions may overlap, for the sake of this research they are all included together and not individually distinguished.

After gaining admission to the sites, the principal investigator first went through each site separately to aggregate obvious tools, structures, and strategies; then, the reviewer returned to each site several times to compare the sites with the aggregated list. The general list of tools, structures, and strategies equaled a list of well over 200 items, without including in the list some of the functions specific to accessibility, which were measured differently, as will be explained subsequently. The entire list of tools, structures, and strategies, along with a list of sites in which these functions are or are not found, is located in Appendix E. Definitions for the tools, structures, and strategies can be found in Appendix F, whereas a simple explanation of the categories included in the sites can be seen here in Table 8. The data analysis section will show all tools, structures, and strategies based on their statistical use throughout the sites.

In order to verify inter-rater reliability of these categories and tools, a second reviewer was given the principal investigator's list of tools, structures, and strategies found in all sites. The second reviewer chose two, or 20%, of the sites to review in order to analyze whether those sites did or did not make use of the tools, structures, and strategies from the list. The second reviewer also added some tools, structures, and strategies to the list based on the analysis of the sites. The two reviewers then compared findings; disagreements were analyzed and individual tools missing from the opposite reviewer's list were reviewed within the sites. The final result was a simple

percentage agreement of 99% and a Cohen's Kappa coefficient of 0.98; a strong level of agreement existed, even after factoring in possible randomization.

Table 8

Categories of Found Tools, Structures, and Strategies

Tool, Structure, or Strategy	Description
Profile and sign-up	The creation of a personal profile and the sign-up process.
Forum and other artifact discussions	Tools specific to discussions within forums and surrounding artifacts.
View of/connection with other users	Tools regarding the information about and connections between other users within the COIL sites.
User-generated (UG) artifacts	Tools to aid with the creation and interactions surrounding artifacts created by users.
Navigation	Tools, structures, and strategies to help users navigate sites.
Analytics	The use of analytics within the site to offer information about users, discussions, and artifacts.
Site-based mobile use	The ability to use the site via a mobile device.
Competition/ Challenges	The purposeful use of competition and challenges within a site.
Outside connections	Connections to social media and other sites or businesses.
Site-generated items	Site-generated lessons, learning events, and other perks.
Funding	The strategies used to fund sites.
Site moderation	The ability to get support and report issues within a site.
Accessibility	The design for accessibility.

Data analysis for phase II. The data analysis of phase II was facilitated by the creation of bar graphs that show the usage of tools, strategies, and structures in descending order for each category of functions. The following charts are the bar graph

analyses of the data with accompanying explanations of the numerical portions of the data. A definition of each tool, structure, and strategy is offered in Appendix F. The order of the information in each graph descends from the functions that had the highest rate of evidence of usage amongst the sites to the lowest rate of use, meaning fewer sites had the tool, structure, or strategy within their environments. Of special note, apart from numerical order, the organization of tools, structures, and strategies represent no other specific order of importance. Also, the number of sites using the various tools may look the same on the graphs, but the actual sites may differ. For example, if nine sites offer the ability to upload images and nine allow video, it might not be the same nine sites fulfilling the two scenarios. Appendix E lists which sites housed which tools.

Profile and sign up. Figure 3 presents the tools, structures, and strategies related to the sign-up process and personal profile generation found in the 10 sites.

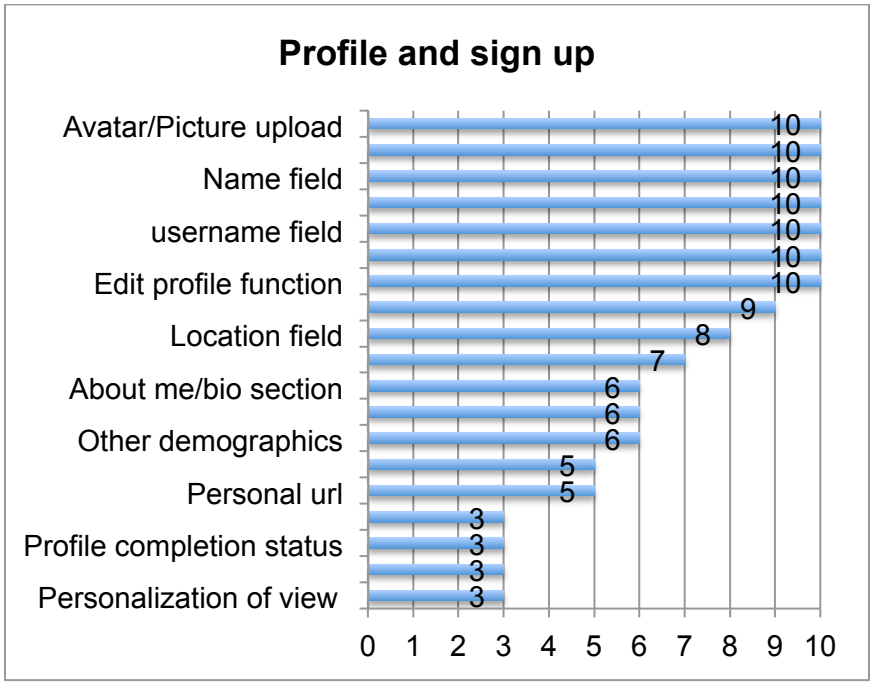

Figure 3. The aggregated tool, structure, and strategy use for the sign-up process and creation of profiles within the 10 chosen COIL sites.

As shown in Figure 3, all of the sites had a sign-up process that entailed entering a personal email, username, and password. An email confirmation was required by all sites. Tools were available for uploading a personal picture or representative avatar and entering a name apart from a username. The sites also allowed for at least some editing of the profile, and almost all of the sites (nine) offered at least some method of controlling the shared aspects of the profile. Other demographics were also requested frequently, some of which are listed here because similar demographics were used by several sites, whereas others were specific enough that they are included under the *other demographics* section. An example of one of these other demographics is a favorite color for craft-based items in the Craft site.

Forum and other artifact discussions. After sign up, the typical gathering spots for many of these communities were within the discussion areas. The graph in Figure 4 for *forum and artifact discussion tools* gives the large variety of tools offered for discussion both in general and regarding specific artifacts. Although discussions are in and of themselves considered an artifact within social science research, the research for this specific section differentiated between forums that were more general question/answer spaces from discussions that surrounded a posted picture, book, or other object (called artifacts). In the discussions for both forums and other artifacts, several tools were evident, as seen in Figure 4.

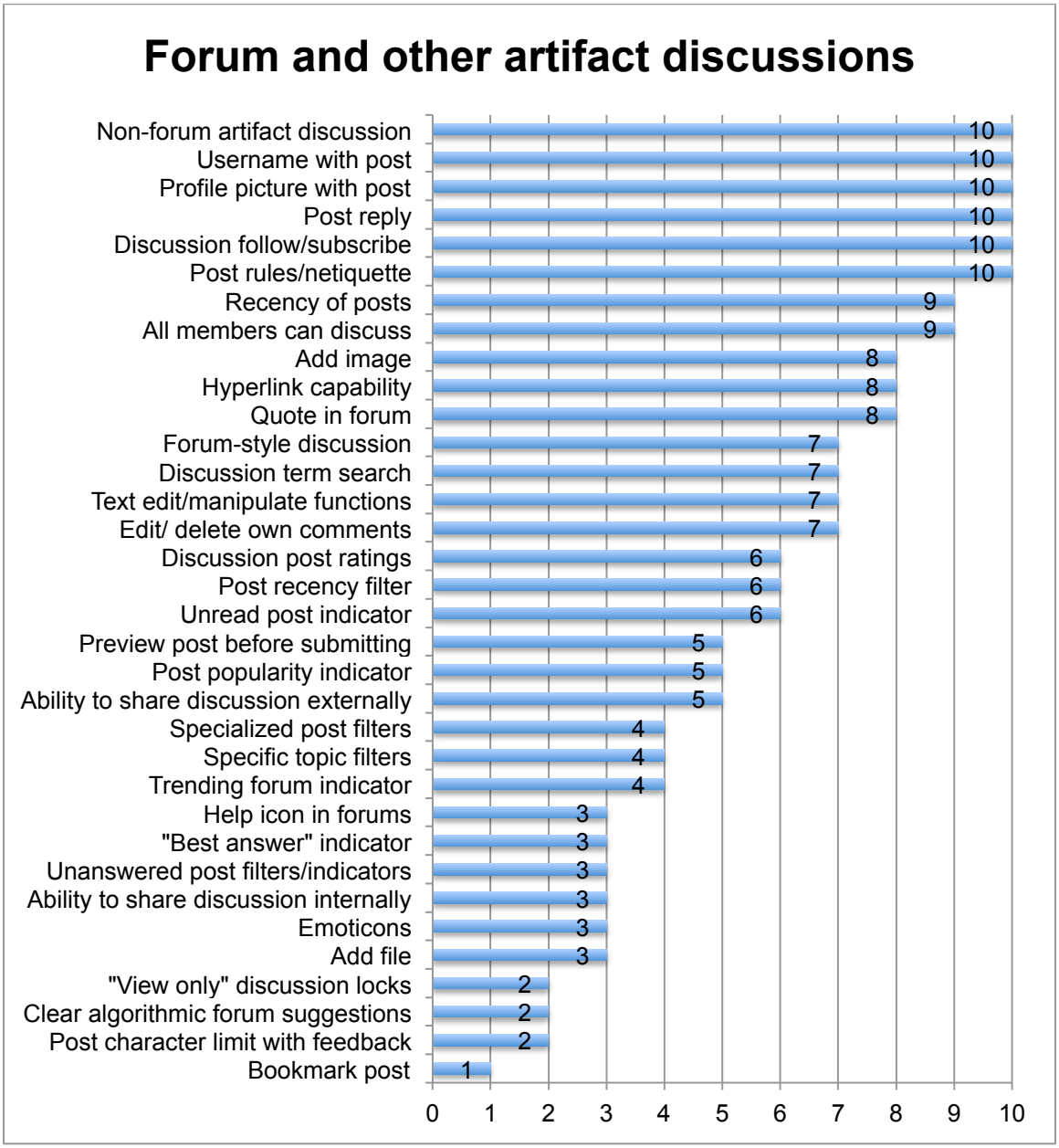

Figure 4. The aggregated tool, structure, and strategy use for forum and artifact discussions within the 10 chosen COIL sites.

There were several tools for discussion in forums and surrounding other artifacts. All sites gave the ability to discuss an artifact, such as a blog, an image, a project, a game, or other types of objects. All sites added the profile picture and username next to each post. All sites also allowed individuals to follow or subscribe to discussions or posts of interest. Beyond this, post rules (sometimes called *netiquette*) were typically

included either in the terms of use area of the site or near the discussion area. The manipulations available within the posts—such as the ability to change text, underline, bold, quote others, hyperlink, and add images—varied by site, but were relatively popular features. Filtering of posts was also popular among the different sites, although it was done differently amongst the sites. Sharing of posts was also a feature added to several sites. In all, the discussion areas tended to be heavily constructed with tools and features to add to the interactive experience.

View of and connections with other users. Beyond connecting within conversations on the site, an important number of tools surrounded the concept of viewing and connecting specifically with other people on the sites. Each tool allowed for a specific type of interaction. For example, there were some sites that allowed for *friend* relationships, meaning a bi-directional connection, whereas some sites specified a *following* connection, meaning a uni-directional relationship. The types of relationships allowed within the sites were supported by the tools, structures, and strategies as seen in Figure 5 and in the subsequent figure, Figure 6, which gives further description of the ability to find and connect with people.

All of the sites allowed some level of access to view other users' profiles, and many sites offered far more inter-user connections. Based on the information from Figure 5, all 10 of the sites allowed individuals to find other users. Figure 6 explains the different types of finding mechanisms available within the sites.

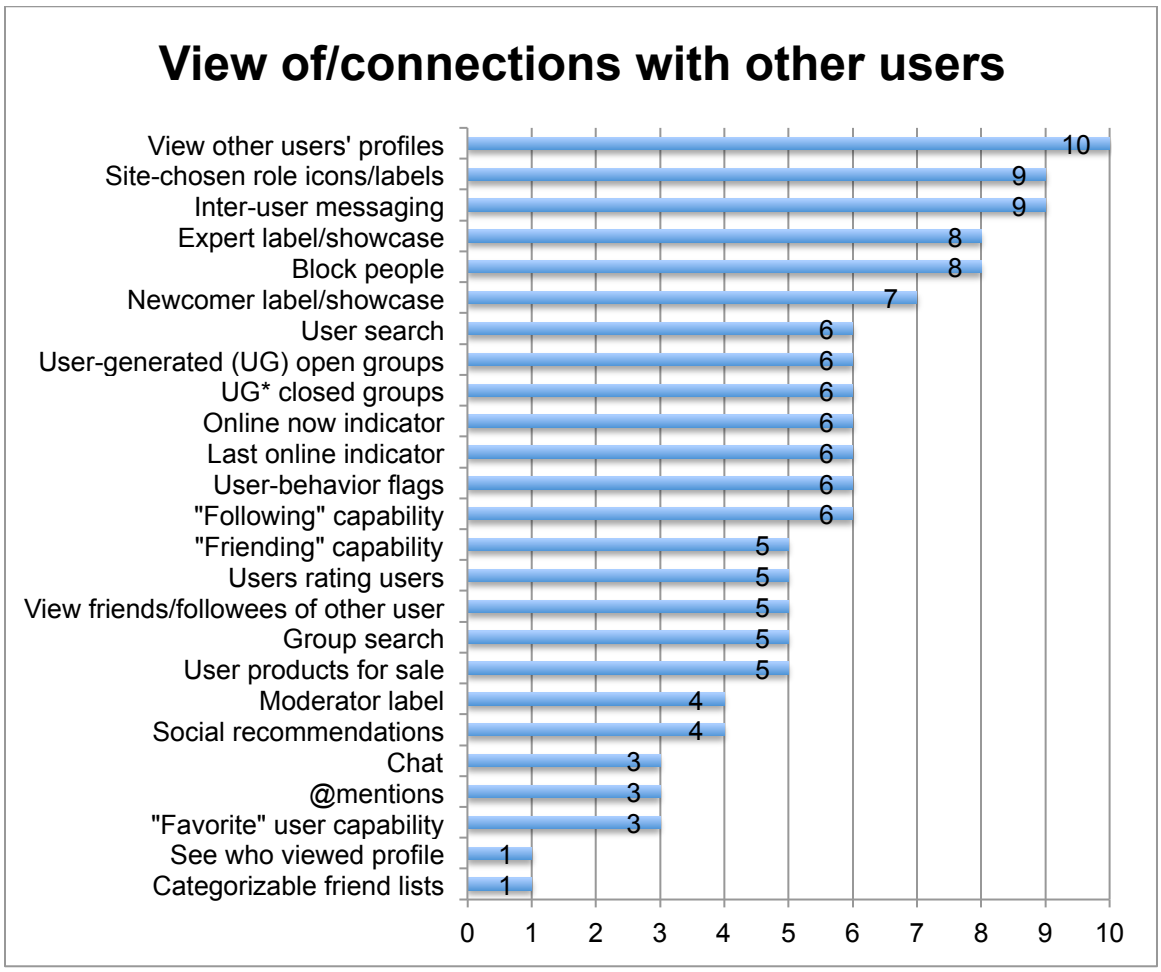

Figure 5. The aggregated tool, structure, and strategy use surrounding user connections within the 10 chosen COIL sites.

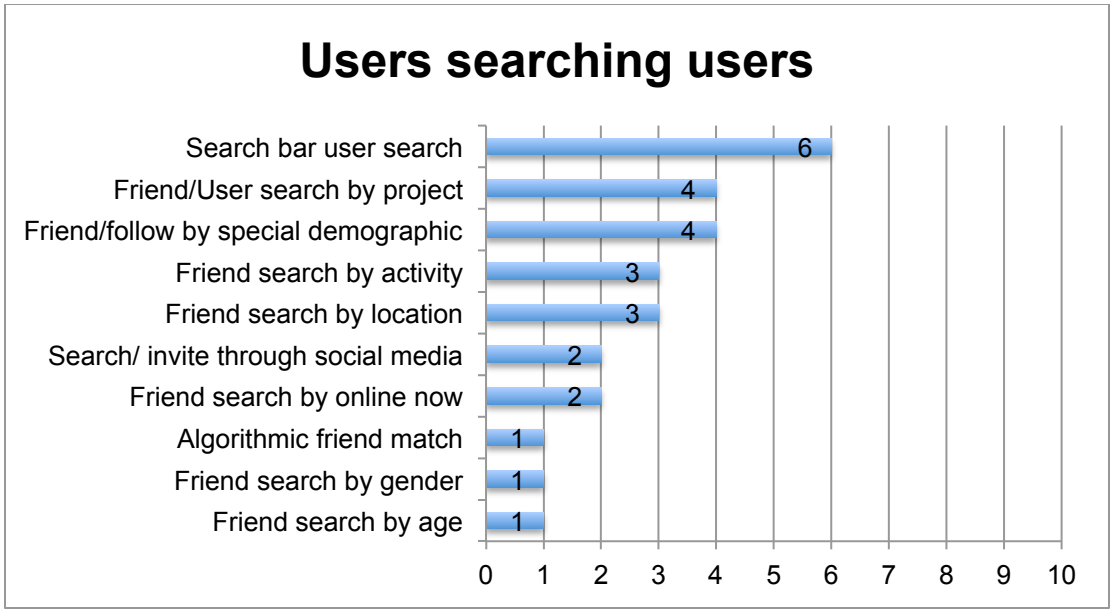

Figure 6. Methods for users to search other users.

Figure 5 also shows other means of making connections. Inter-user messaging was available in at least nine of the sites and might have been available in the 10th, but there was a certain level of restricted access to non-professionals, so not everyone would have the function (making it a function that is not evident and, therefore, not something this research could include). Other functions regarding users were those in which people were assigned special roles and given special information that allowed users to recognize either the importance of a specific user or a user's frequency of site use. Several sites also allowed for open and/or closed groups. Three of the sites had the @mention function, which means that individuals could tag other individuals. Finally, half of the sites allowed users to rate other users, typically through a mechanism that allowed users to *favorite* other users, but also by accumulating positive, and in some sites negative, ratings that were given within forums and other interactions. More of these ratings will be discussed in the section devoted to analytic tools.

***User-generated (UG) artifacts*.** People within these sites were often the main contributors of artifacts. The tools, structures, and strategies relating to user-generated artifacts are specified in Figure 7. User-generated artifacts are those created and/or uploaded by the users and not by the site leadership. Figure 7 shows not only what types of user-generated artifacts were possible based on the tools within the sites, but also the tools, structures, and strategies that related specifically to what could be done with these artifacts, such as rating and sharing.

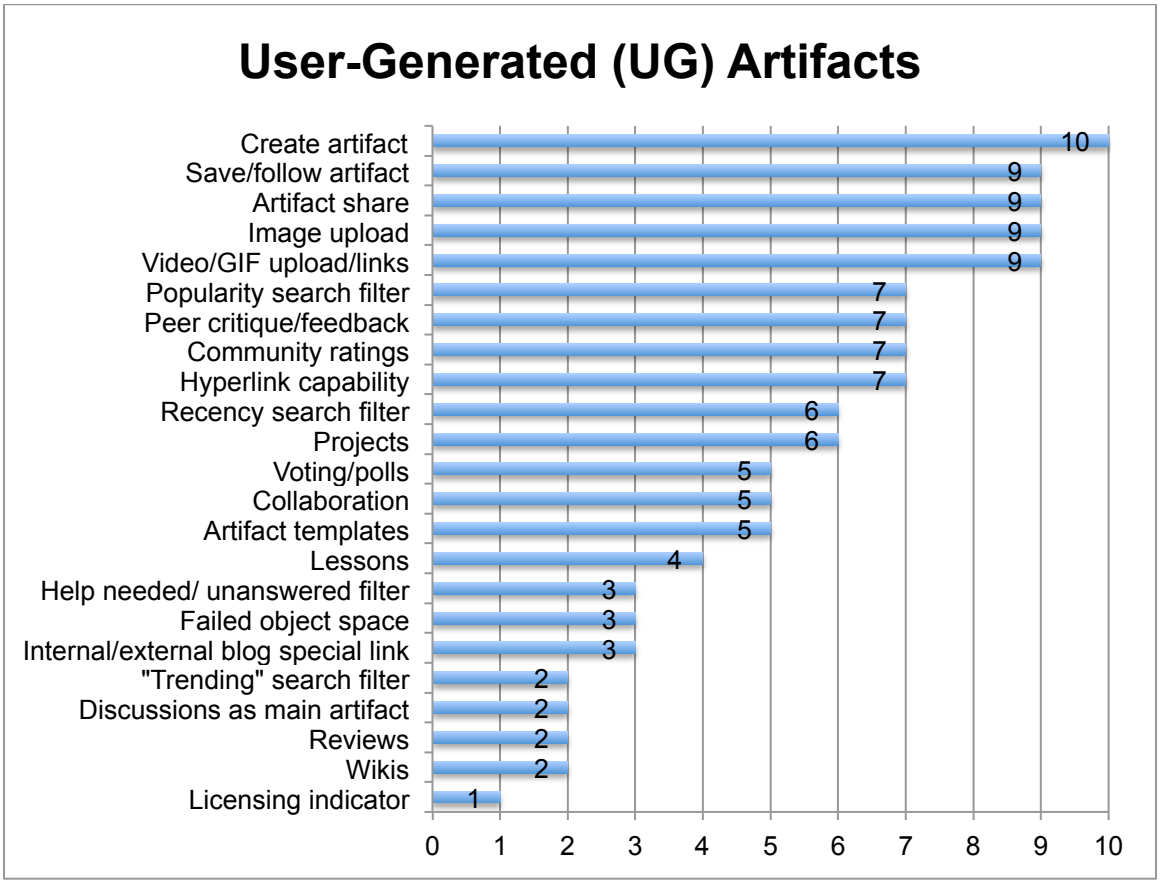

Figure 7. The aggregated tool, structure, and strategy use for user-generated artifacts within the 10 chosen COIL sites.

A variety of different types of user-generated artifacts were allowable within the sites, but not all sites offered the same specific objects as possibilities. Of special note, this section does indicate that two of the sites had forum discussions as their main artifact (unlike the separation of the two terms, forum discussions versus artifacts, as done in the section regarding forum and artifact discussions). The types of artifacts available within different sites included images, videos, GIFS, hyperlinks, projects, lessons, blogs, discussions, reviews, and wikis. What could be done with each artifact also varied per site, such as the ability to save, share, find, rate, and even give specific licensing details for objects.

Navigation. With the abundance of information based on user-generated artifacts and discussions, site navigation was an important area of focus. A review of navigational elements found the tools, structures, and strategies that helped users to locate where they were and find where they wanted to go within the sites. Figure 8 shows the elements used for site navigation amongst the 10 COIL environments.

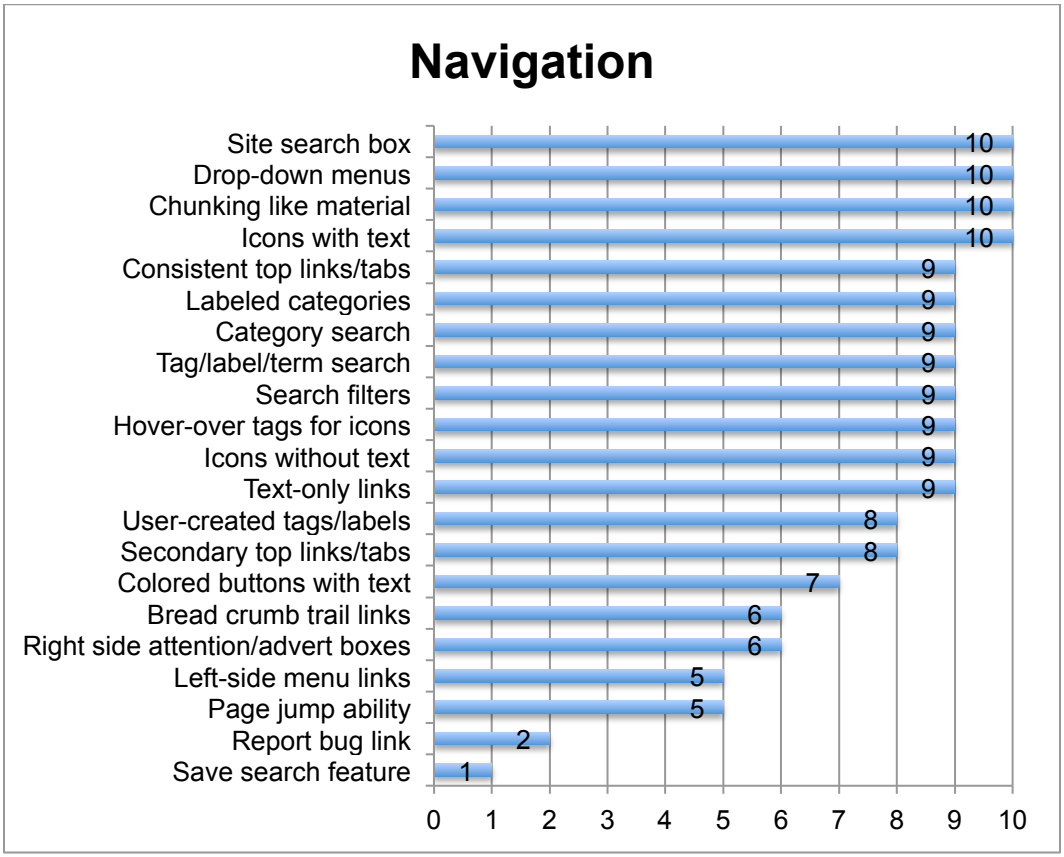

Figure 8. The aggregated tool, structure, and strategy use for navigation within the 10 chosen COIL sites.

Although the visual sites had different colors, text, and icons, the underlying navigational structures tended to fit many of the same molds, such as the appearance of drop-down menus, chunking of similar material, icons with text, and search functions. Most of the sites offered tags, labels, and categories, along with special search functions for the purpose of navigation. One site with extensive advance filtering

features even allowed users to save the searches for easier retrieval of desired information.

Beyond simple navigation features, sites offered guides for navigating and using their sites. Figure 9 presents the different ways sites helped with navigation and site use.

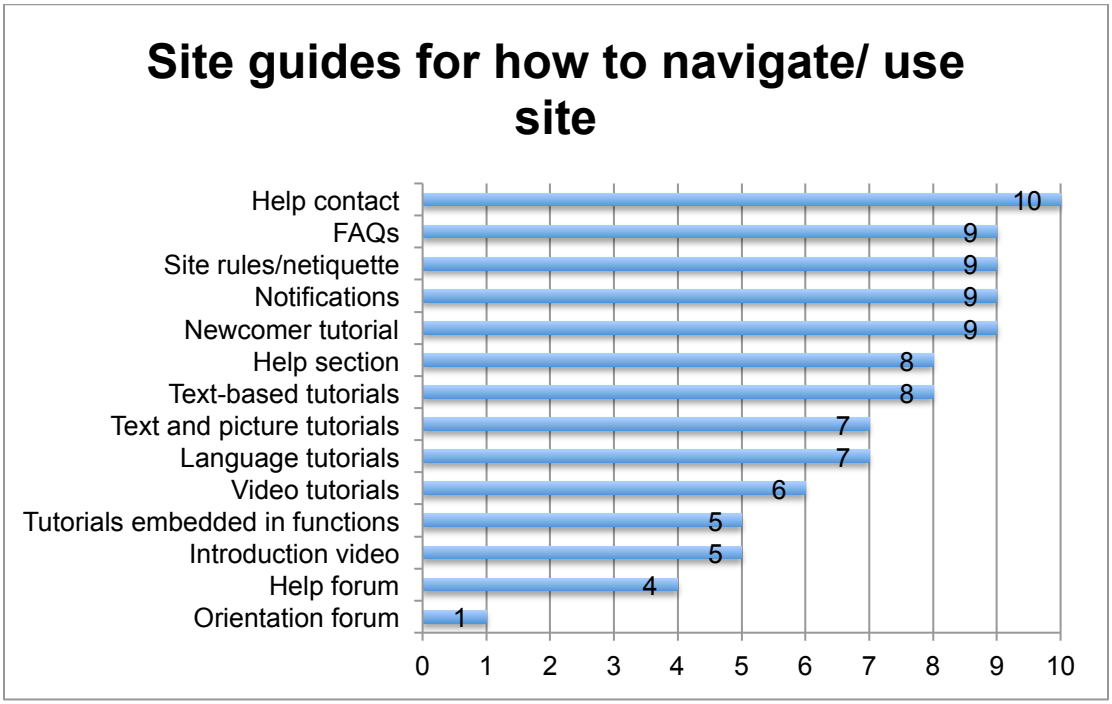

Figure 9. The aggregated tool, structure, and strategy use for site guides and directions for use within the 10 chosen COIL sites.

Users were supported in different ways throughout the sites, but they always had some level of support. Much of the help was driven by the site leaders; however, some of the help and support was offered as special forums or wikis from regular users. Several of the sites had some level of tutorials and offered guidelines for conduct.

Analytics. User and site analytics were some of the more common features between sites, although the subjects of the analytics varied between sites. Figure 10

presents the general types of analytics available, whereas Figures 11-15 represent more specific groups of analytics.

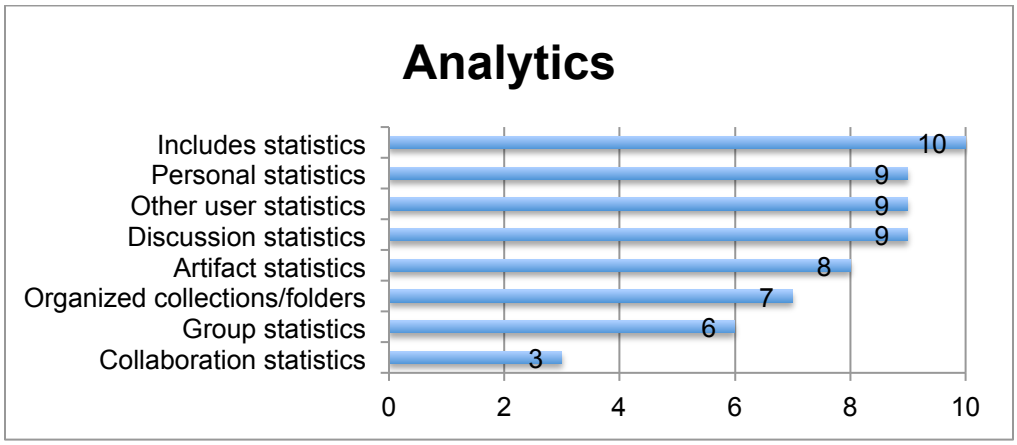

Figure 10. The general aggregated tool, structure, and strategy use for analytics represented within the 10 chosen COIL sites.

In general, most sites allowed users to view personal statistics, statistics surrounding forums and artifacts, and statistics about other users. Other statistics were also available, such as the ability to see other users' collected or saved items and the ability to see collaboration transactions. A more complete view of the types of statistics available can be seen in Figures 11-15 regarding personal statistics, other user statistics, artifact statistics, discussion statistics, and collaboration statistics.

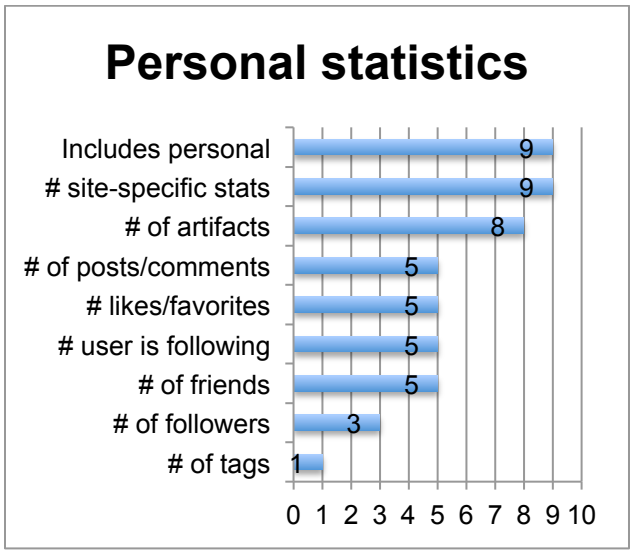

Figure 11. Available personal statistics within sites.

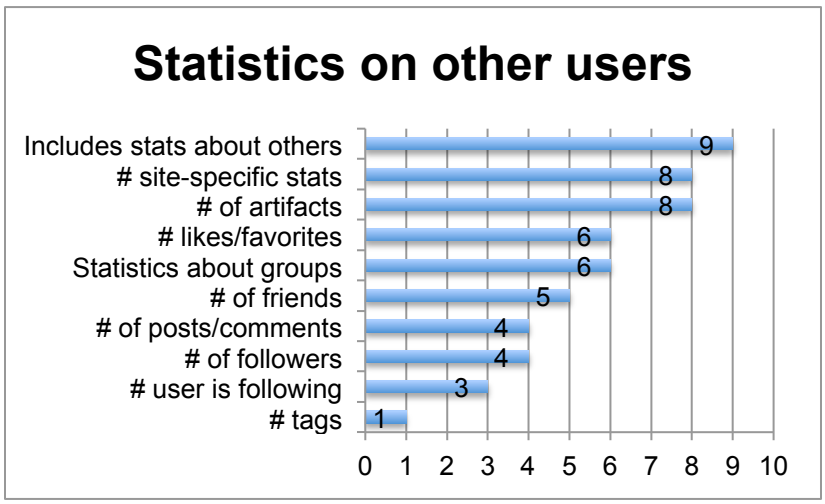

Figure 12. Available statistics about others within sites.

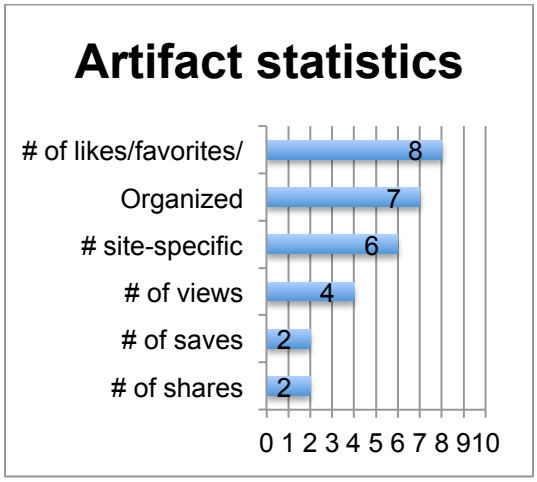

Figure 13. Available statistics about artifacts within sites.

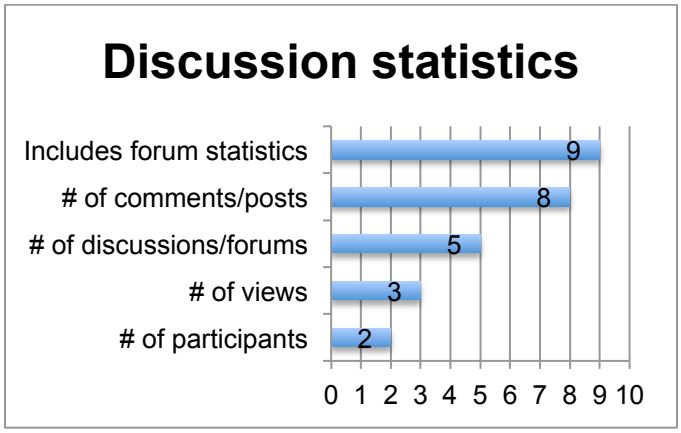

Figure 14. Available statistics about discussions within sites.

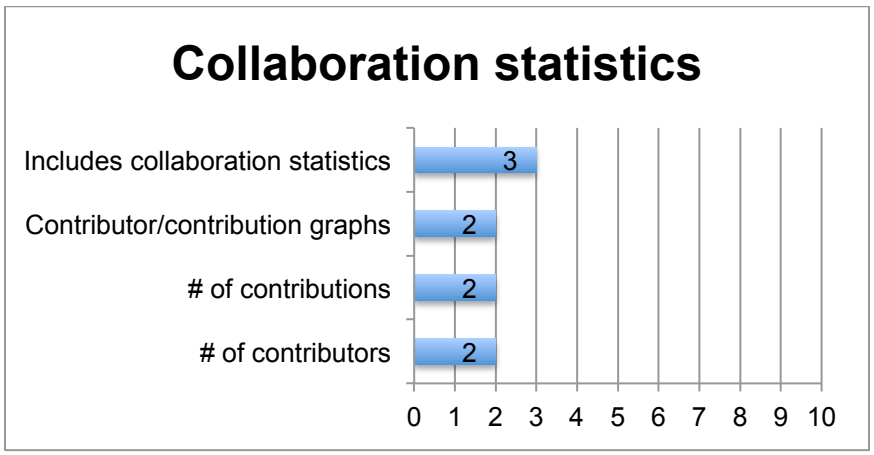

Figure 15. Available statistics about collaboration within sites.

As evidenced by the number of tools used for statistics, analytics were an important aspect of these COIL environments.

Site-based mobile use. Although analytics seemed to be pervasively popular between sites, mobile apps and even mobile design were not as universal. Figure 16 shows that most sites had created a browser version that was somewhat distinct with text zoom, but just over half had a self-made mobile-based app devoted to their environments.

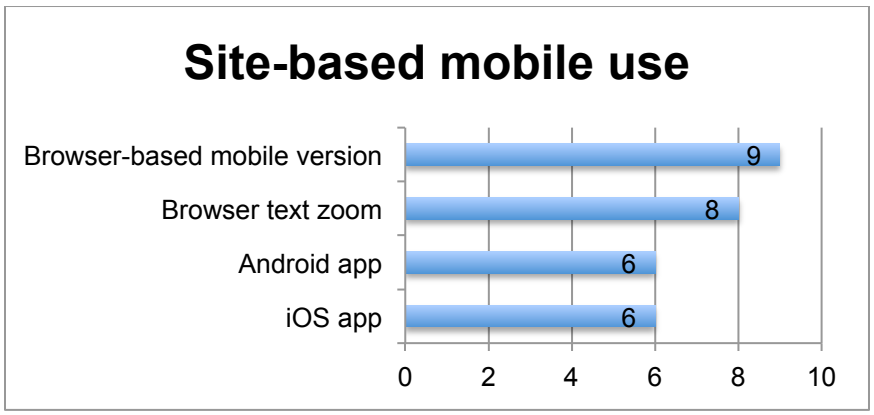

Figure 16. The aggregated tool, structure, and strategy use for mobile use of the 10 chosen COIL sites.

Competition and challenges. Although mobile design was not always a calculated endeavor, competitions and challenges were used quite purposefully in some

of the sites. Some sites had a culture surrounding competitions based on their subject, whereas others seemed to create competition within their sites as a deliberate endeavor. Figure 17 explains the types of tools used in some of the environments to promote challenge or competition.

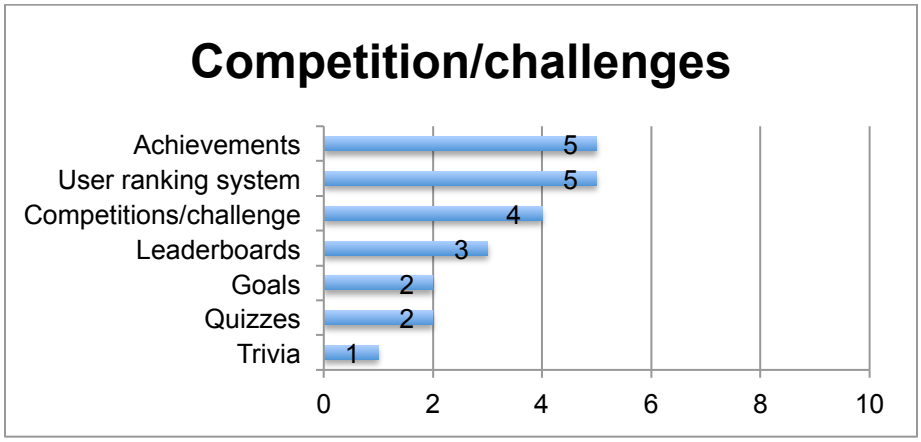

Figure 17. The aggregated tool, structure, and strategy use of competitions and challenges within the 10 chosen COIL sites.

Outside connections. Connections to external entities were inherent in all of the studied platforms. From the literature review, it was clear that outside connections may be important to a site, so special attention was paid to the types of outside connections that were fostered through tools, structures, and strategies within the sites, as seen in Figure 18.

This research associated outside connections to functions such as widgets and links to social media, integration with other sites, apps made by third parties, and job connections. Figures 19 and 20 examine specific social media connections that were available within the sites.

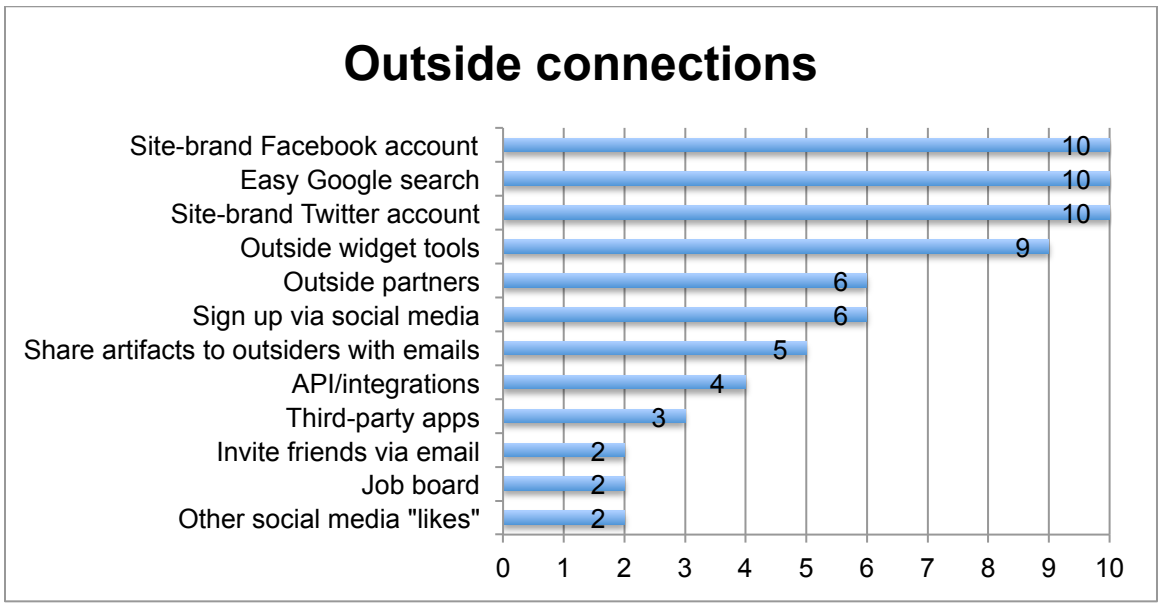

Figure 18. The aggregated tool, structure, and strategy use of outside connections to social media or other businesses from the 10 chosen COIL sites.

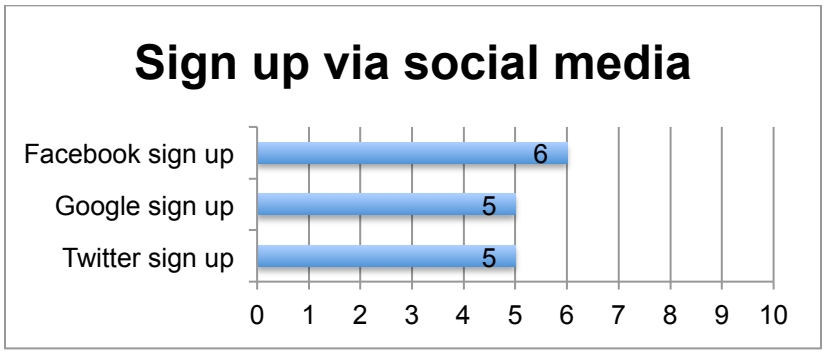

Figure 19. Types of social media used to sign up for access to sites.

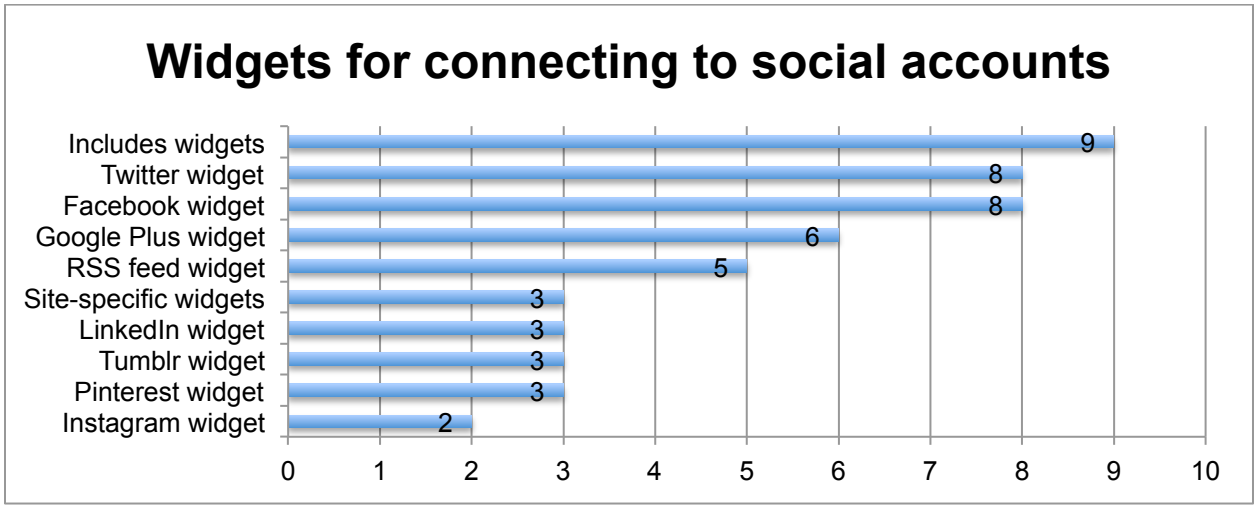

Figure 20. Different widgets available from within COIL environments.

Figures 19-20 show that Facebook, Twitter, and Google took the lead in social media connections. However, there was a spread of other connections, as well, such as LinkedIn, Tumblr, Pinterest, and Instagram.

Site-generated items. Up to this point, the discussion has been geared toward the tools, structures, and strategies created for user interaction, navigation, and analytics, but there were also site-generated items created expressly for the purpose of gaining users and helping users to learn. Figure 21 is devoted to the specific learning functions that the sites generated through either direct creation or sponsoring the creation of experts. Indeed, more of the latter seemed to take place in the sites, with several of them hosting expert-created content.

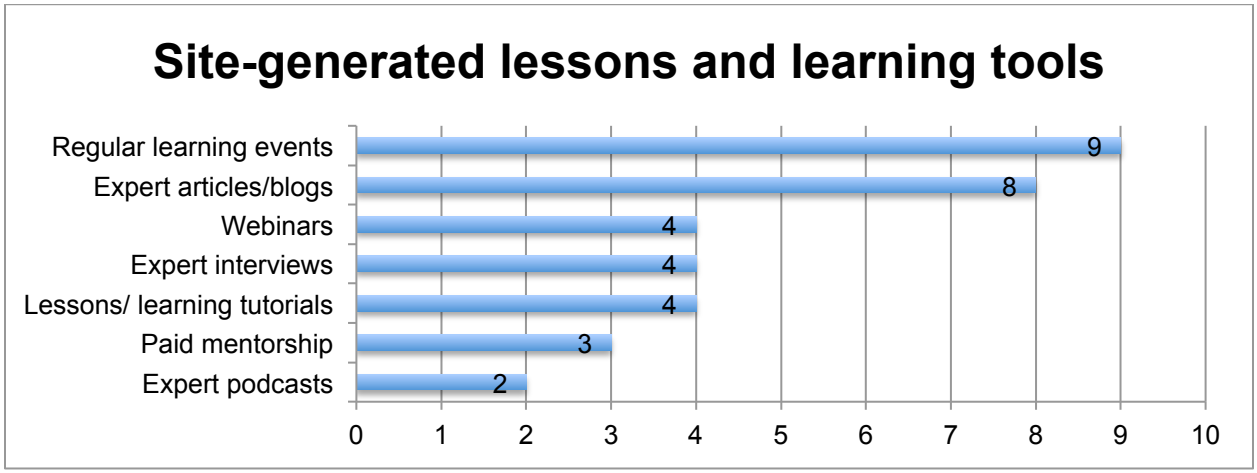

Figure 21. The aggregated tool, structure, and strategy use of site-generated tools for learning and lessons within the 10 chosen COIL sites.

Beyond the learning experience, sites also seemed to be intent in generating branding and interest. Figure 22 describes the different ways sites established themselves as an important place for people to become members.

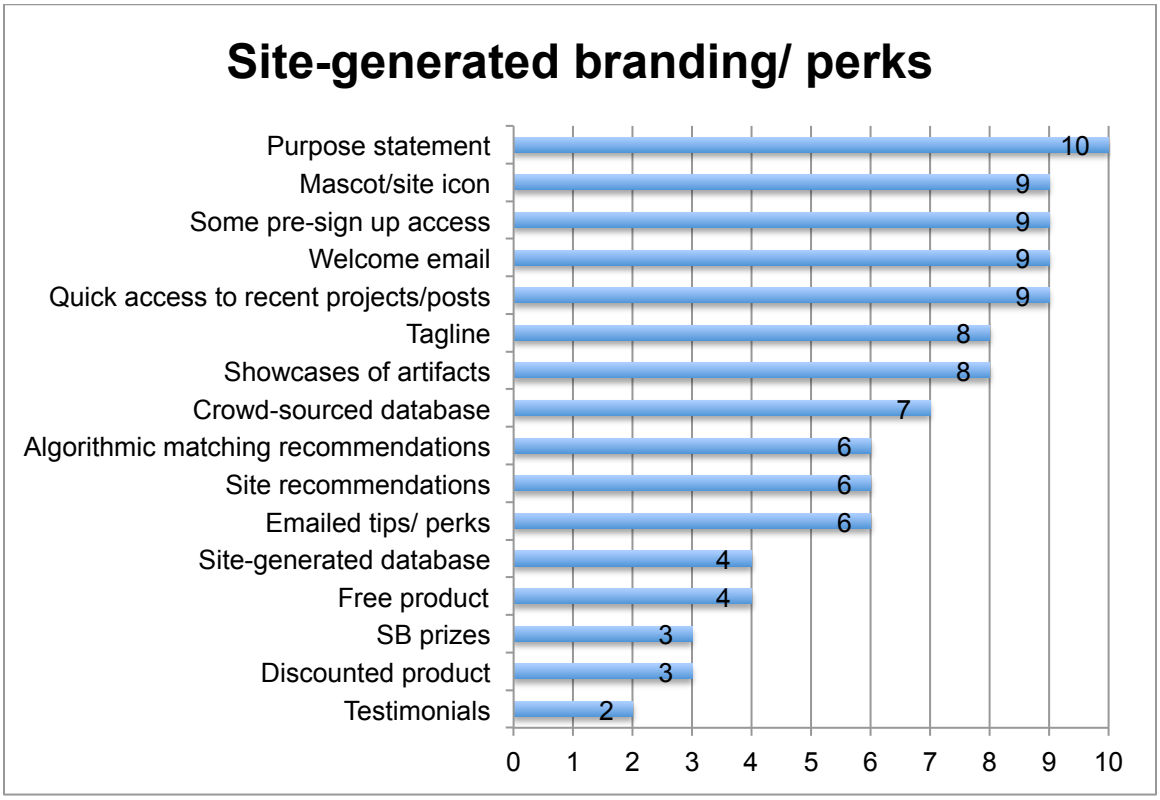

Figure 22. The aggregated tool, structure, and strategy use of site-generated tools for branding and other perks within the 10 chosen COIL sites.

As indicated in Figure 22, access to at least some level of information and view of the sites seemed to be popular mechanisms for gaining membership. Other perks such as access to a database and promised resources were popular functions, and emails were often used to maintain people's interest in content and membership.

Funding. One aspect of these sites that was not as distinguished in the literature was the idea of financial sustainability. Of course, a site owned by a business would be used as part of a larger funding structure. However, many of these sites were not tied to any specific business. Figure 23 demonstrates the evident popularity of different types of funding structures used in different sites.

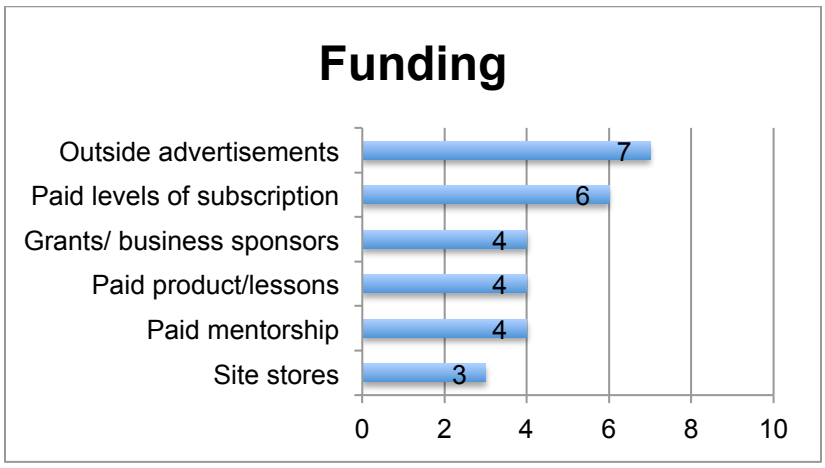

Figure 23. The aggregated tools, structures, and strategies used to fund COIL sites.

The most used funding source was banner advertisements allowed within the sites. Some sites had several areas of advertisement that were disconnected from the purpose of the site; others were very careful about which advertisements could be represented within the site and where these advertisements were displayed. Other funding sources included paid levels of subscription, business or grant sponsors, paid product, or in-site stores selling site-related products.

Site moderation. The safety and the security of individuals seemed to be a common trend for the sites. Assumingly due to the nature and difficulty of monitoring large populations, several sites created easy ways for individual users to report any need for help and even bad conduct within the sites. Figure 24 describes the different types of reporting mechanisms involved in the sites. The balance of site-based and user-generated moderation seemed to make the environments safer and more trustworthy places for interaction.

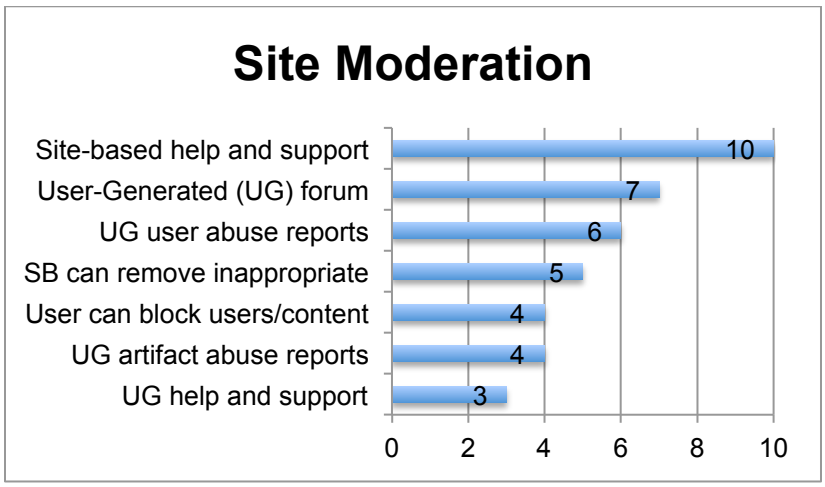

Figure 24. The aggregated tools, structures, and strategies for site moderation within the 10 chosen COIL sites.

Accessibility. Accessibility was measured slightly differently from the other tools. Figure 25 presents some aspects of accessibility, namely, the use of captioned video and /or transcripts of audio. Captioned video usually relied on the common YouTube service as its captioning agent, which does not typically deliver a perfect caption, and only two of the sites had transcripts available of audio.

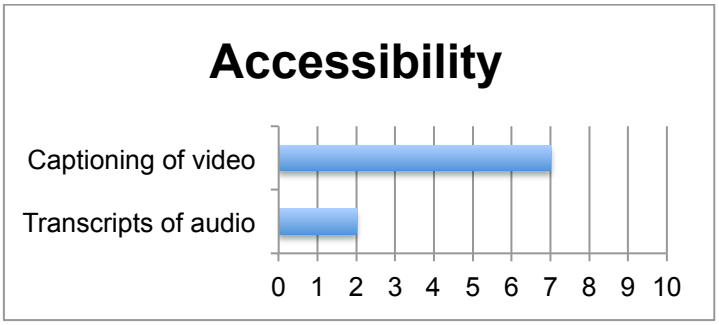

Figure 25. Tools for accessibility within the 10 chosen COIL sites.

The rest of the tools for accessibility were evaluated through an online mechanism, wave.webaim.org, that presented a numerical description of accessibility-related errors in headings, alternative text, and color schema, among other issues. Unfortunately, only six of the sites could be viewed due to restrictions in security and

permissions of these sites. Only non-password protected areas could be assessed. The data from the available sites can be seen in Table 9.

Table 9

Accessibility Errors Based on wave.webaim.org

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Structural elements (headers, alternative text, etc.)	79	26	46	17	49	40
Color contrast	159	8	40	49	106	47

In Table 9, the lower the score, the fewer errors were found. In this case, Site 2 seemed to have been designed with some amount of accessibility in mind, whereas Site 1 had deficiencies in both the structural elements and the color contrast. Overall, accessibility was still an aspect on which all sites could improve. By way of reference, the front page to Facebook had only one structural error and nine color contrast errors when put through the same test. A noteworthy point regarding accessibility is that some of these sites have user-generated material on the front page that was assessed by wave.webaim.org, and user-generated material was less likely to be tagged with headers and alternative (alt) text. This seemed to be the reason that some sites had heightened error scores.

Gathering places differed based on the site. Each site created its customized spaces for gathering. Gathering in this case refers to A. J. Kim's (2000) explanation of gathering together, which refers to the places in which individuals congregate. In some communities, gathering may occur around an object like a game board, a subgroup, a discussion forum, or multiple spaces. Many of the gathering places for the 10 sites tended to be around learning objects or artifacts, some gathering places were in

discussion forums, and some had various gathering spots. Table 10 shows the observed main gathering spots in the individual sites along with an explanation of how these spots gathered individuals. Although specific names are not mentioned to maintain some level of anonymity regarding the sites, general descriptions of customizations are offered.

Table 10

Explanation of Gathering Places for Each COIL Site

Website	Gathering place	Evidence of gathering
Logic/Games	Interactive game board	The main point of the site was to learn to play the logic game, so this was the focal gathering point. Discussions surrounded the game board, as well.
Debate	Debates	Debates had special tools to gather group opinion about the debating opponents.
Graphic Design	Graphic designs	Discussions and analytics surrounded graphics instead of separate forums.
Coding/Web development	Code	Main discussions surrounded the issues and comments about code.
Reading/Writing	Several gathering sections, including around a single book, a genre, an author. Discussions could be started for each of these learning areas.	Discussions and ratings surrounded each area
DIY	User-generated DIY Lessons	Showcased in the beginning and the main point of searches and discussions
Crafts	Multiple gathering places, including around types of crafts, general discussions, groups, etc.	Groups were created around several craft-related topics, while discussions and ratings could also take place around the individual crafts.
Wall Street Oasis	Forums	Categorized forums helped individuals to both find a specific topic of interest and find their gathering place for discussion
Travel	Travel destinations and pictures	Travel destinations were the main visuals and discussion places.
Citizen Science	Specific science projects	Projects had areas of both doing research and discussing the project specifically

Most used tools. Overall, each site had its customizations, but some tools seemed to be popular throughout the sites. All 10 COIL sites used the following tools:

- Avatar/picture upload
- Personal email
- Required email confirmation
- Password field
- Username field
- Name field
- Edit profile function
- View other users' profiles
- Non-forum artifact discussion
- Username associated with discussion post
- Profile picture associated with discussion post
- Post reply
- Discussion follow/subscribe
- Post rules/ netiquette
- Create artifact
- Statistics
- Site search box
- Drop-down menus
- Chunking of similar material
- Icons with text
- Help contact

- Site-brand Facebook account
- Easy Google search
- Site-brand Twitter account
- Purpose statement

Customized tools. Although all sites included certain tools, the site-specific customizations of tools supported the individual interests of the sites. These designs might not be necessary features in other sites due to the differing needs, but are central additions to their specific COIL. Table 11 gives examples of some of the most important customized tools within the different COIL environments.

Table 11

List of Most Salient Customized Tools in Each COIL Site

Website	Customized Tool	Purpose
Logic/Games	Interactive game board (play with computer or other users)	Fulfills main purpose of interactive game play
Debate	Voting polls on debates with customized discussion regarding debate	Leads to wins and losses in debates and makes other users the judges while demanding reasoning behind vote
Graphic Design	Color schema search	Helps individuals to locate color schemas for design
Coding/Web development	Code copy function with ability to either add new code or apply new edits to original code	Based on an open-source coding model, so individuals can repurpose code or add to original
Reading/Writing	Customizable groups with areas for saving books, discussing, creating group challenges and polls, and adding videos/images	Supports the groups' themes on an individual basis
DIY	Templated user-generated lesson format	Guides users to build DIY instructions in formatted way for consistency
Crafts	Extensive search filters and save search function based on crafting needs	Helps individuals to identify and locate exact items in a large database and find them again

(continued)

Website	Customized Tool	Purpose
Wall Street Oasis	Rating system built around an animal-kingdom theme	Builds culture and leads to group-ranked leaders
Travel	Extensive opinion polling regarding travel destinations	Opinions about travel destinations are extracted from travelers who have been to locations and aggregated for those interested in the areas
Citizen Science	Template for building projects	Creates consistency and scaffolding for those joining to help researchers

Summary of phase II. The intent of phase II was to understand the tools, structures, and strategies employed by custom-built environments of COILs. An aggregated list was constructed from the functions within the 10 chosen custom-built COIL sites. Each site was investigated based on the list to find the tools that were widely used versus the tools that were used relatively little. Two of these sites were investigated by a secondary reviewer to maintain a standard of accuracy. In all, over 200 tools, structures, and strategies were found as general tools, whereas each site was also found to have specific customized tools. Graphs and numerical data showing the aggregated use of the tools were created for easier data analysis.

Data and Findings for Phase III

Phase III of this research sought to answer the following research question as stated in Chapters One and Three: *How do the tools, structures, and strategies appear to support the community of online informal learners*? Using both a priori and open code, phase III explored both the shared tools, structures, and strategies as well as the customization of sites to find how the functions supported COILs. Upon completion of codes and themes, a meta-analysis of the themes and tools was conducted to understand the inter-relationship between themes. The previous phases of this research

were created as building blocks to this qualitative phase of exploratory research. The data collection, data analysis, and findings for phase III are explained in this section.

Data analysis for phase III. For phase III, data collection consisted of using both a priori and open codes to look at the tools, structures, and strategies from phase II to see how they appeared to support COILs. The a priori code was based on design literature about building online communities. The open code was based on possibilities from the aggregated lists of tools, structures, and strategies and from basic observed phenomena within the separate COIL environments themselves.

A priori code. The a priori codebook consisted of categories and themes presented in the literature review and Chapter Three. The principal investigator first used these categories and themes to examine the list of tools, structures, and strategies. The same codes were applied to the list by a second reviewer after a brief training on the codes. Both the primary and secondary reviewer had a strong background in social learning theories. The primary researcher and secondary reviewer discussed mutual findings after the first review. It was found that the secondary reviewer needed a more specific definition for some of the codes, namely the difference among profiles, identities, and roles in social design literature; the nuanced meaning of information architecture as a usability piece for the purpose of this research; and the meaning of influence and significance in community-building literature. The final, concise definitions of each term as used in the research can be seen in Table 12.

Table 12

Concise Definitions for A Priori Codes

Theme	Concept	Concise definition
Social design	Profiles	Creation of outward-facing personal description
	Identities	Ability to identify and the support people in their trajectory from newcomer to expert
	Roles	Distinguished roles for governance and moderation
	Relationships	Ability to create relationships (e.g., finding friends, groups, etc.)
Usability	Signifiers	Clear indication of what a structural element does (icons, links, etc.)
	Mapping	Clear indication of how to get to intended points and how one got to current point
	Constraints	Intentional restraints to make more uniformity (e.g., a template guide for posting)
	Feedback	Clear indication that an intended action has been accomplished or not accomplished (e.g., welcome email, discussion posted, or a "you have successfully..."
	Mobile support	Mobile browser or app ability
	Accessibility	Access for people with altered abilities (e.g., sight- or hearing-impairments)
	Information architecture	Information organized and searchable (e.g., clear navigation, filters, search boxes, tags, labels, etc.)
Community building	Purpose	Clearly stated explanation of objectives of community
	Remuneration	Rewards for joining community (e.g., easy access to information, competitions, etc.)
	Influence	Ability to control the environment or the site (e.g. change colors, change rules)
	Belonging	Cultural practices such as events, language, rituals, etc., and being part of groups
	Significance	Outside connections (social media and other), access to experts, clout of community, and clear evidence of passionate work within community
	Rules, policies, and behavior	Clear rules, policies, behaviors

Once the definition of terms had been established, the tools, structures, and strategies were re-coded by both reviewers. This final review established a simple percentage agreement of 96% and a relatively high Cohen's Kappa coefficient of 0.93 to include the possibility of random agreement. The following sections of tables and figures describe the outcomes of this coding process by showing which tools, structures, and strategies were found to pertain to specific categories within the themes of social, usability, and community-building designs. The specific customizations of each of these themes will also be discussed.

A priori code theme 1, social design. Several tools, structures, and strategies within the chosen COIL environments were devoted to social design. Figure 26 shows the findings of the coding process with a list of specific functions as they connected to the categories of profiles, identities, roles, and relationships. The way these functions were customized within the sites is shown in Table 13.

As shown in Figure 26, social design was well-supported, especially in the area of building a personal profile, but also through identities and roles in general, along with the ability to build relationships. Within the sites, certain customizations of these social tools supported the specific learning environments, as seen in Table 13. This table focuses on the most important social design customizations for each site.

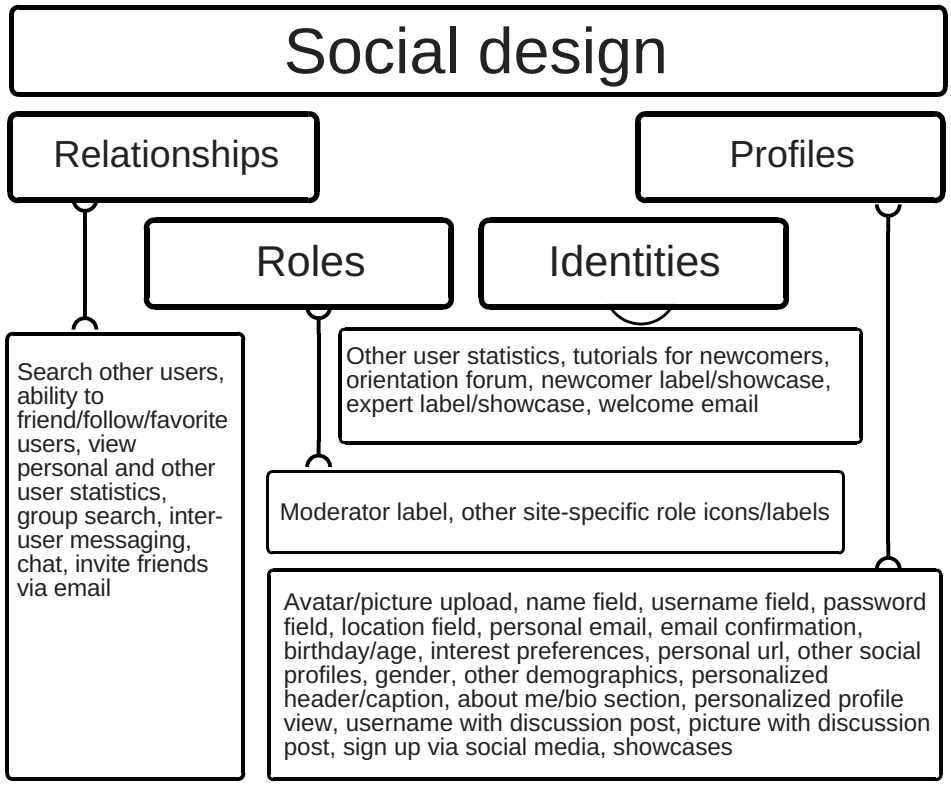

Figure 26. Social design theme with supporting categories and tools.

Table 13

Example Site-Specific Customizations for Social Design

Website	Customization for Social Design
Logic/Games	Profiles identify individuals' world-recognized game scores.
Debate	(a) Profile questions ask for debaters' alignment with hot current topics such as abortion and marijuana. (b) Elo scores, which are debate-related scores, are shown on profiles.
Graphic Design	A special showcase focuses on *debut* designs for newcomers, which begins to establish their identity in the site.
Coding/Web development	Newcomers are supported through an initial step-by-step tutorial that breaks down the complex nature of using the customized tools that allow for code copying and recycling, etc.
Reading/Writing	Profiles are built around preferred books, which lead to algorithmic recommendations of books and groups.

(continued)

Website	Customization for Social Design
DIY	A posting board increases interactive relationships by allowing users to post a comment, sticker, or image on another user's profile wall.
Crafts	Search mechanisms allow relationships to be established based on geographic location.
Finance and Investment	Clear roles ranging from newcomers to experts are aligned with the sites iconic symbols of species of the animal kingdom.
Travel	Profiles pages can be customized to show where a user has traveled.
Citizen Science	Role indicators help individuals to distinguish between lead research project owners and others who are helping with research.

A priori code theme 2, usability design. The second theme from the a priori code required a look at the usability design of the chosen sites. The initial vetting process in phase I already took into account that some thought had been given to usability, so phase III sought to describe the usability features in the sites. Figure 27 specifies the tools, structures, and strategies that most aligned with usability-related categories of signifiers, mapping, constraints, feedback, mobile support, accessibility, and information architecture.

Although all aspects of usability appeared to have some elemental support, information architecture received the most coded tools, indicating that information architecture had a high degree of intentional design based on the observed elements within the sites. In general, customizations for usability within the separate sites tended toward the colors, text, labels, and mixture of structural elements. Many sites used a mix of the placement of information, such as consistent top links that did not change with page changes, along with secondary top links or tabs that did change depending on the specific page, and some aspect of a left-hand menu for personal collections.

Some sites took advantage of the collective user-generated tagging in order to make searches easier within the sites. Each site had a unique mixture of usability features.

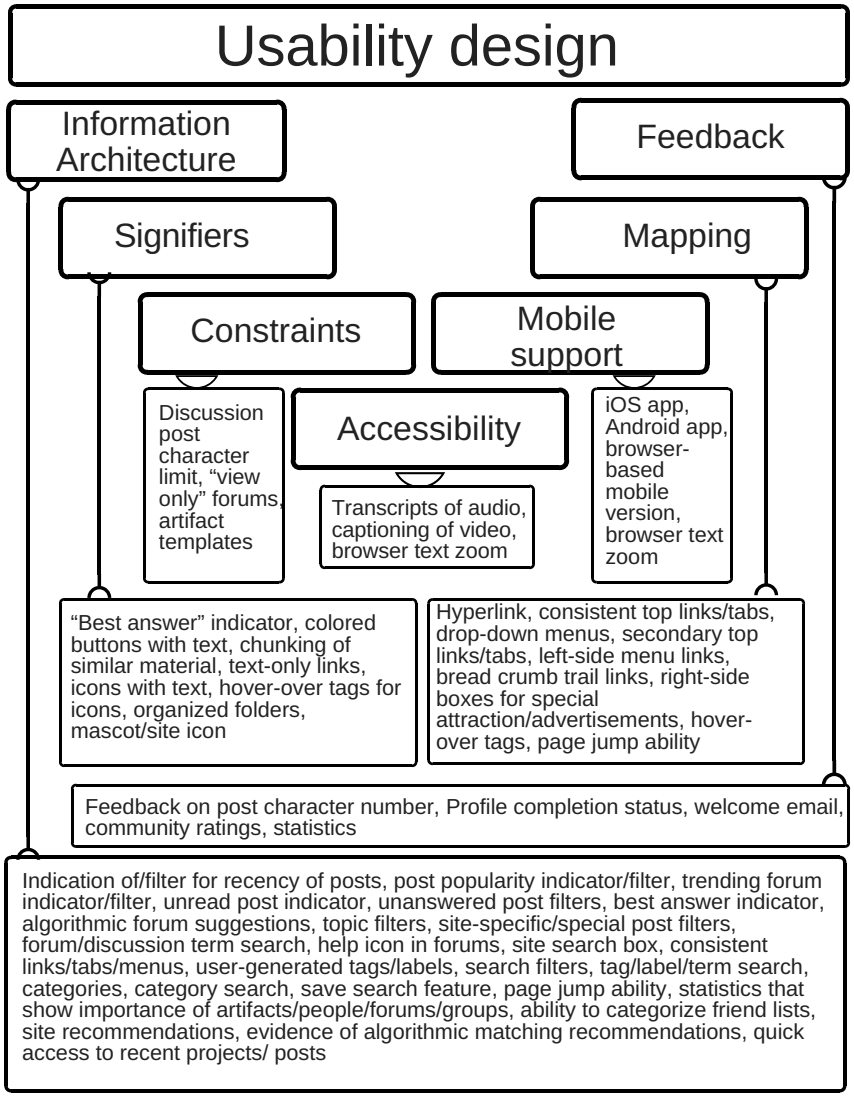

Figure 27. Usability design theme with supporting categories and tools.

A priori code theme 3, community building. The final a priori theme involved community-building strategies. Based on community-building literature, the categories chosen to represent community building were purpose, remuneration, influence, belonging, significance, rules, policies, and behavior. Some of the definitions may be somewhat nuanced. Therefore, to serve as a brief review of the most nuanced

definitions, remuneration means any reward (which could mean explicit or internal) for joining a site; influence means the amount of control an individual or the collective group has over the site; belonging means the events, culture, groups, and internal language that make a user feel a part of the site; and significance means the external clout and the access to experts and information within the site (Howard, 2010). Figure 28 indicates the coded tools, structures, and strategies as they pertain to the categories of community-building design.

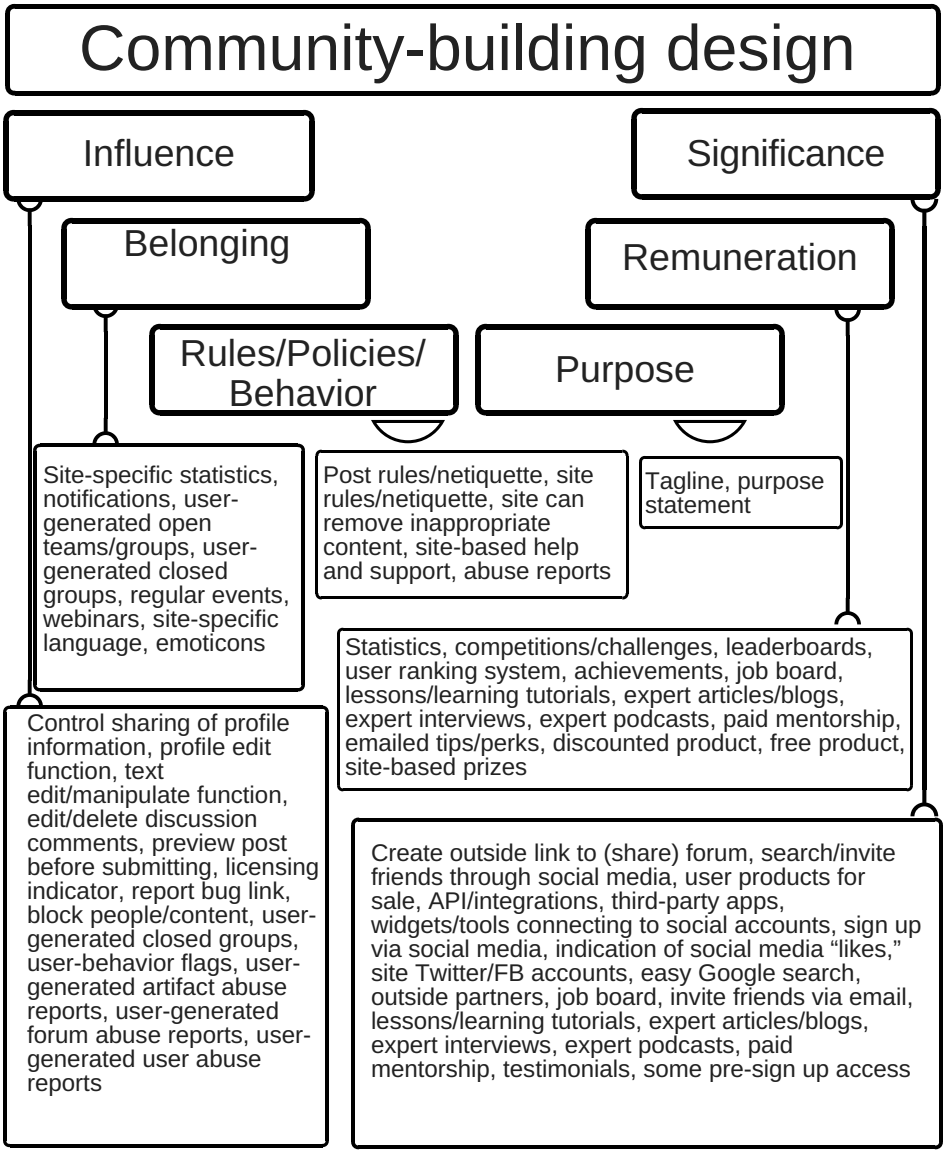

Figure 28. Community-building design theme with supporting categories and tools.

Figure 28 reveals a strong effort toward community building within these sites, especially within the strategies of remuneration, user influence, and significance. Moreover, certain customizations within the sites offer community-building strategies, as well. Table 14 describes some of the customized community-building methods used in specific sites.

Table 14

Example Site-Specific Customizations for Community-Building Design

Website	Customization for Community-Building Design
Logic/Games	Challenges and competitions are central to the design and capability of the tools along with constant statistics regarding wins, losses, and rankings (strategy of remuneration).
Debate	The tools within the site give easy access to create a debate and challenge other individuals to the debates (strategy of remuneration).
Graphic Design	The site is built around a sport theme (strategy of belonging) with specific sports language to describe the activities within the site.
Coding/Web development	(a) The open-source features allow people to save time by accessing pre-made code and changing it to benefit their needs (remuneration), and (b) a themed icon exists throughout the site with a store built around its brand (belonging).
Reading/Writing	Groups can be created and several tools are offered to the groups, such as discussions, challenges, events, photos, videos, and polls (belonging).
DIY	Users receive bronze, silver, and gold medals for their participation on the site (remuneration).
Crafts	Users are allowed into the site creation process (influence) by creating a user-edited wiki to explain how to use the site and a group-produced user help forum.

(continued)

Website	Customization for Community-Building Design
Finance and Investment	An entire culture is built around a specific animal (belonging), enough that the rating system is the animal food for positive remarks and the animal's feces for negative remarks. Identities of users are associated with a member of the animal species based on their novice/expert status.
Travel	Users are given discounts to travel-related items such as flights and hotels (remuneration).
Citizen Science	(a) People who participate in the site are called by a site-related name, __-*ites* (belonging), and (b) many of the research projects have led to published articles (remuneration, significance).

Summary of a priori code findings. Through the a priori coding of tools, structures, and strategies used for sociability, usability, and community-building design, it is evident that the functions of the planned design supported the COILs by making them sociable, usable, and community-based. Each platform contained tools, structures, and strategies for sociability, usability, and community-building, and customization of the tools created a more established community.

Open exploration. Social, usability, and community-building design are helpful supports for COILs and support the community aspect of COILs, but information from this a priori code did not sufficiently answer the question of how these tools, structures, and strategies supported custom-built COILs. Indeed, if each term were extracted from the concept of custom-built environments for COILs, this research would need to show how each element is supported, namely (a) *custom-built environment*, (b) *community of learners*, (c) *online*, and (d) *informal learning*. The a priori code and explanations of customizations fulfilled, in part, the answer to the question of supports for *custom-built environments* and *community*, and all sites were online and thus preemptively vetted to support the *online* aspect of the terms, but more information needed to be extracted for

an understanding of supports for the social *learning* (community of *learners*) and informal learning within the sites. Also, several functions did not fit into the design literature themes for sociability, usability, and community-building. For this reason, an open exploration of tools, structures, and strategies followed the a priori coding in order to establish further comprehension of the supports offered for custom-built COILs. The principal investigator and the secondary reviewer each added themes of interest and then a consensus was made on the final exploratory themes. The themes derived from this coding included social learning, informal learning, personalized learning, and sustainability.

Open code, theme 1, social learning. Social learning seemed to have several tools as support, some of which intersected with the design for sociability and community. Table 15 describes the categories and definitions of the categories for the theme of social learning. The categories included participatory learning, Web 2.0, learning with the ZPD (Vygotsky, 1980), aggregating collective intelligence, and distributed cognition.

Categories for social learning were found to have several supporting tools, structures, and strategies based on the list in phase II. Figure 29 offers a list of those items that the reviewers connected to the categories. As seen in Figure 29, discussions seemed to fit all categories of social learning since the main drivers of discussions were the users. Several tools, structures, and strategies seemed to support participatory learning and aggregating collective intelligence, as well. Overall, social learning was well-supported in the different COIL environments.

Table 15

Concise Definitions for Social Learning Categories

Category	Concise definition
Participatory learning	Ability for individuals to work together around a learning interest
Web 2.0	Tools that allow “many to many” publishing and interactions (instead of “one to many”) (O’Reilly, 2007)
Learning as ZPD	Learning “transactions” that fulfill the Vygotskian event of learning within the ZPD (more knowledgeable “other” helps learner to learn)
Aggregating collective intelligence	Ability for the community collective intelligence to add to the knowledge base
Distributed cognition	Evidence that the knowledge base is spread through different users within the system (meaning a need for working together because different individuals know how different things work)

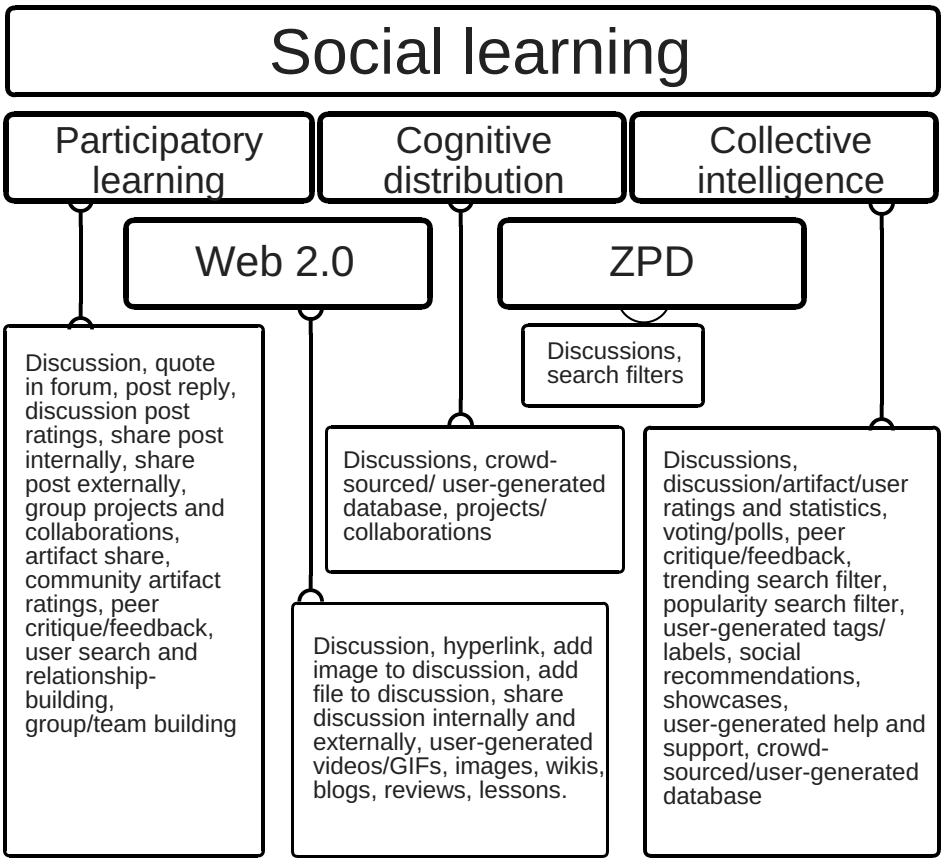

Figure 29. Social learning theme with supporting categories and tools.

Open code, theme 2, informal learning. Differentiated from social learning, informal learning has more to do with the individual's ability to be driven by a personal motivation to learn and an ability to be self-directed without the guidance of a prescribed learning environment. This type of learning would need support from the tools, structures, and strategies of the environment. Based on the observed aspects of the studied COILs, informal learning categories of self-directed learning, learner-focused learning, just-in-time answers, access to information, unscripted learning, and contextually-situated learning were chosen as representations of informal learning. Table 16 offers a definition for each category.

Table 16

Concise Definitions for Informal Learning Categories

Category	Concise definition
Self-directed learning	Support for learners who are driven by a personal need to learn
Learner-focused learning	Support for individuals who have a purposeful learning interest that needs to be satisfied by the environment
Just-in-time answers	Individuals can receive quick answers to questions
Access to information	Adequate information exists and is easy to access
Unscripted learning	Learning is not formalized, scripted, or prescribed (learner decides best method of learning)
Contextually-situated learning	Learning is contextualized and situated based on learner experience/need

The COIL environments supported informal learning with tools dedicated to helping users find and store relevant information. Figure 30 lists the types of tools the

researchers deemed most helpful for informal learning. Informal learners benefit especially from the ability to search and access data in the COIL environments since these sites do not necessarily have devoted mentors. The chosen COIL environments appeared to support informal learning through their tools, structures, and strategies.

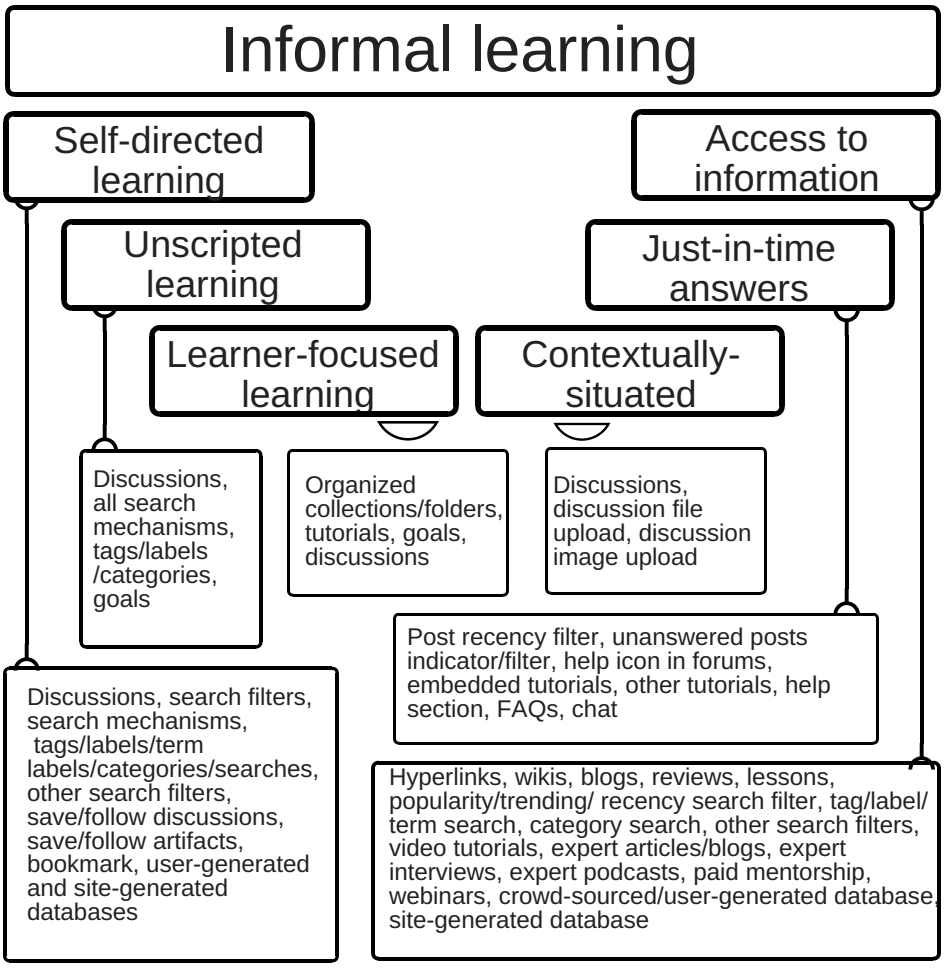

Figure 30. Informal learning theme with supporting categories and tools.

Open code, theme 3, personalized learning. The open coding process found that some tools fit better into a personalized learning category rather than positioning them as a social or informal type of learning. Granted, some aspects of informal, self-directed learning intersect with personalized learning. However, the coding process revealed personalized learning needed a theme of its own. Table 17 describes the different

categories that fit into a personalized learning theme, including personal and group feedback, having control over personal learning and the personal learning environment, storing learning objects, productive failure, and optional content.

Table 17

Concise Definitions for Personalized Learning Categories

Category	Concise definition
Personal/group feedback	Elements that support personal/group feedback
Storing learning objects	Support for saving or easily reconnecting with personal collections of learning objects
Constructivism/ Constructionism	Support for scaffolding and constructing learning through personal hands-on experience
Productive failure	Support for showing personal failure and learning from it
Optional content	Optional lessons/ tutorials/ content that help users to improve understanding
Personal control	Personalized control of the learning and learning environment

Personalized learning had its own specific supports through tools, structures, and strategies that supported the learner. Figure 31 gives examples of the specific functions that supported personalized learning in the chosen COIL environments. Through tools, structures, and strategies that allowed individuals to obtain personal or group feedback, store or follow points of interest, fail and learn from the failure, and access optional content, individual needs for learning on a general level were well-supported through the chosen COILs.

Open code, theme 4, sustainability. The final theme from the open coding process showed two types of efforts toward sustainability within the studied COIL sites, namely, financial sustainability and sustainability of membership. Sustained

membership was already treated somewhat in the section on community-building as the design measures taken toward attracting and keeping members. However, it is noteworthy to add that the large membership of the 10 COIL sites increased both visibility and trust in the sites, which worked toward the sustained membership.

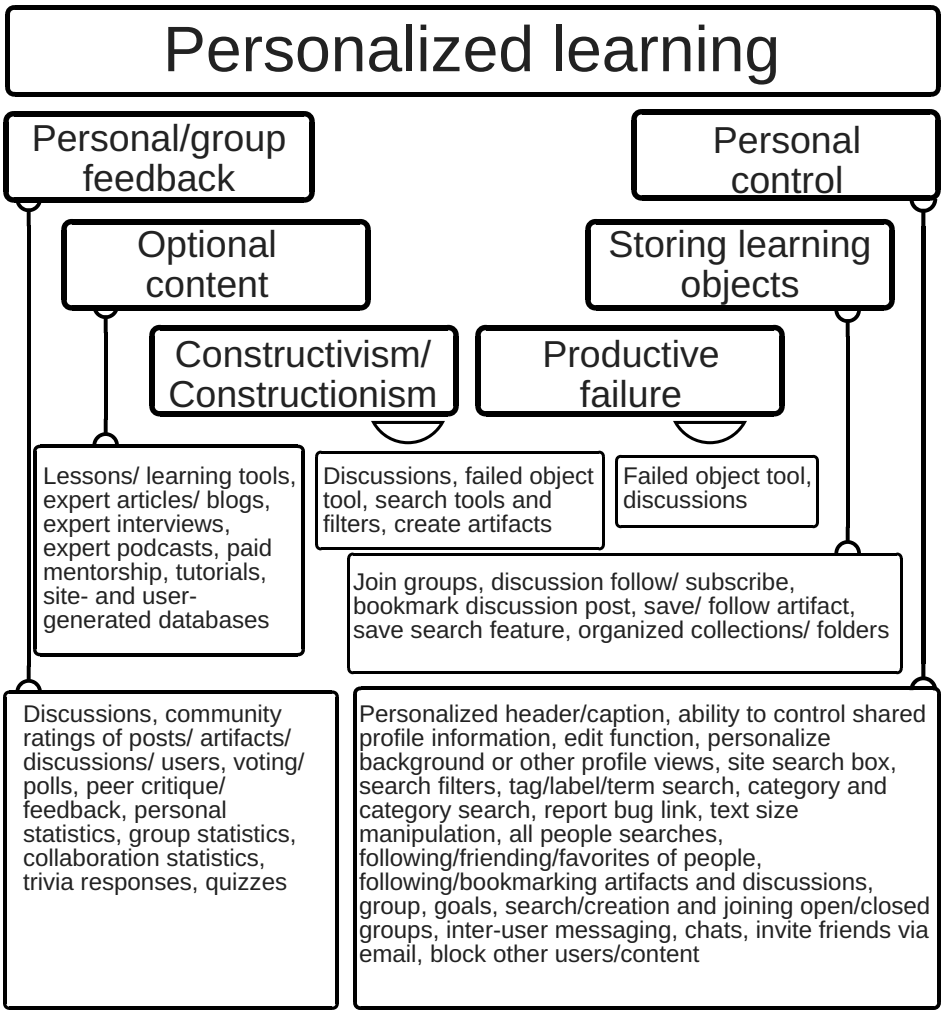

Figure 31. Personalized learning theme with supporting categories and tools.

Financial sustainability within the sites was designed through different strategies. Many of the sites employed advertisements or paid subscriptions as their principal means of funding. Other sites used paid products and site stores or a mix of two different funding sources. One site had grants from sponsoring institutions, whereas

another site had a business sponsor that earned money from the main learning interest of the site. In all, sustainability was a necessary strategy in order to keep the custom-built COILs going.

Custom-built design for learning. Although the general tools used by the COILs under investigation have been listed previously, a view of the customizations made specifically for the learning process offers a better picture of the designs for learning. Many individual sites had salient designs for the learning process and needs of their users. Table 18 offers examples of these customizations.

Table 18

Example of Site-Specific Customizations for Learning

Website	Customization for Learning
Logic/Games	Extensive game-related tutorials, including visual training for chunking the game board, computer play, and case-based studies.
Debate	Exhaustive forum-based tutorial sent to newcomers in order to teach them the rules and language of debate.
Graphic Design	Regular interviews and blog posts allowed users to have access to expert information about designs and jobs in the design field.
Coding/Web development	Each shared code had a tab that explicitly showed tagged problems with the code, which allowed other users to scour the code and help with the problem areas (productive failure).
Reading/Writing	One of the perks of the site was to give users access to several renowned authors either through discussion boards or interviews. Readers were allowed to ask questions through both platforms and get first-hand information from the authors (who could be considered experts in their specific book).
DIY	The central theme of this DIY site was a templated method of user-generated instructions for doing DIY projects. The template kept the instructions in manageable lesson formats to make learning easier.

(continued)

Website	Customization for Learning
Crafts	Individuals had space to save their learning and write notes about newly learned features. Also, users had several ways to search individuals for friending, including through location and craft preferences, to create like-minded learning partnerships.
Finance and Investment	(a) Routine business tips were sent to email for learning software and trade secrets. (b) Expert mentors were a paid product.
Travel	Each destination had a section for tips from travelers who had traveled to the area to help users learn important aspects of travel.
Citizen Science	User-generated research projects were built through templates in order to scaffold the research work into small enough chunks for individuals to be able to process the research needs and help with data entry.

Sites had the users' learning needs in mind when designing the various tools, structures, and strategies within the environment to support learning progress within the sites. Although this list of customizations is not exhaustive, it offers a view of some of the most important supports for learning in the sites.

Meta-analysis of phase III. Although the thematic view of tools, structures, and strategies gives insight into the basic building blocks of these sites, connections between the themes offer a broader picture of how the themes united in the sites to support the various COILs. Therefore, a meta-analysis was conducted to reveal the inter-relationship of the various themes. Findings from the meta-analysis indicate that the thematic units supported each other in important ways, building from the themes used in the phase III a priori code, namely usability, community-building, and social designs, to the more pinnacle open themes of social, informal, and personalized learning, as shown in Figure 32.

Inter-relationship of themes. Themes had an inter-related and reciprocal relationship as can be seen in Figure 32, which represents the inter-relationship of the

themes within COIL environments. During the coding process, it was found that sustainability created the funding for the environment to exist, while usability was foundational for community-building, social design, social learning, informal learning, and personalized learning. Information architecture was one of the most important elements of usability's foundational support.

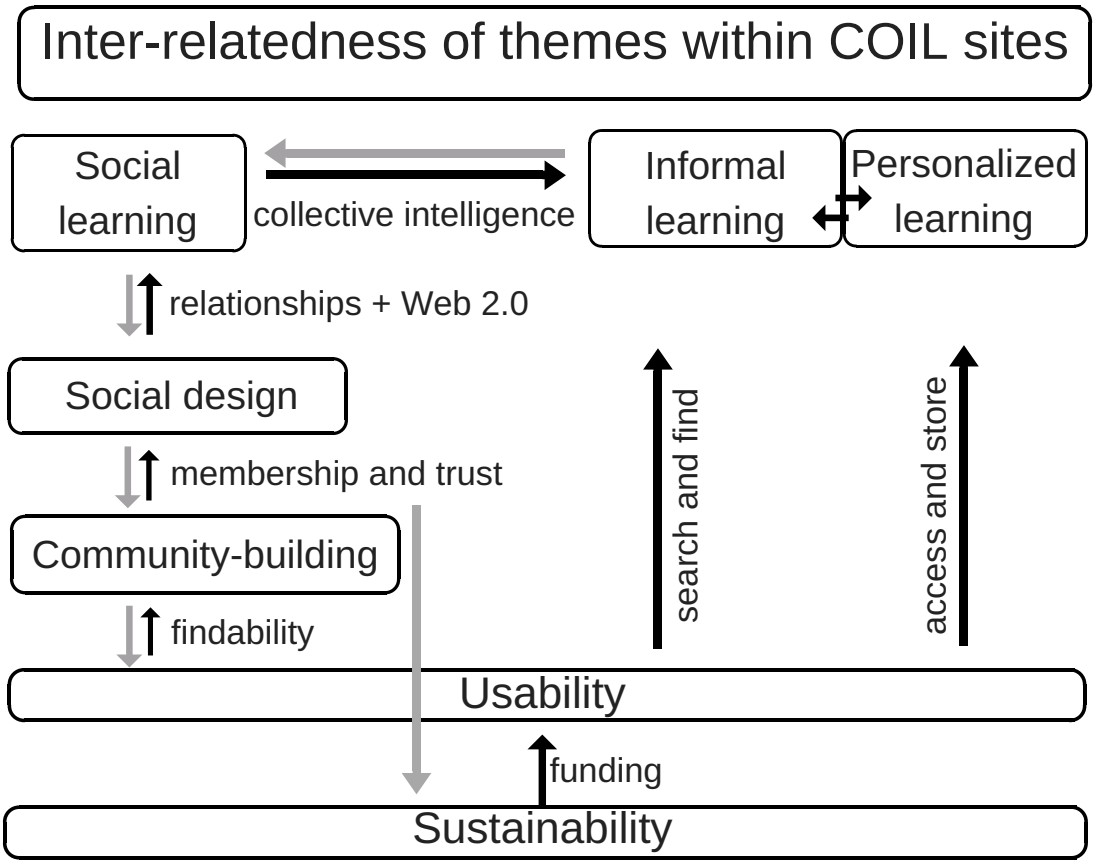

Figure 32. Inter-relationship of themes in COIL environments.

There was a great deal of inter-relationship among themes. Indeed, community-building was necessary for the initial gathering of individuals and trust-building, which built the social mass for social design and also reciprocated the ability of the site to have sustained membership. Social design was necessary to build relationships, and Web 2.0 tools advanced the social design into social learning. The collective information

from the social conglomerate of learning was key for informal learning, and informal learning and personal learning were tightly connected with the self-directed nature of informal learning leading to a personalized learning path.

Paths for self-directed learning. Beyond the inter-relationship among themes, a closer look at the allowances of the open themes made it easy to see that there was a very specific way that social learning mixed with site design to create different learning paths for an informal learner. Figure 33 describes three paths and shows the spectrum.

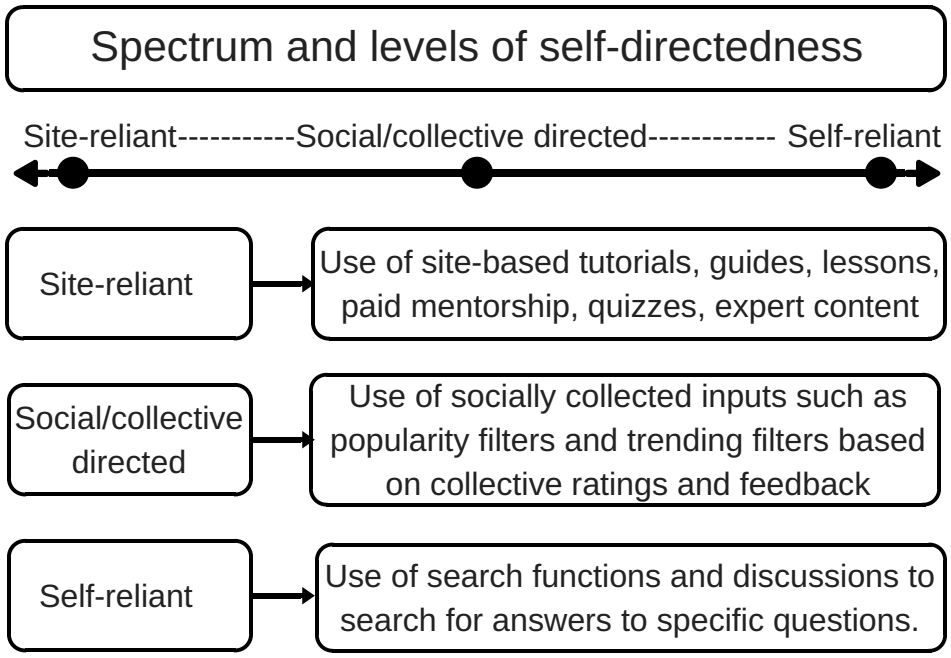

Figure 33. Spectrum and levels of self-directedness.

As seen in Figure 33, it was found that a self-directed learner had a spectrum of self-directed activities, ranging from less self-directed learning through reliance on site-generated content to more self-directed learning through search and find mechanisms and discussions. The following three distinct paths were found, but a learner might choose a mixture of these paths, making the self-directed nature a sliding scale on a spectrum instead of a single identifiable method: (a) learning from the site-created

content and learning materials such as sponsored blogs and articles, (b) learning from the collective intelligence of others through tools such as the analytics and popularity search features, or (c) learning from self-driven questions through tools such as discussions or search bar functions.

Summary of phase III. The final phase of this research sought to establish the supports that the tools, structures, and strategies of the custom-built COIL sites gave to their communities. An a priori code book related to literature on social, usability, and community-building design was used by both the principal investigator and a secondary reviewer as a preliminary review of the functions within the COIL sites. Then, an open exploratory coding process was implemented to find how the tools, structures, and strategies of the sites supported the COILs. The open exploratory process found that social learning, informal learning, personalized learning, and sustainability were all supported within the custom-built COILs. A meta-analysis of these themes and their underlying tools found that each of these were inter-related and most of the openly coded themes built off of the a priori themes. A list of general and customized tools was included in the research.

Summary of Results

The findings of a series of three phases of study to explore custom-built COILs found that simple Google and Quora searches led to several sites that fit the definition of custom-built COILs. Ten of these sites were reviewed further for tools, structures, and strategies, with a resultant aggregated list of over 200 functions within the 10 sites. Both common and customized functions were found within the sites, with specific customizations relating to the specific learning interest of the sites. These tools,

structures, and strategies were then explored through the perspective of the literature pertaining to sociability, usability, community-building, social learning, and informal learning. Each of these themes was observable and highly supported within the sites, and personalized learning and sustainability were also found as strong themes during the open exploration. All of the phases show a strong argument for custom-built COILs as a collective phenomenon worthy of further research.

Chapter Five: Conclusion

This study investigated the special environments built to house communities of online informal learning (named COILs for the purpose of this research). Although created by unrelated groups and previously not studied jointly, communities of individuals with specific learning interests have blossomed across the Internet since the late 20th century in response to a social need to learn together (Lévy, 1997). Many of these sites are custom-made to serve the particular needs of their respective communities' learning interest while hosting large numbers of members. Much different from their formal counterparts, however, these informal environments are built without a prescribed learning structure or teacher; rather, these sites accommodate learning by facilitating knowledge sharing between members. These custom-built sites represent the organic design choices that support a distinctive learning approach, requiring the deliberate use of tools, structures, and strategies to support the specific needs of their members.

COIL sites offer incredible learning potential, yet research has not connected the various sites together as a focused study. Many of these sites have substantial membership numbers and large databases of user- and site-generated learning objects, making them potential powerhouses of learning for self-directed learners who want to learn in social environments; however, since they are not connected to formal learning environments and are created by disparate entities, collective research on these community learning sites has not been conducted thus far. Indeed, they have not been given a collective name until this study. This study was conducted to both reify the concept of custom-built COILs and research the choices of tools, structures, and

strategies that serve these types of learning spaces. The following research questions were used to guide the study:

1. What current types of online platforms are custom-built to host a community of informal learners for a specific learning purpose?
2. What tools, structures, and strategies are evident in these custom-built environments?
3. How do these tools, structures, and strategies appear to support the community of online informal learners?

This concluding chapter gives a brief synopsis of the conceptual framework, along with a summary of the findings from three phases of study, and the strengths, limitations, implications, and recommendations of the study.

Synopsis of Conceptual Framework

In the absence of direct research on COILs, the conceptual framework of this study was developed around the theories of socio-technical systems (Bijker, 1995; Engeström, 1987; Engeström & Sannino, 2010; Nardi, 1996), participatory culture (Itō, 2010; H. Jenkins, 2006), social and social constructivist learning (Bandura, 1971; Gee, 2005; Lave & Wenger, 1991; Vygotsky, 1980; Wenger, 1998), and informal learning (Brew, 1947; Hague & Logan, 2009; Knowles, 1950; Livingstone, 2001; Schwier & Seaton, 2013), with support from community-building and other design literature (Bacon, 2012; Crumlish & Malone, 2015; Howard, 2010; A. J. Kim, 2000; Kraut et al., 2012; Krug, 2014; Preece, 2001). Socio-technical systems theory provides the viewpoint that the building blocks of online ecosystems are both a mirror of social needs

and the tools that direct social interactions (Bijker, 1995), meaning both inform each other.

The advent of Web 2.0 tools (O'Reilly, 2007) that allowed the general public to produce instead of merely consume created the capacity for what Henry Jenkins (2006) deemed *convergence culture* or *participatory culture* (H. Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009) in which a community of individuals could create and learn from each other. This change in tools has given a phenomenon like a COIL the means to thrive, and with these tools COILs have made new spaces for learning: spaces in which learning can become both more social and more self-directed. Social and social constructivist learning (Bandura, 1971; Gee, 2005; Lave & Wenger, 1991; Vygotsky, 1980; Wenger, 1998) and informal, self-direct learning (Brew, 1947; Hague & Logan, 2009; Knowles, 1950, 1975; Livingstone, 2001; Schwier & Seaton, 2013) are thus integral to these communities.

Although the theoretical literature regarding social and informal learning and socio-technical reciprocation inspired the underlying ideas for COIL research, practical design literature on community building from Preece (2001), A.J. Kim (2000), Howard (2010), Bacon (2012), Kraut (2012), and Crumlish and Malone (2015) helped to guide some of the conceptual understanding of extant design-based ideology. With this in mind, the following definitions of terms were created to describe custom-built COILs (as stated in Chapter One).

1. *Community of learners*: A social group of individuals gathered together around a common learning interest (A. J. Kim, 2000) and participating in activities, rituals, and shared learning culture (Preece, 2001).

2. *Online learning*: Learning that is mostly or fully online.
3. *Informal learning*: Learning that is self-directed and not tied to predominantly prescribed or formal education (Hager & Halliday, 2007; Livingstone, 2001).
4. *Custom-built environment for COIL:* A platform custom built specifically for the learning interest and needs of the community of online informal learners.

This research sought to build upon this literature in order to reify, or give a name to, the phenomenon of COIL environments while establishing a foundational study regarding the custom-built COILs with their specific choices of tools, structures, and strategies chosen for the distinctive needs of the learners surrounding the learning interest.

Although some needs for community-building are known—such as tools for social design (Crumlish & Malone, 2015; Preece, 2001), usability (Krug, 2014), and other specific strategies for building communities (Bacon, 2012; Howard, 2010; A. J. Kim, 2000; Kraut, 2012; Preece, 2001)—a review of the literature found that online communities created to foster informal learning had not been reviewed for their use of these design techniques (Owens, 2014; Sackey et al., 2015), nor did the literature show any attempt to collectively explore the environments for their support of social and self-directed learning. For this reason, this qualitative, exploratory study was conducted to understand the COIL phenomenon and explore the way the environments were built and customized to fit the needs of the users.

Summary of Research

The exploratory study was conducted in three phases. The following list gives a brief synopsis of the research.

1. In phase I, Google and Quora searches for diverse types of sites were conducted and each site was vetted for its fulfillment of the custom-built COIL definition of terms, *community of learners, online, informal learning,* and *custom-built environment*. A group of 53 out of 75 sites of diverse subjects were found to fulfill the terms, meaning 71% of the original sites. A secondary reviewer analyzed over 20% of the sites, resulting in a 96% agreement. However, the Cohen's Kappa coefficient only provided a score of .36 due to the amount of *yes* responses for the sites.
2. For phase II, each site was analyzed by two coders for the content of tools, structures, and strategies. This content analysis generated a list of over 200 general tools, structures, and strategies between the sites, along with customized tools and features specific to the learning needs in each site. Intercoder reliability measures found a 99% agreement of these functions and had a strong Cohen's Kappa coefficient of .98 for 20% of the sites.
3. For phase III, the tools, structures, and strategies were analyzed qualitatively for their support of the needs of communities of online informal learners. Several findings based on sociability, usability, community-building design, and social and informal learning were uncovered, along with findings for personalized learning and sustainability. A meta-analysis was also conducted at this stage, which revealed an inter-relationship of the themes along with a view of the spectrum of self-directedness that could take place within these sites. Intercoder reliability measures found that the two coders agreed on

96% of the tools, structures, and strategies that supported these themes and had a strong Cohen's Kappa coefficient of .93 for the themes.

Types of Custom-Built COILs

Findings related to phase I answered the research question regarding the types of sites that fit the definition of terms for custom-built environments for COILs. Beginning with a general list of academic subjects inspired by typical higher education programs and other, non-academic, subject matter, a search was conducted and a list of diverse sites was created and vetted for fulfillment of the terms of custom-built COILs. The following findings were derived from phase I.

Finding 1: Numerous and diverse custom-built COILs exist. Fifty-three out of 75 possible websites were found to fulfill all of the terms of (a) a *community of learners*, (b) *online*, (c) *informal learning*, and (d) a *custom-built environment*. A Google and Quora search for over 40 subtopics of academic programs and non-academic subjects established the initial list of 75 possible sites for review. Based on the review, the most common unfulfilled terms were that (a) the term *community* did not fulfill the requirements of being a group of people gathering around a learning interest with its own events, rituals, and shared learning culture (Preece, 2001); (b) the site led to a scripted or formalized learning environment instead of an *informal learning* environment; and (c) the environment was little more than a question and answer forum with no evidence of customized design for the specific COIL.

Finding 2: *Online community* has a range of meanings. The searches for *online communities* related to the various topics revealed a spectrum of ideas regarding the concept of *community.* Many *communities* consisted simply of collecting individuals'

contact information for the purpose of sending bulk emails. On the other side of the spectrum was the concept more consistent with A.J. Kim's (2000) definition of individuals congregating around a learning interest, along with Preece's (2001) definition of a community sharing culture, events, and rituals. This research only accepted the latter definitions by Preece and A. J. Kim as a fulfillment of the term *community*.

Finding 3: Learning topics were mostly practice-based. Similar to Lave and Wenger's (1991) research in situated learning, this study found that the communities created for co-participation in learning tended to be more practice-based than theoretical. A search of general subjects based on terms used for academic departments and programs was less likely to result in finding a community than if the subject was parsed into more practicable sub-topics. For example, a search for online communities devoted to *business* would typically lead to practicing communities devoted to *entrepreneurship* or *finance*. A search for an online community devoted to *humanities* would lead to formal education sites, so more practicable (and perhaps creative) sub-topics such as online communities for *travel* and *genealogy* were used to find informal communities loosely connected to the concept of *humanities*. Practice-based subjects such as *art* and *writing*, along with the less-academic topics of *crafts* and *do-it-yourself* (DIY) were easier sites to find based on simple searches for online communities out of the initial list of academic and non-academic topics. *Language* sites were easy to find, but less likely to fulfill all of the terms used to describe COILs.

Finding 4: Not all communities thrived. Some of the Google and Quora searches led to articles about communities within the different topics. Although some of

these articles connected to existing and thriving communities, others connected to communities that no longer existed. This indicated that there were a number of communities that did not thrive. Examples of communities that did not thrive included several citizen journalism communities and some language communities. Kraut (2012) expressed the difficulty of building a thriving community, indicating several potential reasons for failure, including issues with clarity of purpose, lack of connection to appropriate membership numbers, or competition with other communities, among other possible problems.

Finding 5: Some sites had sizeable and thriving membership. A further vetting of the sites based on delimiters meant to establish 10 custom-built COIL sites for further review found that some sites hosted a substantial number of users and had existed for a length of time. All of the chosen 10 sites had existed for a range of 7-14 years. Seven of the sites had over one million enrolled members, including one with more than 20 million members and another with over 50 million members. Out of the 10 chosen sites, the site with the lowest number of members still had an impressive 350,000 enrolled users. These sites carried participant lists that far exceeded most contemporary formal institutions' memberships. The chosen sites for review included topics as varied as science, art, business, debate, DIY, crafting, games, reading and writing, travel, and computer programming. Based on the analysis of the 10 thriving sites conducted in phase III, design for community-building, sociability, and usability (Bacon, 2012; Crumlish & Malone, 2015; Howard, 2010; A. J. Kim, 2000; Kraut et al., 2012; Krug, 2014; Preece, 2001) were a part of the studied thriving sites, which may have factored into the way these sites thrived.

Summary of findings for types of existing custom-built COILs. As an answer to the first research question regarding the types of sites that could be considered custom-built COILs, a diverse range of existing sites was found to fulfill the terms encapsulated by the concept of custom-built COILs. The term *community* was not always consistent with the theoretical concept of community, and some sites that may have been considered candidates were no longer in existence, suggesting that not all custom-built COILs thrive. However, the topics of the communities that were still in existence ranged from non-academic topics to topics more- or less-related to academic concepts. Some of these communities hosted considerable numbers of users. Fifty-three of the initial list of 75 candidate sites were found to fulfill the terms of custom-built COILs, 10 of which were chosen for further review.

The Tools, Structures, and Strategies of 10 COILs

Based on the 10 chosen sites from phase I, phase II analyzed the content of each site to answer the second research question regarding the tools, structures, and strategies used to design custom-built COIL sites. The following findings were developed from phase II.

Finding 6: Expansive list of tools, structures, and strategies for COIL design. The first finding was a list of over 200 general tools, structures, and strategies used within the sites. No single site employed all of the general functions, but many of the functions were shared between sites. Overall, the tools were categorized into the following groups for easier representation: (a) profile and sign-up, (b) forum and other artifact discussions, (c) view of and connections with other users, (d) user-generated artifacts, (e) navigation, (f) analytics, (g) site-based mobile use,

(h) competition/challenges, (i) outside connections, (j) site-generated items, (k) funding, (l) site moderation, and (m) accessibility. The entire list of tools, structures, and strategies can be found in Appendix E, with definitions in Appendix F.

Finding 7: All 10 custom COIL environments shared some elements. Some of the tools, structures, and strategies found during phase II were shared among all sites. It was not surprising to see shared tools due to specific design literature regarding tools, such as that by Crumlish and Malone (2015), A. J. Kim (2000), and Preece (2001). The list of tools, structures, and strategies used in all sites included functions for (a) understanding the purpose of the site; (b) adding and editing personal profiles; (c) viewing other users' profiles; (d) creating artifacts; (e) creating and posting to artifact discussions; (f) viewing user information associated with discussions, (g) viewing statistics of artifacts, users, discussions, etc.; (h) easily accessing information within the site; and (i) finding information about the site from external social media and searches. All sites held these elements as important for the design of their custom-built COILs.

Finding 8: Each custom-built COIL had functions specific for its needs. Each COIL site had custom-built tools, structures, and/or strategies pertaining specifically to the learning interest of the site. The custom-built COILs were focused on the specific learning interest, so the gathering places of individuals (where the interactions normally occurred) tended to surround the specific learning objects. More information on the specific customizations can be found in Chapter Four.

Finding 9: User-generated material less likely to be accessible. In regard to accessibility, out of the six sites that were capable of being tested, all had errors, many of which seemed to be exacerbated by the fact that user-generated material was often

on the tested pages and users were less likely to put tags or alternative text on their personal uploads. This topic of accessibility for user-generated content was treated in a conference paper in 2009 (García, Gonzalez, & García, 2009), which offered suggestions to (a) build platforms that are accessible in the first place, (b) create prompts that help users to generate accessible headers and tags, and (c) ask the community to collectively help with creating tags and headers, etc., for user-generated items. As of yet, these sites did not show as many signs of accessibility as other large social media sites.

Finding 10: Only some sites had special mobile designs. Although mobile use has become an important design feature (Krug, 2014), specific mobile-related app design was only apparent in half of the studied sites, and one of the sites did not even have browser-related mobile design. It seemed that mobile design had not yet become a part of COIL design as a whole, which might be due to the disparate customization of the various sites.

Finding 11: Each site had its gathering space or spaces. Sites varied regarding where the users gathered based on A. J. Kim's (2000) definition of gathering within sites, meaning spaces where most of the user interaction took place. Some sites gathered around learning objects such as a game board or an artifact, other sites gathered around discussion forums, some sites gathered around expert interviews, and some sites had multiple gathering places. The gathering places took advantage of the best spaces for learning about the main learning interest of the site.

Summary of findings for tools, structures, and strategies of 10 COILs. Phase II answered the second research question regarding the types of tools,

structures, and strategies used within custom-built COIL sites. Over 200 general tools were used between the 10 sites, some of which were included in all sites and some of which were customizations specifically for the particular COIL. The tools located in all sites covered functions relating to site purpose and external view of the site, user profiles, artifact creation, discussions, information search tools, and analytics of objects or users within the site. Each site also had its own customizations focused on the learning interest of the community. Accessibility had specific issues related to user-generated content, and mobile design was apparent in some COIL sites but not in others. Apart from variation in accessibility and mobile design, however, it was apparent that each of the 10 studied COILs was a result of significant thought regarding customized design for the learning needs of the members with a solid basis in common design methods.

How the Tools, Structures, and Strategies Support the COILs

Phase III used an exploratory, qualitative method (Marshall & Rossman, 2006) to further investigate the information gathered during phases I and II in order to answer the third research question regarding the way the tools, structures, and strategies appeared to support the custom-built COILs. For this phase of the study, it was important to return to the definition of custom-built COILs to determine exactly what needed to be supported by the tools, structures, and strategies. The meaning of custom-built COILs was defined as (a) a *community of learners* that was (b) *online* and focused on (c) *informal learning* within a (d) *custom-built environment*. Phase I of the research already extracted sites that fulfilled the theme of being *online*, and phase II of the research already established some of the items that were *custom-built* for the

environments, so phase III focused on the concepts of *community of learners* and *informal learning* with the expectation that other themes would emerge. In order to understand these concepts further, this exploratory study was done through (a) a priori code from the literature based on social, usability, and community-building design (Bacon, 2012; Crumlish & Malone, 2015; Howard, 2010; A. J. Kim, 2000; Kraut et al., 2012; Krug, 2014; Preece, 2001); and (b) open coding, which included an intentional view of elements pertaining to social and informal learning along with an open exploration.

Finding 12: The 10 COIL sites were designed for sociability. Based on the literature regarding the importance of social design in a community (Crumlish & Malone, 2015; Preece, 2001), the first a priori theme of design for *social design* or *sociability* was analyzed and found to be inherent in all sites based on the supporting sociability characteristics of profiles, identities, roles, and relationships. Tools for building and viewing profiles along with tools for finding people and establishing relationships were the most represented tools for social design. Within many of the sites, specific customizations were created to: (a) connect profiles to specific aspects of the learning interest as suggested by Crumlish and Malone (2015), which allows for easier searches from other users according to A. J. Kim (2000); (b) support newcomers with the navigation and use of the site, or onboarding as explained by Wenger (2009); (c) increase search capability to view other users with similar interests (A. J. Kim, 2000); (d) increase interactivity as highlighted by Crumlish and Malone; and (e) describe the roles of individuals within the site as suggested by Preece (2001) and A. J. Kim. Sociability was a clear design standard in all of the sites.

Finding 13: The 10 COIL sites were designed for usability. Beyond social design, the literature has defined usability as an important design feature for creating communities (Krug, 2014; Preece, 2001). Therefore, the second a priori theme was *usability*. An analysis of all sites showed that many aspects of usability were built into all of the sites, including aspects helping users to navigate the sites such as Krug's (2014) examples of mapping functions, signifiers, constraints, and feedback, along with extensive thought toward information architecture (U.S. Department of Health and Human Services, 2016) with mechanisms for searching and finding information. Customizations of these functions included some sites that took advantage of extensive search mechanisms and topic- or temporal-focused search filters, whereas others used templates to guide the creation of artifacts for more consistent navigation and usability. Overall, usability was a clear theme in all 10 sites, and usability supported not only the community aspect of the site, but also the learning aspects of the site, as will be discussed subsequently.

Finding 14: The 10 COIL sites were designed for community. As a clear support of community, community-building design was granted its own theme due to the different strategies involved with community-building that needed specific investigation. All sites showed a clear indication of efforts in the art of building community through the use of purpose (Howard, 2010; A. J. Kim, 2000; Preece, 2001, 2004), remuneration, influence/control, belonging, significance (Howard, 2010), and site rules (Preece, 2001). Each site had a clear purpose statement (Crumlish & Malone, 2015; A. J. Kim, 2000; Kraut, 2012; Krug, 2014, Howard, 2010). Members were remunerated through good user interface, as suggested by Howard (2010) and Preece (2001), and information, as

indicated by A. J. Kim (2000). Users often had influence or control over the community and community environment through manipulations of the physical environment or a voice in the community, which Howard (2010) and Preece (2001) listed as the most important aspect of a community. Individuals could establish a sense of belonging through the connections and relationships that build what Bacon (2012) called social capital, subgroups, as suggested by A. J. Kim (2000), and specialized semiotic domains, as described by Gee (2004), among other factors. External and internal significance and clout were offered by attracting experts, as suggested by Howard and Kim, and connecting to outside social media sites, as suggested by Howard (2010) and Crumlish and Malone (2015). Finally, all sites had some level of guidelines or explanation of behavior within the site such as suggested by Preece. Overall, every factor deemed relevant in community-building literature was found in these communities.

Finding 15: The 10 sites supported social learning for COILs. Social and social constructivist learning was supported in multiple ways within the 10 COIL sites. The following tools, structures, and strategies give a view of some of the major supports for social learning within the sites:

- The individual as consumer and producer (Shirky, 2008b) or *prosumer* through use of Web 2.0 tools that promoted participatory learning (Ito, 2010; H. Jenkins, 2006) was supported through functions that allow the creation of artifacts and discussions; the ability to establish relationships and build groups; and extensive artifact, discussion, and user rating systems.

- The social ability to learn from others within the ZPD (Vygotsky, 1980) was facilitated through the use of discussions and the extensive search functions within the sites.
- It was easy to tap into distributed cognition (Hollan et al., 2000; Salomon, 1997), or the distribution of knowledge through the extensive user-generated databases in most of the sites and the projects and collaborations within some of the sites.
- Collective intelligence (Lévy, 1997) was aggregated in multiple ways and organized into easy-to-access learning morsels. Crowd-sourced databases were tagged and labeled for easy searches, the collective group rated or voted for artifacts and users, and the aggregated ratings were turned into filters for easier viewing of popular and trending artifacts.

Several aspects of social and social constructivist learning had some level of support through the tools, structures, and strategies of the COIL sites.

Finding 16: The 10 sites supported informal learning within COILs. *Informal learning* was chosen as a theme with the following underlying concepts and supports:

- Self-directed learning, as per Malcolm Knowles (1975), is an individual ability to seek out learning based on an inner drive or purpose. This was supported in the 10 COILs through the individual ability to access extensive databases, search and save, and take part in discussions.
- Learner-focused learning, which intersects with personalized learning (J. Jenkins, 1998), was supported in the 10 studied COILs through the ability to

save and organize learning, create goals, watch tutorials, and post questions to discussions.

- Just-in-time learning, as emphasized by Riel and Polin (2001), considers the immediacy of answers and learning. This was supported through the 10 COILs by filters and signifiers that showed post recency and unanswered posts, help sections and tutorials, and user-to-user chats, all of which allowed for quick learning.
- Access to information is important to self-directed learning (Knowles, 1975). All of the studied sites had extensive databases created by both the site and the users. Many of the sites also had articles, blogs, discussions, and other artifacts that were labeled and could be searched through extensive search mechanisms.
- Unscripted learning, which is an important part of the chosen definition for informal learning (Livingstone, 2001) for this study, was supported in the 10 COILs through extensive tagging, labeling, and categorizing coupled with search mechanisms within the sites. Using these functions, the learner could take charge of her/his learning instead of an instructor taking charge.
- Contextually-situated learning (Lave & Wenger, 1991) was supported within the COIL environments through the discussions, databases, and search features since these tools supported learning that was driven by an individual's context-specific needs situated within an environment that housed answers to specific questions.

Overall, informal learning was supported by the tools, structures, and strategies within the custom-built COIL sites due to the fact that the sites housed adequate information, through user-generated or site-generated databases or information, with built-in mechanisms for individuals to find the appropriate information for their learning needs through the often extensive site search mechanisms and filters or the discussion boards. At the same time, more information regarding informal learning emerged within the sites. Much like the literature regarding the spectrum of informal learning being implicit and explicit, this research found that the self-directed nature of informal learning also had a spectrum of *self-directedness*, or levels of self-direction. More on this will be included in Finding 20.

Finding 17: The 10 sites supported personalized learning within COILs. Some of the features built into the site seemed to be devoted more to a support for personalized learning needs instead of a separate social or informal learning need. For this reason, *personalized learning* was added as a theme to capture the functions directly related to personal learning needs. The theme of *personalized learning* included the following concepts as a basis:

- The benefit of personalized feedback, discussed by Hattie and Timperley (2007), was facilitated in the COIL environments through tools that allowed for aggregated community ratings, voting/polls, peer critique, and instant quiz and trivia answers.
- Personal control of learning, studied specifically within self-directed learning literature (Van Zile-Tamsen, 1997) and as computer-based formal education strategies (Milheim & Martin, 1991; Shih-Wei & Chien-Hung, 2005), was

enabled in the sites through the ability to join specific groups of interest, save and follow discussions, users, and artifacts, and even block unwanted content.

- The ability to organize and save learning objects for personal future use was apparent throughout all sites, which was recommended by Crumlish and Malone (2015).
- Constructivism/Constructionism as a learning method means to be able to have authentic learning experiences (Dewey, 1938) through the creation of artifacts and the feedback the artifacts receive (Papert, 1993). This was facilitated through these COILs in the areas where people could post and discuss artifacts and in the general discussion areas. Even the feedback from the community ratings of artifacts, etc., supported Constructionism.
- Optional and abundant content within the COIL environments helped individuals gain personalized learning. Content areas could be found in the site- and user-generated databases, the discussions, the expert blogs and articles, and lessons and tutorials throughout the site.
- Productive failure, the topic of a relatively recent set of studies by Kapur (2008) and written about in larger circles (Seiter, 2016), refers to an explicit teaching technique of giving students complex problems without the protective scaffolding of direct instruction. Although not used as a direct instruction technique, the basic idea of productive failure was supported explicitly in some of the sites with spaces devoted to discussions surrounding

artifact problems and issues, whereas other sites' discussion boards housed productive failure as an affordance.

Overall, personalized learning needs seemed to be well-supported within the COIL sites through many of the same discussion, search, artifact creation, and content saving features as informal learning.

Finding 18: The 10 sites supported COILs through efforts in sustainability. The final theme recognized through the open coding process was the theme of *sustainability*, both in terms of sustained membership and financial sustainability. Although community-building literature described efforts toward sustained membership, not much covered the subject of financial sustainability, with the exception of a few pages from Bacon's (2012) community-building book, which supplied a list of different types of funding sources for sustainability. Each of the COIL sites exhibited one or more of the sustainability strategies outlined in the book, including paid advertisements, paid levels of subscription, paid product, site stores, and grants or sponsorships. Although perhaps not directly related to the concepts of *community of learners*, *online*, *informal learning*, and *custom-built environments*, sustainability seemed to be a key support to an entire COIL site.

Finding 19: An inter-related nature of themes within the sites. Findings 19 and 20 may be the most interesting aspects of the sites since they combine research from disparate groups on community-building, usability, social design, social and social constructivist learning, informal learning, personalized learning, and even sustainability. A meta-analysis of themes led to an eagle-eye view of how the themes were inter-

related. As shared in Chapter Four and presented again subsequently, Figure 34 (Figure 32 in Chapter Four) shows the inter-relationship of themes.

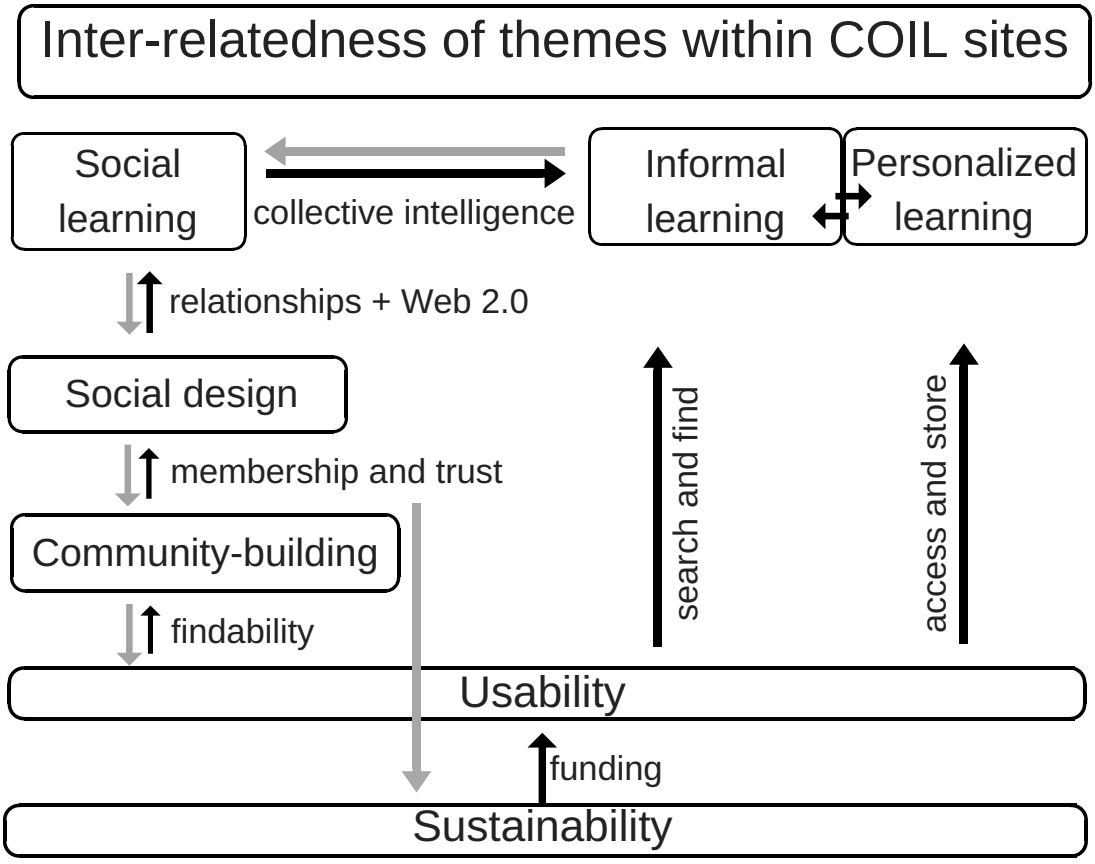

Figure 34. Inter-relatedness of themes within COIL sites.

Each theme within the COIL sites builds on the other themes in interesting ways. The following inter-relationships existed among the 10 studied COIL sites:

- Sustainability supported the entirety of the sites by keeping them viable through adequate funding and membership.
- Usability supported every other aspect of the sites, including the ability to find the communities so that users could establish their membership, the ability to find items and people within the site, and the ability to save learning objects.

- Community-building supported social design in the sites by attracting an adequate number of individuals to the sites and making the sites trustworthy enough that adequate social relationships could be made.
- Social design, along with the Web 2.0 tools, created spaces for social learning with an adequate aggregation of collectively created artifacts, user ratings of the artifacts, and continued trust-building through relationships established within the sites.
- Socially-created and vetted artifacts supported informal learning in the studied sites by giving access to adequate amounts of information and immediacy of answers, while discussions furthered the informal learners' appeasement of curiosity.
- Informal learning and personalized learning were highly connected as individuals chose their own paths and created their learning within the spaces. Finding 20 describes the levels of self-directedness within the sites that could lead individuals down different paths toward personalization of the learning.
- Many of these themes also had a reciprocal relationship, as the constructivist nature of informal building created more artifacts for social learning, social learning created more relationships for social design, and social design created more trust and significance of the site, which led to more community-building and increased sustainability of membership.

Finding 20: Paths for self-directedness within COIL sites. The meta-analysis that led to an understanding of the inter-relatedness of themes also led to an

understanding that within many of the COIL sites there was a spectrum of informal, self-directed learning supported by the tools, structures, and strategies. The functions within some of the sites could naturally lead users toward self-directed learning based on a spectrum of three possible distinctions of paths and a range between the points on the spectrum. Figure 35 shows the spectrum of site-reliance to social-directedness to self-reliance.

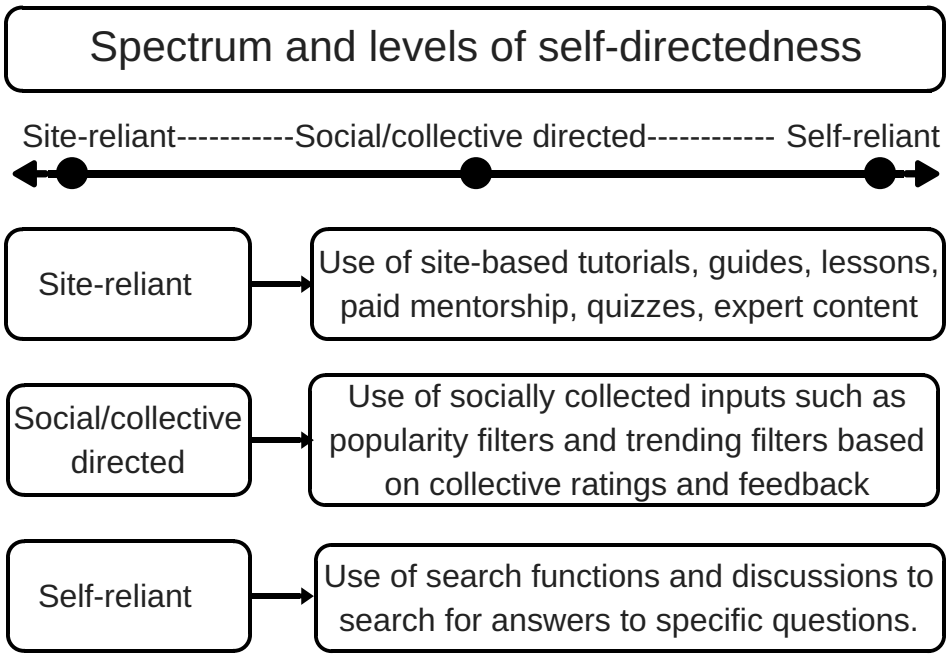

Figure 35. The spectrum and levels of self-directedness in the COIL sites.

As shown in Figure 35, individual learners who wished to learn within the sites could (a) rely on the guidance of the site for their learning, (b) rely on the social inputs that were filtered into tools such as popularity and trending searches, or (c) rely on their inner drive for learning specific content by using the search functions and specific discussion posts to search for answers. The spectrum shows the range of choices within these paths and no single individual would need to rely on only one path; rather, an individual could use all three paths in one session or the tools could allow for a range

between the three distinct paths, such as socially rated items being the choice of an otherwise self-reliant search. Not all sites, however, had equal offerings of each path. Some of the 10 studied sites had more to offer in one path than others, so the possible choice of paths may have been guided by the content of the site.

Summary of how the tools, structures, and strategies supported COILs. Phase III research found that the tools, structures, and strategies within the studied custom-built COIL sites supported the concepts of sociability, usability, and community-building design methods. Beyond these known themes, the tools, structures, and strategies also supported social and social constructivist learning, informal learning, personalized learning, and financial sustainability. Each of the a priori and openly explored themes had a strong and often reciprocal relationship with each other. Moreover, different levels of self-directedness were also found in many of the sites. In all, these sites represent supported spaces for communities of learners gathered online to learn informally.

Implications of This Research

In Chapter One, it was noted that several groups might find this study important, including: (a) learners who want more choice in their learning, (b) individuals who want to create custom-built COIL environments, (c) builders of formal learning management systems, (d) learning scientists who want to understand how social constructivism is organically produced in custom-built COIL sites, and (e) formal education administrators who are curious about creative and alternative methods of online learning. Possible implications for each of these groups are described here.

Learners who want more choice in learning. Individuals who do not have the means to obtain more formal education, who do not achieve their learning goals in formal environments, or who find formal education environments too restrictive have powerful learning environments at their disposal. By understanding how COILs create a flatter world of easy access to learning (Darling-Hammond, 2010) and help to achieve learning goals, consumers of learning can be more informed about their extended possibilities of learning.

Creators of custom-built environments. Learning entrepreneurs who seek to build or expand custom-built COIL sites for learners can look at the list of tools itemized in phase II of this research to see important features. An understanding of the sociability, usability, and community-building design benefits of each tool along with an indication of the support the tools offer for social, informal, and personalized learning could be useful in selecting appropriate tools. Also, an idea of how other sites sustain themselves financially can be helpful for those seeking to build similar sites.

Builders of formal learning management systems. On the more formal side of the learning spectrum, learning management systems (LMSs) for formal education are constructed quite differently from COIL environments due to the isolated courses, Instructionism (Papert, 1993), and grading structures that drive LMS technologies. However, according to a report by EDUCAUSE (M. Brown, Dehoney, & Millichap, 2015), current LMS systems are facing an identity crisis as higher education begins to realize the instructor-centered model is not best for learning. COIL environments can help LMS creators understand how learning can happen in an organic and social way for a more learner-centered learning experience.

Learning scientists. Learning scientists can also benefit from this study by understanding the socio-technical underpinnings of fostering social constructivist platforms that cater to specific learning interests. These custom-built COIL sites represent organically grown ecosystems that foster social learning through participation and mutual sharing of artifacts and information. Further study of these types of sites can help learning scientists to understand more intricate aspects of social constructivist learning.

Formal education administrators. As formal education begins to struggle against outside competitors and high costs (Johnson et al., 2012), it might be to its advantage to view organic learning that happens within custom-built COILs. Inasmuch as formal education has begun to investigate MOOCs (Yuan & Powell, 2013), competency-based instruction (Burke, 1989), and other creative learning methods, custom-built COILs could be an additional benefit to the formal education repertoire of learning.

Limitations of Study

The strength of an exploratory study is that it provides an initial view of a phenomenon that has perhaps not received a great deal of attention (Marshall & Rossman, 2006). However, this also means that there are limitations to what can be studied. Several limitations exist for this study, including:

- This study only provides a general overview of information regarding custom-built COIL sites.
- The study does not offer an exhaustive list of custom-built COIL sites; rather, it gives the definitions and processes used to find custom-built COIL sites.

- The number of sites used for further study was 10, which is not a large enough number to make broad generalizations about all custom-built COIL sites.
- The list of tools, structures, and strategies designed within the sites relied on information that was evident; certain tools, structures, and strategies may not have been evident based on the free subscription level or the lack of access to the sites' algorithms.
- The large number of tools within the sites also means that nuances of tools, structures, or strategies may have been missed by the two reviewers engaged in the research.
- There were no attempts to make assessments of levels of learning or comparisons regarding the use of tools among sites.
- Although it is asserted that site creators and formal education administrators might be served by this study, exact replicas of the sites would not be advisable for any party due to the customizations and differing needs of these types of sites, so this study does not offer a scientific recipe for success in either interest case.

Recommendations for Further Study

Since this study was exploratory, this research represents merely the first step toward understanding these environments. There is a great deal more to be explored in COIL environments, spanning a breadth and depth of possible research topics. In order to understand the breadth of custom-built COILs, the following research projects could be helpful:

- A larger number of sites analyzed for their tools, structures, and strategies to better understand commonalities and differences for more generalizability.
- A focused view of the numbers of participants and differences in tools based on the numbers.
- A study about sites that succeed and thrive versus those that do not.
- A study of learning outcomes and how they compare to more traditional learning environments.
- A study of the *critical mass* necessary for participation and artifact creation in order to make a thriving learning environment.
- A further study into the inter-relationship of themes and self-directed paths within COIL sites.
- A collective examination of COIL sustainability and connection to industry.

In order to establish more depth regarding custom-built COILs, the following studies could prove useful:

- Lived experience studies of either designers or learners within COIL environments.
- An analysis of COIL records to track and record learning across time.
- Surveys of learners within COIL environments.
- An examination of the role analytics play in learning in COIL environments.
- An investigation into how to use free COILs to measure informal learning.
- A study of individual awareness of identity growth within COILs.
- An investigation into the use of automated tools in place of humans for some tasks.

- Examination of other specific themes and their comparative tools in COIL environments, such as profiles and creating personal identity, collective discussion feedback and learning, or the ability to store learning objects and learning.

There is a great deal of potential research to be done regarding custom-built COIL environments.

Concluding Remarks

This study examined an emerging socio-technical phenomenon created by the affordances of new tools developed over the 20 years prior to the study. These tools have established an entirely new and interconnected way of learning. As Lévy (1997) foretold, “[The] vision of the future is organized around two complementary axes: the renewal of the social bond through our relation to knowledge and collective intelligence itself” (p. 11). In the absence of a single orator and judge, these sites have harnessed the collective as a powerful form of learning and assessment. COILs indeed exist as an important study for the future of learning.

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APPENDIX A

Human Subjects Research Certificate

LEARNER	Kimberly Welch (ID: 4119948) [redacted] USA
DEPARTMENT	GSEP-EDLT program
PHONE	[redacted]
EMAIL	kwelch@pepperdine.edu
INSTITUTION	Pepperdine University
EXPIRATION DATE	04/15/2017

SOCIAL & BEHAVIORAL RESEARCH - BASIC/REFRESHER : Choose this group to satisfy CITI training requirements for Investigators and staff involved primarily in Social/Behavioral Research with human subjects.

COURSE/STAGE:	Basic Course/1
PASSED ON:	04/16/2014
REFERENCE ID:	12804531

REQUIRED MODULES	DATE COMPLETED	SCORE
Belmont Report and CITI Course Introduction	04/15/14	3/3 (100%)
Students in Research	04/15/14	10/10 (100%)
History and Ethical Principles - SBE	04/15/14	5/5 (100%)
Defining Research with Human Subjects - SBE	04/15/14	5/5 (100%)
The Regulations - SBE	04/15/14	5/5 (100%)
Assessing Risk - SBE	04/15/14	5/5 (100%)
Informed Consent - SBE	04/15/14	5/5 (100%)
Privacy and Confidentiality - SBE	04/15/14	5/5 (100%)
Research with Prisoners - SBE	04/15/14	4/4 (100%)
Research with Children - SBE	04/16/14	4/4 (100%)
Research in Public Elementary and Secondary Schools - SBE	04/16/14	4/4 (100%)
International Research - SBE	04/16/14	3/3 (100%)
Internet Research - SBE	04/16/14	5/5 (100%)
Research and HIPAA Privacy Protections	04/16/14	3/5 (60%)
Vulnerable Subjects - Research Involving Workers/Employees	04/16/14	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	04/16/14	2/5 (40%)

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI Program participating institution or be a paid Independent Learner. Falsified information and unauthorized use of the CITI Progam course site is unethical, and may be considered research misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Program Course Coordinator

APPENDIX B

IRB Approval Letter

Pepperdine University
24255 Pacific Coast Highway
Malibu, CA 90263
TEL: 310-506-4000

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: March 31, 2016

Protocol Investigator Name: Kimberly Welch

Protocol #: 16-03-234

Project Title: Custom-built environments for communities of online informal learning: An exploratory study of tools, structures, and strategies

School: Graduate School of Education and Psychology

Dear Kimberly Welch:

Thank you for submitting your application for exempt review to Pepperdine University's Institutional Review Board (IRB). We appreciate the work you have done on your proposal. The IRB has reviewed your submitted IRB application and all ancillary materials. Upon review, the IRB has determined that the above entitled project meets the requirements for exemption under the federal regulations 45 CFR 46.101 that govern the protections of human subjects.

Your research must be conducted according to the proposal that was submitted to the IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For any proposed changes in your research protocol, please submit an amendment to the IRB. Since your study falls under exemption, there is no requirement for continuing IRB review of your project. Please be aware that changes to your protocol may prevent the research from qualifying for exemption from 45 CFR 46.101 and require submission of a new IRB application or other materials to the IRB.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite the best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the IRB as soon as possible. We will ask for a complete written explanation of the event and your written response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the IRB and documenting the adverse event can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* at community.pepperdine.edu/irb.

Please refer to the protocol number denoted above in all communication or correspondence related to your application and this approval. Should you have additional questions or require clarification of the contents of this letter, please contact the IRB Office. On behalf of the IRB, I wish you success in this scholarly pursuit.

Sincerely,

Judy Ho, Ph.D., IRB Chairperson

cc: Dr. Lee Kats, Vice Provost for Research and Strategic Initiatives

APPENDIX C

Number of Websites Found Based on Topic/Subtopic Searches for Communities

Table C1

Number of Websites Found Based on Topic/Subtopic Searches for Communities

Academic term	Topics and Subtopics	Number of sites found
Business	Finance and investment	3 sites
	Entrepreneurship	2 sites
Music and Arts	General arts	2 sites
	Graphic design	2 sites
	Painting	3 sites
	General music	2 sites
	Photography	2 sites
Language Arts	Creative writing	4 sites
	Language learning	5 sites
	Reading	2 sites
Architecture	Building/home design	2 sites
Math	Math	1 site
	Algebra	1 site
	Logic/Brain games	2 sites
	Analytics	2 sites
Technology	Code/ Web developers	4 sites
	3D printing	1 site
	Robotics	1 site
Science	Citizen science	2 sites
	Environmental sustainability	3 sites
	Entomology	1 site
	Antibody engineering	1 site
Behavioral and Social Science	History	1 site
	Spirituality	1 site
	Meditation	1 sites
Humanities and Political Science	Genealogy	1 site
	Travel	2 sites
	Debate	1 site
Communication	Journalism/ current events	3 sites
	Video and video-making	1 site
Health and Nutrition	Fitness	3 sites
	General health	1 site
	Yoga	1 site
	Food/ Nutrition	2 sites

(continued)

Academic term	Topics and Subtopics	Number of sites found
Law	Rights groups	3 sites
	Police	1 sites
	Activism	1 site
[Non-academic]	Crafts	2 sites
	Fashion industry	1 site
	DIY	1 site

APPENDIX D

List of 75 Website Topics along with Their Fulfillment of the Defining Terms for Custom-built Environment for a COIL

Table D1

List of 75 Website Topics along with Their Fulfillment of the Defining Terms for Custom-Built Environment for a COIL

Websites	Community of learners	Online	Informal learning	Custom-built
Finance and investment site 1		X		X
Finance and investment site 2	X	X	X	X
Finance and investment site 3		X		
Entrepreneurship site 1		X		
Entrepreneurship site 2		X	X	X
General art site 1	X	X	X	X
General art site 1	X	X	X	X
Graphic design site 1	X	X	X	X
Graphic design site 2	X	X	X	X
Painting site 1	X	X	X	X
Painting site 2	X	X	X	
Painting site 3	X	X	X	
General music site 1	X	X	X	X
General music site 2	X	X	X	X
Photography site 1	X	X	X	X
Photography site 2	X	X	X	X
Writing site 1	X	X	X	X
Writing site 2	X	X	X	X
Writing site 3	X	X	X	X
Writing site 4	X	X	X	X
Language site 1		X		
Language site 2		X	X	X
Language site 3		X		X
Language site 4	X	X	X	X
Language site 5	X	X	X	X
Reading site 1	X	X	X	X
Reading site 2	X	X	X	X
Building/Home design site 1		X	X	X
Building/Home design site 2		X	X	X
Math site 1	X	X	X	X
Algebra site 1	X	X	X	

(continued)

Websites	Community of learners	Online	Informal learning	Custom-built
Logic/Brain games site 1	X	X	X	X
Logic/Brain games site 2	X	X	X	X
Analytics site 1	X	X	X	X
Analytics site 2	X	X	X	X
Code/Web developers site 1	X	X	X	X
Code/Web developers site 2	X	X	X	X
Code/Web developers site 3	X	X	X	X
Code/Web developers site 4	X	X	X	X
3D printing site 1	X	X	X	X
Robotics site 1	X	X	X	X
Citizen science site 1	X	X	X	X
Citizen science site 1	X	X	X	X
Environmental sustain site 1	X	X	X	X
Environmental sustain site 2	X	X		X
Environmental sustain site 3	X	X	X	X
Entomology site 1	X	X	X	X
Antibody Engineering site 1	X	X	X	X
History site 1		X	X	X
Spirituality site 1	X	X	X	
Meditation site 1	X	X	X	X
Genealogy site 1	X	X	X	X
Travel site 2	X	X	X	X
Travel site 2		X	X	X
Debate site 1	X	X	X	X
Journalism/Current events site 1		X	X	
Journalism/Current events site 2	X	X	X	X
Journalism/Current events site 3	X	X	X	X
Video/Video-making site 1	X	X	X	
Fitness site 1	X	X	X	X
Fitness site 2	X	X	X	X
Fitness site 3	X	X	X	X
Yoga site 1	X	X	X	X
Food/Nutrition site 1	X	X	X	X
Food/Nutrition site 2	X	X	X	X
Rights groups site 1	X	X	X	X
Rights groups site 2	X	X	X	X
Rights groups site 3		X	X	
Police site 1		X	X	
Activism site 1		X	X	
Crafts site 1	X	X	X	X
Crafts site 2	X	X		X
Fashion site 1	X	X	X	X
DIY site 1	X	X	X	X
DIY site 2	X	X	X	X

APPENDIX E

List of Tools, Structures, and Strategies and Inclusion in Sites

Table E1

List of Tools, Structures, and Strategies and Inclusion in Sites

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
Profile and sign up										
Avatar/Picture upload	X	X	X	X	X	X	X	X	X	X
Personal email	X	X	X	X	X	X	X	X	X	X
Name field	X	X	X	X	X	X	X	X	X	X
Password field	X	X	X	X	X	X	X	X	X	X
username field	X	X	X	X	X	X	X	X	X	X
Requires email confirmation	X	X	X	X	X	X	X	X	X	X
Edit profile function	X	X	X	X	X	X	X	X	X	X
User control of profile	X	X	X	X	X	X		X	X	X
Location field	X	X	X	X	X	X			X	X
Birthday/Age	X	X			X	X		X	X	X
About me/bio section		X	X		X			X	X	X
Interest preferences	X	X			X	X			X	X
Other demographics	X	X	X		X	X			X	
Gender	X	X			X	X			X	
Personal url		X		X				X	X	X
Other social profiles	X							X	X	
Profile completion status	X	X			X					
Personalized header		X			X		X			
Personalization of view		X	X		X					
Forum and other artifact discussions										
Non-forum artifact discussion	X	X	X	X	X	X	X	X	X	X
Username with post	X	X	X	X	X	X	X	X	X	X
Profile picture with post	X	X	X	X	X	X	X	X	X	X
Post reply	X	X	X	X	X	X	X	X	X	X
Discussion follow/subscribe	X	X	X	X	X	X	X	X	X	X
Post rules/netiquette	X	X	X	X	X	X	X	X	X	X
Recency of posts	X	X	X	X	X	X	X		X	X
All members can discuss	X	X	X	X	X	X	X		X	X
Add image	X	X	X	X	X		X		X	X
Hyperlink capability	X	X	X	X	X		X		X	X
Quote in forum	X	X	X	X	X		X		X	X
Forum-style discussion	X	X	X			X	X		X	X

(continued)

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
Discussion term search	X	X	X	X			X		X	X
Text edit/manipulate functions		X	X	X		X	X		X	X
Edit/delete own comments	X	X	X	X			X		X	X
Discussion post ratings	X	X		X	X		X		X	
Post recency filter	X	X		X		X		X		X
Unread post indicator	X	X	X			X			X	X
Preview post before submitting		X		X		X	X		X	
Post popularity indicator	X	X		X		X		X		
Share discussion externally		X				X	X	X		X
Specialized post filters	X		X	X					X	
Specific topic filters			X			X		X	X	
Trending forum indicator	X	X	X	X						
Help icon in forums			X				X		X	
“Best answer” indicator	X				X					X
Unanswered post filters/indicat			X				X			X
Share discussion internally					X	X	X			
Emoticons			X	X		X				
Add file	X			X						X
“View only” discussion locks						X		X		
Clear algorithm forum suggest	X	X								
Post character limit w/feedback	X					X				
Bookmark post	X									
View of/connections with other users										
View other users’ profiles	X	X	X	X	X	X	X	X	X	X
Site-chosen role icons/labels	X	X	X	X	X	X	X		X	X
Inter-user messaging	X	X	X	X	X	X	X		X	X
Expert label/showcase	X	X	X	X	X	X	X			X
Block people	X	X	X	X	X	X		X	X	
Newcomer label/showcase	X	X				X	X	X	X	X
User search	X	X	X		X		X		X	
User-generated open groups	X	X	X				X		X	X
User-generated closed groups	X	X	X	X				X	X	
Online now indicator		X	X		X	X	X		X	
Last online indicator		X	X	X		X	X		X	
User-behavior flags		X	X	X		X			X	X
“Following” capability	X	X	X	X				X		X

(continued)

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
“Friending capability		X	X		X	X			X	
Users rating users	X	X	X	X		X				
View friends/followees of others		X	X		X	X			X	
Group search		X	X				X		X	X
User products for sale		X			X			X	X	X
Moderator label		X				X	X		X	
Social recommendations	X	X	X		X					
Chat			X		X				X	
@mentions				X			X	X		
“Favorite” user capability						X		X		X
See who viewed profile					X					
Categorize friend lists					X					
User-generated artifacts										
Create artifact	X	X	X	X	X	X	X	X	X	X
Save/follow artifact		X	X	X	X	X	X	X	X	X
Artifact share		X	X	X	X	X	X	X	X	X
Image upload		X	X	X	X	X	X	X	X	X
Video/GIF upload/links		X	X	X	X	X	X	X	X	X
Popularity search filter		X		X	X	X	X	X		X
Peer critique/feedback			X	X		X	X	X	X	X
Community ratings		X		X	X	X		X	X	X
Hyperlink capability		X	X	X			X	X	X	X
Recency search filter		X				X	X	X	X	X
Projects				X		X	X	X	X	X
Voting/polls		X			X	X			X	X
Collaboration			X	X		X	X	X		
Artifact templates				X		X	X		X	X
Lessons					X	X	X			X
Help needed/unanswered filter						X	X			X
Failed object space			X	X					X	
Internal/external blog link		X	X						X	
“Trending” search filter				X			X			
Discussions as main artifact	X	X								
Reviews		X			X					
Wikis				X					X	
Licensing indicator										X
Navigation										
Site search box	X	X	X	X	X	X	X	X	X	X
Drop-down menus	X	X	X	X	X	X	X	X	X	X
Chunking like material	X	X	X	X	X	X	X	X	X	X
Icons with text	X	X	X	X	X	X	X	X	X	X

(continued)

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
Consistent top links/tabs	X	X		X	X	X	X	X	X	X
Labeled categories	X	X	X	X	X	X	X		X	X
Category search	X	X	X	X	X	X	X		X	X
Tag/label/term search	X	X	X	X		X	X	X	X	X
Search filters	X	X	X	X		X	X	X	X	X
Hover-over tags for icons	X	X	X	X	X	X	X		X	X
Icons without text	X	X	X	X	X	X	X		X	X
Text-only links		X	X	X	X	X	X	X	X	X
User-created tags/labels	X	X		X	X		X	X	X	X
Secondary top links/tabs	X	X		X		X	X	X	X	X
Colored buttons with text	X	X	X		X	X			X	X
Bread crumb trail links	X		X		X	X	X		X	
Right side attention/advert box	X	X	X	X	X				X	
Left-side menu links		X	X			X			X	X
Page jump ability	X	X	X			X			X	
Report bug link		X	X							
Save search feature									X	
Site guides for how to navigate/use site										
Help contact	X	X	X	X	X	X	X	X	X	X
FAQs	X	X	X	X	X	X		X	X	X
Site rules/netiquette		X	X	X	X	X	X	X	X	X
Newcomer tutorial	X	X	X	X	X	X	X		X	X
Help section		X	X	X	X		X	X	X	X
Text-based tutorials	X	X	X		X	X	X	X	X	
Text and picture tutorials		X	X	X		X	X		X	X
Language tutorials	X		X	X	X	X		X	X	
Video tutorials		X	X	X		X		X	X	
Tutorials embedded in function		X	X	X			X			X
Introduction video	X		X	X		X			X	
Help forum						X	X		X	X
Orientation forum						X				
Analytics										
Includes statistics	X	X	X	X	X	X	X	X	X	X
Personal statistics	X	X	X	X	X	X		X	X	X
Other user statistics	X	X	X	X	X	X		X	X	X
Discussion statistics	X	X	X	X	X	X	X		X	X
Artifact statistics		X		X	X	X	X	X	X	X
Organized collections/folders		X		X	X		X	X	X	X
Group statistics		X	X	X	X				X	X
Collaboration statistics				X				X		X

(continued)

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
Site-based mobile use										
Browser-based mobile version	X	X	X	X	X	X	X	X		X
Browser text zoom		X	X	X		X	X	X	X	
Android app		X	X	X	X			X		X
iOS app		X	X	X	X			X		X
Competition/challenges										
Achievements	X	X	X			X				X
User ranking system	X	X	X			X				X
Competitions/challenges		X	X			X				X
Leaderboards	X		X			X				
Goals		X			X					
Quizzes		X	X							
Trivia		X								
Outside connections										
Site-brand Facebook account	X	X	X	X	X	X	X	X	X	X
Easy Google search	X	X	X	X	X	X	X	X	X	X
Site-brand Twitter account	X	X	X	X	X	X	X	X	X	X
Outside widget tools	X	X	X		X	X	X	X	X	X
Outside partners	X	X		X	X		X			X
Sign up via social media	X	X	X		X	X				X
Share artifacts to outside email	X		X			X		X		X
API/integrations		X		X				X	X	
Third-party apps				X				X	X	
Invite friends via email			X			X				
Job board	X							X		
Other social media “likes”			X			X				
Site-generated lessons and learning tools										
Regular learning events	X	X	X	X		X	X	X	X	X
Expert articles/blogs	X	X	X		X		X	X	X	X
Webinars	X	X	X	X						
Expert interviews	X	X	X					X		
Lessons/learning tutorials	X		X			X				X
Paid mentorship	X		X	X						
Expert podcasts		X						X		
Site-generated branding/perks										
Purpose statement	X	X	X	X	X	X	X	X	X	X
Mascot/site icon	X	X	X	X	X		X	X	X	X
Some pre-sign up access	X	X	X	X	X	X	X	X		X
Welcome email	X	X	X	X	X	X	X		X	X

(continued)

	Sites									
Tools	1	2	3	4	5	6	7	8	9	10
Quick access to recent posts	X	X	X	X		X	X	X	X	X
Tagline	X	X	X	X	X		X	X		X
Showcases of artifacts	X	X		X	X	X	X		X	X
Crowd-sourced database				X	X	X	X	X	X	X
Algorithm matching recomm.		X	X	X	X			X		X
Site recommendations	X	X	X		X		X			X
Emailed tips/perks	X	X	X		X		X			X
Site-generated database	X	X	X		X					
Free product	X	X	X		X					
SB prizes	X	X			X					
Discounted product	X	X			X					
Testimonials			X					X		
Funding										
Outside advertisements	X	X	X		X	X			X	X
Paid levels of subscription	X		X	X	X			X		X
Grants/business sponsors	X	X			X		X			
Paid product/lessons	X		X	X					X	
Paid mentorship	X		X	X					X	
Site stores				X				X	X	
Site moderation										
Site-based help and support	X	X	X	X	X	X	X	X	X	X
User-generated forum abuse	X	X			X	X	X		X	X
User-generated abuse reports			X	X	X	X			X	X
Site removal of inappropriate			X	X			X	X		X
User can block users/content			X	X				X	X	
UG artifact abuse reports					X	X			X	X
User-generated help/support							X		X	X

APPENDIX F

Definitions of Tools, Structures, and Strategies in Alphabetical Order

Table F1

Definitions of Tools, Structures, and Strategies in Alphabetical Order

Name of tool	Category	Definition	# of sites
"Best answer" indicator	Forum/artifact discussion	Most popular answers (seemingly based on ratings) are signified with a "best answer" symbol.	3
"Favorite" user capability	People	Users can select to add other users as "favorites."	3
"Following" capability	People	Users can follow others, which is a one-way relationship decided by the user who wants to follow.	6
"Friending" capability	People	Users can friend others, which is a two-way relationship decided by both users.	5
"Trending" search filter	User-generated artifacts	Search filters lead individuals to recently popular artifacts.	2
"View only" discussion locks	Forum/artifact discussion	Some discussions within the sites can only be viewed and are not open to general user discussion.	2
@mentions	People	Users can link posts to other users by mentioning their name with the @symbol, which can call the attention of the other user	3
Ability to share discussion externally	Forum/artifact discussion	Site allows discussions to be shared either through social media or email.	5
Ability to share discussion internally	Forum/artifact discussion	Users can share specific discussions with other users within site.	3
About me/bio section	Profile and sign up	Site allows user to express information about him/herself in longer prose.	6
Accessible color ratio	Accessibility	Colors contrasted enough that those with color difficulties could differentiate (measured through webaim).	N/A
Achievements	Competition/ challenges	Site has special icons or labels for achievements within the site.	5
Add file	Forum/artifact discussion	Discussion areas allow user to upload files.	3
Add image	Forum/artifact discussion	Users can add images to discussions.	8
Algorithmic matching recommendations	Site-generated branding/perks	Site matches users with content or others based on algorithms.	6
All members can discuss	Forum/artifact discussion	All members are given the ability to discuss (not just experts or special members).	9
Android app	Site-based mobile use	An Android app exists tha was created by the site.	6
API/integrations	Outside connections	Site allows others to integrate with it through an API or other means.	4
Artifact share	User-generated artifacts	Site allows individuals to share artifacts either internally or externally (or both).	9

(continued)

Name of tool	Category	Definition	# of sites
Artifact statistics	Analytics	Artifact statistics are available, which could include the number of users who liked, followed, viewed the artifact among other statistics.	8
Artifact templates	User-generated artifacts	User-generated artifacts are created through site templates for consistency.	5
Avatar/Picture upload	Profile and sign up	Site allows user to upload a picture or an avatar.	10
Birthday/ Age	Profile and sign up	Site asks for the birthdate or age of the user.	7
Block people	People	Users can block other users so that they don't have to interact with the other users anymore.	8
Bookmark post	Forum/artifact discussion	Site allows user to save a post by bookmarking.	1
Bread crumb trail links	Navigation	Site shows the trail of page navigation starting at the top left corner of site.	6
Browser text zoom	Site-based mobile use	Mobile phones allow individuals to magnify the text in the mobile browser.	8
Browser-based mobile version	Site-based mobile use	The browser of the mobile version of the site is responsive to mobile device screens (size and structure of information especially)	9
Captioning of video	Accessibility	Videos are captioned (this could be custom captioning or could rely on YouTube).	7
Categorizable friend lists	People	Friend lists can be categorized by a user into separate groups based on user-driven labels.	1
Category search	Navigation	Site is categorized content that can be searched for by name.	9
Chat	People	Users can use chat function with others.	3
Chunking like material	Navigation	Content of a similar topic is chunked together for easier viewing.	10
Clear algorithmic forum suggestions	Forum/artifact discussion	Algorithms are used to suggest forum topics for users based on preferences or other information.	2
Collaboration	User-generated artifacts	Spaces on the sites allow for easy collaboration between members.	5
Collaboration statistics	Analytics	Projects or areas of collaboration include statistics. Statistics could include number and times of contributions.	3
Colored buttons with text	Navigation	Site uses colored buttons with text to attract users to actionable buttons.	7
Community ratings	User-generated artifacts	The community rates the user-generated artifacts.	7
Competitions/challenge	Competition/ challenges	Site includes competitions or challenges between users.	4
Consistent top links/tabs	Navigation	Site has top links that remain consistent throughout site navigation.	9
Create artifact	User-generated artifacts	Users can create artifacts within the site.	10
Crowd-sourced database	Site-generated branding/perks	Site amasses database from user-generated items.	7

(continued)

Name of tool	Category	Definition	# of sites
Discounted product	Site-generated branding/perks	Site gives discounts to products related to learning interest.	3
Discussion follow/subscribe	Forum/artifact discussion	Discussions can be stored/followed by individual users.	10
Discussion post ratings	Forum/artifact discussion	Users can rate discussions.	6
Discussion statistics	Analytics	Discussion statistics are available, which could include the number of users who liked, followed, viewed the discussions among other statistics.	9
Discussion term search	Forum/artifact discussion	A search bar allows for free searches not related to specific filters.	7
Discussions as main artifact	User-generated	Some sites do not have separate artifact spaces, so discussions are the main artifact.	2
Drop-down menus	Navigation	Areas of the site can be hovered over or clicked on to reveal broader options in a drop-down format.	10
Easy Google search	Outside connections	Site can easily be searched through a Google search (indicating possible search engine optimization).	10
Edit profile function	Profile and sign up	Site allows user to edit the profile after the initial setup.	10
Edit/ delete own comments	Forum/artifact discussion	Users can edit or delete personal discussion comments.	7
Emailed tips/ perks	Site-generated branding/perks	Site emails tips to special announcements to users.	6
Emoticons	Forum/artifact discussion	Emoticons are available within discussion box.	3
Expert articles/blogs	Site-generated learning tools	Site has experts who write articles and blogs within the site.	8
Expert interviews	Site-generated learning tools	Site has expert interviews that are viewable by the users.	4
Expert label/showcase	People	Experts are either labeled or shown as experts in a special area.	8
Expert podcasts	Site-generated learning tools	Site includes podcasts from experts.	2
Failed object space	User-generated artifacts	A special space is available for users to post objects that did not work or function correctly.	3
FAQs	Site guides for navigation/use	Site has a separate space for frequently asked questions.	9
Forum post heading capability	Accessibility	Forum posts have special headings (only measurable through webaim if site allowed).	N/A
Forum-style discussion	Forum/artifact discussion	Site has forums with different topics and threads typically created by users.	7
Free product	Site-generated branding/perks	Site has free product to give to users.	4
Gender	Profile and sign up	Site asks for gender demographic.	5
Goals	Competition/ challenges	Site has an area for individuals to set goals related to the learning interest within the site.	2

(continued)

Name of tool	Category	Definition	# of sites
Grants/ business sponsors	Funding	Site uses grants or business sponsors as a large part of its funding.	4
Group search	People	Groups can be searched by special interest labels.	5
Group statistics	Analytics	Groups give indication of numbers, recency of use, and other group statistics.	6
Headers/accessibility navigation aids	Accessibility	Headers are located in appropriate places to guide site reader (measured through webaim).	N/A
Help contact	Site guides for navigation/use	Site has a help contact that helps users to reach a real person/people.	10
Help forum	Site guides for navigation/use	Site has a forum for users to seek help through questions and answers.	4
Help icon in forums	Forum/artifact discussion	Forums have a special help symbol that will lead to a support person or area for the users.	3
Help needed/ unanswered filter	User-generated artifacts	Site generates a filter for unanswered artifact posts or calls for help.	3
Help section	Site guides for navigation/use	Site has an area dedicated to help for users.	8
Hover-over tags for icons	Navigation	Icons without text can be hovered over to show what they do.	9
Hyperlink capability	Forum/artifact discussion	Users can hyperlink text within discussions.	8
Hyperlink capability	User-generated artifacts	Individuals can hyperlink to artifacts or within the artifact they create on the site.	7
Icons with text	Navigation	Icons and text are together to signify what a click does.	10
Icons without text	Navigation	Site includes icons that do not have text indicating the purpose of the icon.	9
Image upload	User-generated artifacts	Site allows image uploads as artifacts.	9
Includes statistics	Analytics	The site includes statistics (in general).	10
Inter-user messaging	People	Users can use a site-based messaging system to communicate with each other.	9
Interest preferences	Profile and sign up	Site asks for user's interests, typically based on community learning interest.	6
Internal/external blog special link	User-generated artifacts	Site allows for user blogs within the site or links to user blogs outside the site.	3
Introduction video	Site guides for navigation/use	Site has an introductory video to explain the site.	5
Invite friends via email	Outside connections	Site allows users to invite outside friends via email.	2
iOS app	Site-based mobile use	An iOS app exists that was created by the site.	6
Job board	Outside connections	Site has a job board to outside agencies.	2
Labeled categories	Navigation	Site has labeled categories to guide learners.	9
Language tutorials	Site guides for navigation/use	Site has a space dedicated to helping individuals learn the specialized language used within the site.	7

(continued)

Name of tool	Category	Definition	# of sites
Last online indicator	People	Users can see when another user was last on the site.	6
Leaderboards	Competition/ challenges	Site shows the leaders of site-related things such as challenges, discussion likes, artifact likes, etc.	3
Left-side menu links	Navigation	Structure of site has left-sided menu links in some or all of the site.	5
Lessons	User-generated artifacts	User-generated lessons are made available through special places on the site.	4
Lessons/ learning tutorials	Site-generated learning tools	Site includes lessons or learning tutorials specific to the learning interest.	4
Licensing indicator	User-generated artifacts	Users can indicate their licensing preferences for uploaded artifacts or content.	1
Location field	Profile and sign up	Site asks where the person is currently located.	8
Mascot/site icon	Site-generated branding/perks	Site brands itself with a mascot or special icon.	9
Moderator label	People	Individuals who are moderators for discussions have a special label.	4
Name field	Profile and sign up	Site asks for a name.	10
Newcomer label/showcase	People	Newcomers are either labeled or shown as newcomers in a special area.	7
Newcomer tutorial	Site guides for navigation/use	Site includes a newcomer tutorial of any kind.	9
Non-forum artifact discussion	Forum/artifact discussion	Discussions take place around artifacts and not solely in forums.	10
Notifications	Site guides for navigation/use	Site has an area for special site announcements and notifications regarding the site.	9
Online now indicator	People	Users can see who is currently on the site.	6
Organized collections/folders	Analytics	Users can view other users' number of organized collections/folders.	7
Orientation forum	Site guides for navigation/use	Site has a forum to help new users to navigate or use the site.	1
Other demographics	Profile and sign up	Site asks for site-specific or other demographics not listed.	6
Other social media "likes"	Outside connections	Site shows the number of "likes" the site has received on other social media sites.	2
Other social profiles	Profile and sign up	Site allows user to attach account or show other social profiles.	3
Other user statistics	Analytics	Users can see statistics about other users, including their number of posts, number of people following them, and other statistics.	9
Outside advertisements	Funding	Site allows outside advertisements in order to receive funding.	7
Outside partners	Outside connections	Businesses or other agencies are partnered with the site.	6
Outside widget tools	Outside connections	Site has widgets connecting to outside media such as Facebook, Google, Instagram, RSS, etc.	9

(continued)

Name of tool	Category	Definition	# of sites
Page jump ability	Navigation	Long lists with pages of information allow users to jump forward to specific pages.	5
Paid levels of subscription	Funding	Site allows different access at different levels based on payment plan.	6
Paid mentorship	Site-generated learning tools	Site includes the ability to find a mentor who can be paid.	3
Paid mentorship	Funding	Site receives funds through mentorship it produces.	4
Paid product/lessons	Funding	Site has product or lessons users can pay for.	4
Password field	Profile and sign up	Site asks for a password.	10
Peer critique/feedback	User-generated artifacts	Peers are able to give (typically written) critique or feedback.	7
Personal email	Profile and sign up	Site asks for a personal email for communication.	10
Personal statistics	Analytics	Users' personal statistics are visible, showing information such as amount of time on the site, number of posts, number of friends or followers, etc.	9
Personal url	Profile and sign up	Site allows other users to connect to individual's personal site.	5
Personalization of view	Profile and sign up	User can change their personal view of the site. This could mean color, objects, images, or other visible items.	3
Personalized header/caption	Profile and sign up	User can customize own header or a caption viewable by other users.	3
Popularity search filter	User-generated artifacts	Search artifacts based on community-rated popularity	7
Post character limit with feedback	Forum/artifact discussion	Text box indicates how many characters one can post and gives feedback on remaining characters.	2
Post popularity indicator	Forum/artifact discussion	Based on user reviews, popular posts are signified.	5
Post recency filter	Forum/artifact discussion	A filter allows individuals to search based on recency of posts.	6
Post reply	Forum/artifact discussion	Individuals can post a reply to an initial topic.	10
Post rules/netiquette	Forum/artifact discussion	Site has some indication of rules/netiquette for posting and contributing to site.	10
Preview post before submitting	Forum/artifact discussion	Discussion area allows user to preview a post before submitting.	5
Profile completion status	Profile and sign up	Site gives indication of whether the profile has been completed.	3
Profile picture with post	Forum/artifact discussion	Profile picture is included with/near discussion posts.	10
Projects	User-generated artifacts	Site has reserved space to showcase or help with projects.	6
Purpose statement	Site-generated branding/perks	Site has a clear purpose statement.	10
Quick access to recent projects/posts	Site-generated branding/perks	Site allows for quick user access to projects or posts.	9

(continued)

Name of tool	Category	Definition	# of sites
Quizzes	Competition/ challenges	Site includes quizzes for individuals to test their knowledge.	2
Quote in forum	Forum/artifact discussion	Site allows users to draw quotes from previous posts to show which post is receiving a response.	8
Recency of posts	Forum/artifact discussion	Date and/or time stamps are indicated on posts.	9
Recency search filter	User-generated artifacts	Filters help users find recently posted artifacts.	6
Regular learning events	Site-generated learning tools	Site has regular events such as online webinars, games, chats, etc.	9
Report bug link	Navigation	Users can report bugs to the site managers.	2
Requires email confirmation	Profile and sign up	Site requires user to give email address and to verify connection through email.	10
Reviews	User-generated artifacts	Users or experts are able to review objects.	2
Right side attention/advert boxes	Navigation	Structure of site has advertisement or attention attracting boxes on right side.	6
Save search feature	Navigation	Users can save previous searches to locate information easier next time.	1
Save/follow artifact	User-generated artifacts	Users can either store other users' artifacts or follow the artifact (including ratings and discussions).	9
SB can remove inappropriate content	Moderation	Site can remove inappropriate content.	5
SB prizes	Site-generated branding/perks	Site gives away prizes to users.	3
Search filters	Navigation	Site has search filters for guided navigation.	9
Secondary top links/tabs	Navigation	Site has second level of top links or tabs that may change based on page.	8
See who viewed profile	People	Users can see who within the site has viewed their profile.	1
Share artifacts to outsiders with emails	Outside connections	Users can share artifacts externally via email.	5
Showcases of artifacts	Site-generated branding/perks	Site shows artifacts of interest to individuals.	8
Sign up via social media	Outside connections	Individuals can sign up through Facebook or other social media.	6
Site recommendations	Site-generated branding/perks	Site gives recommendations to help individuals on learning path.	6
Site rules/netiquette	Site guides for navigation/use	Site has a set of rules or netiquette listed within the site.	9
Site search box	Navigation	Site search box is available.	10
Site stores	Funding	Site has a store to sell product related to the site.	3
Site-based help and support	Moderation	Site has a space for individuals to find help or support.	10
Site-brand Facebook account	Outside connections	Site has a Facebook page.	10
Site-brand Twitter account	Outside connections	Site has a Twitter account to be followed by others.	10

(continued)

Name of tool	Category	Definition	# of sites
Site-chosen role icons/labels	People	The site specifies roles for users, often as the user works to establish him/herself, but also based on other user information.	9
Site-generated database	Site-generated branding/perks	Site has a database that would be of interest to users.	4
Social recommendations	People	Users are recommended to each other as friends based on algorithmic social recommendations.	4
Some pre-sign up access	Site-generated branding/perks	Site allows nonmembers to view artifacts or posts from within the site.	9
Specialized post filters	Forum/artifact discussion	Post filters specialized for various post demographics are available, such as time-, length-, or other related needs.	4
Specific topic filters	Forum/artifact discussion	Filters for specific and often site-related topics are available for perusal.	4
Spoken version of text	Accessibility	Site readers could easily read text (measured through webaim).	N/A
Tag/label/term search	Navigation	Site allows open searches based on specific tags, labels, or terms.	9
Tagline	Site-generated branding/perks	Site has a clear tagline to show the purpose of the site.	8
Testimonials	Site-generated branding/perks	Site advertises user testimonials.	2
Text and picture tutorials	Site guides for navigation/use	Site has documentation “how-to” areas in the form of pictures and text.	7
Text edit/manipulate functions	Forum/artifact discussion	Users can bold, highlight, italicize, or otherwise manipulate text in discussion boxes.	7
Text size manipulation	Accessibility	Text size could be manipulated separate from the Zoom feature that manipulates all content.	N/A
Text-based tutorials	Site guides for navigation/use	Site has documentation “how-to” areas in the form of text.	8
Text-only links	Navigation	Site includes links that are not signified with larger buttons or colors.	9
Third-party apps	Outside connections	Apps created by other parties are created to integrate or make mobile navigation easier for the site.	3
Transcripts of audio	Accessibility	Audio transcripts are included with audio on site.	2
Trending forum indicator	Forum/artifact discussion	Forums that are recently popular are signified.	4
Trivia	Competition/ challenges	Site includes trivia for individuals to test their knowledge.	1
Tutorials embedded in functions	Site guides for navigation/use	Tutorials are embedded as guides or as quick pop-up boxes that can be clicked from the function where a user needs help.	5
UG* artifact abuse reports	Moderation	Users can indicate to the site that an artifact is outside of the guidelines of the site.	4
UG* help and support	Moderation	Users can access support areas created by other users.	3
UG* user abuse reports	Moderation	Users can indicate to the site that another user is abusing the site.	6

(continued)

Name of tool	Category	Definition	# of sites
UG* closed groups	People	Users can create closed groups that can be joined through invitation only.	6
Unanswered post filters/indicators	Forum/artifact discussion	Unanswered posts are signified through special symbols and/or filters.	3
Unread post indicator	Forum/artifact discussion	Unread posts are signified with colors, numbers, or other special symbols.	6
User can block users/content	Moderation	Users can control the content and user interactions within the site.	4
User control of profile sharing	Profile and sign up	Site allows user to control how much of a personal profile is shown.	9
User products for sale	People	Users can sell their personal products either within the site or with a link to another site.	5
User ranking system	Competition/ challenges	Users are ranked within the site based on exterior or interior rankings.	5
User search	People	Users can search other users.	6
User-behavior flags	People	Users can flag other users who seem to be trolling or otherwise behaving poorly on the site.	6
User-created tags/labels	Navigation	User can create searchable tags or labels for items and posts.	8
User-Generated (UG) forum abuse reports	Moderation	Users can indicate to the site that a forum post falls outside of the guidelines of the site.	7
User-generated (UG) open groups	People	Users can create groups that are open for others to join.	6
username field	Profile and sign up	Site asks for a username.	10
Username with post	Forum/artifact discussion	Username is included with/near discussion posts.	10
Users rating users	People	Users can rate other users (often with “likes”).	5
Video tutorials	Site guides for navigation/use	Site has video tutorials for the various uses of the site.	6
Video/GIF upload/links	User-generated artifacts	Site allows individuals to upload videos or GIFs as artifacts.	9
View friends/followees of other user	People	Users can see the friends of other users or the individuals tha other users have followed.	5
View other users’ profiles	People	Users can view other users’ profiles and information.	10
Voting/polls	User-generated artifacts	Special tools or spaces on the site allow for member votes and polling.	5
Webinars	Site-generated learning tools	Site does webinars regarding the learning interest.	4
Welcome email	Site-generated branding/perks	Site sends an email to welcome newcomers to the site.	9
Wikis	User-generated artifacts	Wikis are available for users to interact and collaborate.	2

*UG means user-generated

APPENDIX G

Documented Permission from Authors for Figures Used

To: Y. Engeström from K. Welch
Dated: September 16, 2016
Re: Email seeking permission for Activity Theory figure (Figure 1)

Dear Professor Engestrom,
I'm seeking permission to use your version of the activity theory triangle in my dissertation. Would you be open to this?

Thank you,
Kim Welch
Pepperdine University

To: K. Welch from Y. Engeström
Dated September 19, 2016

Dear Kim, you have my permission. Please remember to include a reference to the original source of the diagram.
With best regards,
Yrjö Engeström

To: Authors of Digital Habitats from K. Welch
Dated November 7, 2015
Re: Email seeking permission for Tools Landscape figure (Figure 2).

Hello,
I'm in the process of writing a dissertation on online informal learning community platforms, and I would love to use Figure 5.1-the tools landscape to represent some of the things I would like to convey about the three polarities as explained in the book as they pertain to technology stewardship. Could you please grant me permission to use this figure in my dissertation?

Thank you,
Kim

To: K. Welch from the authors of Digital Habitats
Dated: November 7, 2015

As one of three, I say yes! I presume John and Etienne will say the same thing!
N

_____
Definitely yes.

John

_____
Yes from me too.

Etienne
