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IMPLEMENTING A DIGITAL SHARING SPACE IN ONLINE STUDIO COURSEWORK IN THE FIELD OF LANDSCAPE ARCHITECTURE

by

Elizabeth Braithwaite

A thesis proposal submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF LANDSCAPE ARCHITECTURE

Approved:

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Benjamin George, Ph.D. Major Professor	Keith Christensen, Ph.D. Committee Member
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UTAH STATE UNIVERSITY
Logan, Utah

2022

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ABSTRACT

Implementing a Digital Sharing Space in Online Studio Coursework in the Field of Landscape Architecture

by

Elizabeth Braithwaite, Master of Landscape Architecture

Utah State University, 2022

Major Professor: Dr. Benjamin George
Department: Landscape Architecture and Environmental Planning

Social interaction is a critical component of instruction in landscape architecture, including the forms of deep interaction that occur in the studio learning environment. Studio learning focuses on the collaborative interaction between peers and instructors, and ongoing iterative critique. Maintaining this high degree of social interaction online is a primary concern when adopting distance education. This study explores the implementation and effectiveness of interactive treatments through digital sharing spaces that engage landscape architect students in social interaction while enrolled an online course. In an undergraduate landscape architecture class across two course assignments, forty-six students engaged in different online learning platforms. The platforms included discussion boards on Canvas, message boards and check-ins on Basecamp, and critiques and work-sharing on the online whiteboard Conceptboard. The posts and comments made on the platforms, assignment grades, and a survey sent to students after project completion were analyzed. The content of the discussion boards appeared to be more influenced by students' exposure and previous experience to the platform than the format

of the platform used. Students that were more engaged with online interaction performed better on the assignments than those who did not have active participation, regardless of platform use.

Conceptboard use was correlated with significantly higher grades. Little difference in students' performance occurred between the use of Canvas and Basecamp as a discussion platform. Basecamp did show greater overall participation, depth of interaction, and students' perception of interaction over other platforms. This study suggests that implementing techniques for online interaction can improve student success.

(119 pages)

PUBLIC ABSTRACT

Implementing a Digital Sharing Space in Online Studio Coursework in the Field of Landscape Architecture

Elizabeth Braithwaite

Landscape architecture education focuses on creating socially-rich environments for learning. Coursework in landscape architecture often is labeled as "studio learning." These types of classes involve a high degree of collaboration and detailed critique. They create opportunities for students to interact with each other and their professors. When considering the adoption of online learning, a primary concern of landscape architecture professors is to maintain this high degree of social interaction in online classes.

This study explores the use of several platforms to facilitate social interaction in online landscape architecture coursework. These platforms include Canvas, Basecamp, and Conceptboard. Canvas is the learning management system used for the course, and work done for this project included interaction on the discussion boards. Basecamp is a collaboration tool that included message boards and check-ins for students. Conceptboard included visual work-sharing on an online whiteboard and was used for scheduled critiques between students and the professor or TA. Over the course of two assignments, students interacted online within these different platforms. To determine the effectiveness of the platforms, data was collected from the content posted to platforms, the grades of students' assignments, and a survey sent to students.

Students that used any platform performed better on their assignments than those who did not. Conceptboard users especially had higher grades than those who did not. Conceptboard was generally used to post work and receive a critique from a professor or

TA. When comparing students who used Basecamp and Canvas, there was little difference in students' performance.

Basecamp provided a benefit in more participation, and students who used the platform responded that they were more engaged with their fellow peers. During the study, students did respond that they had opportunities to interact with their peers. This study suggests that using online platforms for student interaction can have a positive benefit for students.

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Special thanks to my family, especially my husband Joe. Without the support at home, I could have never had the success I have had.

Liz Braithwaite

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CHAPTER I

INTRODUCTION

Social interaction is a critical component of instruction in landscape architecture, including deep interaction that occurs in the studio learning environment. Studio learning focuses on the interaction between peers and instructors and integrates collaboration and ongoing, iterative critique. Maintaining this high degree of social interaction online is the primary concern for landscape architecture faculty in adopting distance education, even as distance education increases in use (George, 2014). However, research regarding methods to facilitate online interaction in landscape architecture education and related design fields is lacking. The purpose of this study is to implement an online digital sharing space that facilitates interaction between students and see if that interaction supports student learning.

The Need for Social Interaction

Effective learning does not occur in isolation. Students need a variety of different interactions to occur to learn. This includes interaction with course content and social interaction with peers and teachers (Moore, 1989). Social interaction can strengthen learning. To facilitate social interaction, learning communities can be developed (Lave & Wegner, 1991). When students are within a learning community, they learn more than content, they learn how to reflect on problems and develop critical thinking skills (Schön, 1987). They learn from seeing others' work and seeing not only the result but the process of how things are done and created (Hutchins, 1995).

Design fields, including landscape architecture, have long relied on studio learning environments to facilitate this social interaction. Studio learning creates a collaborative learning environment. Students are invited to work closely with others through critique, group work, and collaborative problem-solving. Work is not done in isolation, but students work through the process of design with each other. Traditionally, this is done in a physical location, in the studio.

Increase of Distance Education

Distance education is growing and changing the face of higher education (Christensen & Eyring, 2011). Distance education has many benefits, including flexible learning that is not reliant on time or space. The Covid-19 pandemic demonstrated the advantage of this flexibility, and many courses that were traditionally face-to-face transitioned to an online environment. During this time, in a study done by the Utah State University Center for Student Analytics, students experienced major challenges in engaging with their fellow students and social isolation (N. Legler, personal communication, February 8, 2021). Facilitating social interaction in distance education should be an area of focus for educators.

Due to concerns with social learning, and the traditional nature of in-person studio learning, some design fields are hesitant to adopt distance education (George, 2014). Distance education does not have the built-in collaboration inherent in working in the same physical space; therefore, traditional collaborative techniques like critique and group work can be more difficult.

Social Interaction with Studio Learning in Distance Education

Even though social learning can be more difficult in an online setting, it is not impossible. Interactive treatments such as online spaces, social networks, and tools in learning management systems can facilitate a range of social interactions. In addition, the increased use of technology means that work is frequently done on a computer instead of on physical paper. This can often make traditional classroom techniques, like pin-ups and peripheral observation, more difficult even when learning occurs in the same physical space. Developing interactive treatments to facilitate social learning can overcome the barriers of social isolation in distance education.

Although some techniques to facilitate social interaction in an online setting have been studied, the results are varied (Blevis et al., 2008; Fleischmann, 2019; George, 2018; Li, 2007). Ongoing changes in technology also result in a need to analyze new interactive treatments and how they might be facilitated in online environments. This thesis seeks to implement a digital sharing space to facilitate online-processed based learning, specifically between peers. Three technologies were utilized: Canvas, Conceptboard, and Basecamp. This study seeks to explore if it worthwhile to engage in the utilization of outside spaces for collaboration, as opposed to using traditional methods. The timing of this study occurred when the Covid-19 pandemic pushed many traditionally in-person classes online, facilitating a need for additional opportunities for online social learning.

Two studies are presented in this thesis. The primary study comprises a primarily quantitative analysis of the purposeful implementation of digital sharing spaces in an online undergraduate landscape architecture studio course (see chapters 3-5). A

secondary case study provides a qualitative look at the utilization of the same collaborative software used as a digital sharing space in the first study, but within the context of a separate class. This class was a graduate-level landscape architecture course that occurred both in-person and online, within the dynamics of the changing Covid-19 pandemic (see chapter 6).

CHAPTER II

LITERATURE REVIEW

Theoretical Foundation

Vygotsky proposed that learners are capable of learning more if they have the opportunity for imitation with the help and guidance of more experienced peers (1980). He considered that the social environment is critical for learning and that social interactions transform our learning experiences (Schunk, 2012, Vygotsky, 1980). Termed social constructivism, this theory focuses on the social environment in which learning occurs and includes peer-assisted and cooperative learning (Cobb & Bowers, 1999; Schunk, 2012). Cobb & Bowers (1999) state that “To learn is to participate and contribute to the evolution of communal practices” (p.10).

As part of a social constructivist environment, collaboration occurs among learners, and with an instructor who acts as a mentor, not simply a disseminator of knowledge (Jonassen, 1994). A mentor is a more experienced guide who facilitates the opportunity for learners to make their own discoveries. In this collaborative environment, cognition is not separated from the social context, and the educational experience is summed up as a "collaborative communication process for the purpose of constructing meaningful and worthwhile knowledge" (Garrison et al., 1999, p.92). Social constructivism is suited for design fields because of the focus on student-centered, collaborative learning (Wang, 2011).

Building on the idea of a social environment, Lave & Wegner (1991) proposed that we learn by active participation in a community of practices, termed legitimate

peripheral participation. This community is dependent on legitimate social interactions: the social interactions and work we do, even as a beginner, matters (Lave & Wegner, 1991). Participants in a community of practice (or learning community) have increasing roles of participation until mastery is reached, mirroring apprenticeships (Lave & Wegner, 1991). As part of a learning community, Hutchins (1995) proposed a "horizon of observation," by which learners in the community can observe others through the use of open interactions and open tools (Hutchins, 1995). When participants see advanced peers working, hear the collaborative work done by others, and see how others interact with tools used, these interactions act as an instrument of instruction (Hutchins, 1995; Lave & Wegner, 1991).

Collaboration and social learning are integral to the learning process. Facilitation of learning communities and rich social interaction should be fundamental to the learning environment. Without social interaction, the learning experience lacks many critical components that foster a complete learning experience.

Studio Learning

In design fields, including landscape architecture, studio learning is the dominant educational vehicle for design coursework (Cennamo et al., 2011; Coyne & Rosenman, 1990; Oxman, 2001, Rice, 2017). Studio learning is a type of open-ended, design-centered, problem-based learning (Cennamo et al., 2011; Oxman, 2001) which specifically focuses on learning by doing under the supervision of a master designer (Kuhn, 2001; Schön, 1987). Schön (1987) described studio learning as a "reflective conversation with the situation," where students learn to reflect on what they do and

develop knowledge in action.

Studio learning involves critiques, collaboration, juries, and pin-ups (Bucciarelli, 2001; Cennamo et al., 2011; Dutton, 1987; Kuhn, 2001; Kvan, 2001; Schön, 1987). This results in deep interaction between learners and instructors, where the interaction is a valuable source of learning and an essential aspect of studio learning. The social venue and collaborative learning environment of the studio contribute to the development of knowledge and skill in all studio members (Cennamo et al., 2011; Oxman, 2001; Sireesha, 2018). Bucciarelli (2001) states that "Designing requires the negotiation of interests and proposals of different participants; hence the process is social and knowledge socially construed" (p.297). Within the studio, there is general dissemination of knowledge between peers through a collaborative process (Abdulla et al., 2011; Cennamo, et al., 2011). Students will seek assistance and advice from other peers and see more experienced students as experts (Cennamo et al., 2011; Broadfoot & Bennett, 2003). Although the social atmosphere is generally positive, some social components like competition and hierarchy can be present that prevents learning (Abdulla et al., 2011; Dutton, 1987).

Social constructivism, learning communities, and studio learning all explain the importance of social interaction within landscape architecture education. Due to the nature of traditional studio learning, transitioning from a physical studio to distance education (DE) is challenging. The adaptation of DE within the field of landscape architecture has been slow (George, 2014). In a study done by the American Society of Landscape Architects (ASLA) in 2008, online education was shown to be in the initial stages of development with some adaptation among programs. The use of DE has

generally been limited to classwork outside of studio learning. As of this writing, there are currently no Landscape Architecture Accreditation Board accredited programs offered fully online (American Society of Landscape Architects, n.d.). In a study of landscape architecture faculty, they were most concerned about how the social component of the traditional can be translated into an online environment (George, 2014). Concerns include social isolation from peers without idea sharing, no rapport with others, difficulty in critiquing student work, and a lack of face-to-face interaction (George, 2017b). One landscape architecture faculty member summed up this concern by saying, "There is something lost when students can't look across to others [sic] desks and see their works and/or iterations, overhear conversations, or participate in impromptu pop-up discussions and topics" (George, 2014, p.59). Social isolation between peers can result in the reduction of ideas, knowledge, and quality design work (Dutton, 1987; George & Walker, 2017; Schön, 1983).

This literature review will first establish the desirability of using distance education, explore methods and theories that exist for interaction within distance education, and specifically look at studies that look at techniques for social interaction within distance education in design fields, especially focusing on the interaction between students and how it supports student learning.

Distance Education

The availability of distance education (DE) has increased in undergraduate education and that trend is expected to continue (Seaman et al., 2018; Lokken, 2019). DE is changing the profile of higher education (Christensen & Eyring, 2011). DE has

numerous benefits: it is flexible, can extend education to more people, can be efficient, allows for higher interaction with materials presented, and allows for students and faculty in multiple locations (Arkorful & Abaidoo, 2015; Eyring & Christensen, 2012; Kaplan & Haenlein, 2016). Disadvantages of DE center on the lack of personal interaction and face-to-face content and communication (Arkorful & Abaidoo, 2015). DE can further be subdivided into asynchronous and synchronous. DE, including asynchronous learning, has been shown to provide positive outcomes for students in both attitude and achievement (Bernard et al., 2009).

Within DE, the literature is univocal about the importance of interaction (Abrami et al., 2011; Bernard, et al., 2009; Swan, 2002). Interaction occurs through learner to content, learner to instructor, and learner to learner interaction (Moore, 1989). Interaction between the learner and interface can also be considered (Hillman et al., 1994; Muirhead, 2002). There is the added benefit of vicarious interaction, interaction by those who observe others and do not engage in direct interaction (Sutton, 2001). Students in DE can outperform those in traditional coursework when learner interactions occur (Abrami et al., 2011; Lou et al., 2006).

Social Interaction Within DE

Several frameworks have been developed that highlight the importance of social interaction. These include the community of inquiry, and affinity spaces (Garrison et al., 1999; Gee, 2004). The community of inquiry framework features three main parts: social presence, cognitive presence, and teaching presence (Garrison et al., 1999). Within social presence, open communication occurs with cohesion between learners (Garrison et al.,

1999). Cognitive presence engages learners in critical thinking and understanding (Garrison et al., 1999). Finally, the instructor is present and acts as a facilitator to guide the discourse (Garrison et al., 1999, Garrison & Arbaugh, 2007). Instructor presence can lead to increased learning as instructors facilitate peer interaction and guide learners to collaborative efforts (Bernard, et al., 2009; Garrison & Gleveland-Innes, 2005; Lahti & Hakkaranien, 2014; Muirhead, 2004; Swan, 2002,).

Affinity spaces denote a space where people with a common endeavor interact, traditionally in a virtual sphere (Black, 2008, Gee, 2004). These affinity spaces overcome barriers such as location, status, and ability, and blends everyone into a shared space where informal learning occurs (Black, 2008, Gee, 2004). Several features of this space include the ability of newcomers and experts to interact, and the space is changed by interaction (Black, 2008; Gee, 2004). This encourages the growth of many types of knowledge (Black, 2008; Gee, 2004).

On a review of the literature regarding interactive treatments (ITs) within DE, the authors state, “The major conclusion from this review is that designing ITs into DE courses, whether to increase interaction with the material to be learned, with the course instructor or with peers, positively affects student learning" (Bernard et al., 2009). It is important to direct interaction to meaningful cognitive discussion and collaboration (Garrison & Cleveland-Innes, 2005; Swan, 2002; Tu & McIsaac, 2002). Intentional ITs that are an integral feature of the course have been shown to increase learning (Abrami, etal, 2011, Kaplan & Haenlein, 2016).

DE is ideally learner-centered, cognitive learning, facilitated by social engagement between learners with instructor facilitation that happens to occur in an

online space. Current techniques to facilitate interaction used by researchers include learning management systems, discussion boards, Facebook, blogs, and other platforms designed by researchers (Karatas et al. 2017).

Computer and digital technology are changing the traditional education model (Oxman, 2008). Within the field of design, the use of computers is increasing, resulting in lower social contact (Guney, 2015; Wang, 2011). Technology and ITs can increase the creative capabilities of learners, including collaboration, communication, and creativity when they are used for clear means (Wang, 2011). ITs create the ability to establish collaborative networks, foster a collective spirit, as well as allowing enhanced critical thinking skills, and promote effectiveness in communication (Siressha, 2018). Technology enables global communication and a large resource base and the use of technology, including social media, has increased in the career field (Kvan, 2001; Sireesha, 2018).

Increased use of technology can also lead to the isolation of students from peers and lost opportunities for learning by doing in the physical studio (Saghafi et al., 2012). Without instructor facilitation and proper implementation of ITs, the social component of studio learning can be lost, and this is reflected in the concerns of landscape architecture professionals (George, 2017a)

Techniques for Online Social Interaction in Design Fields

IT's in design fields are sometimes termed virtual design studios. Virtual design studios have the benefit of allowing studio interaction to occur anywhere, and anytime, and focus on process-based, constructive learning (Saghafi et al., 2012). When instructor

facilitation and reinforcement combine with student-centered learning and responsibility, collaborative learning can take place. Broadfoot & Bennett (2003) suggest four main components to a virtual design studio: learning by doing, a dialogue between learner and instructor, collaborative context, and a focus on processed-based learning. These recommendations match research done in DE that encourages the use of social engagement within an online space.

Current research focusing on DE and social interaction in design fields is varied. While, there are few empirical studies (Wang, 2011) and a lack of precedents (George, 2017a), DE in the design field has been shown to provide good outcomes, student satisfaction, and quality work (Blevis et al., 2008; Fleischmann, 2019; George, 2018; Li, 2007). Fleischmann (2019) states, "There is no question that in certain contexts, online design education is possible and does produce positive results from student and teacher perspectives" (p.14). ITs used in DE in design within the literature include the use of social networking sites such as Facebook, learning management systems, and communicative technology like email and videoconference. Advantages show that using ITs can result in an increase in peer interaction and academic engagement and engage learners that traditionally would feel excluded in traditional classwork due to barriers like language (McCarthy, 2010). ITs can be a valuable collaboration tool, that enables virtual teamwork, mentoring, and provide the opportunity for faculty and peers to work together across various location and disciplines (Bender, 2005; Karakaya & Senyapılı, 2008; Lauche et al., 2008; McCarthy, 2012,). The use of ITs can result in better critique and feedback, as well as meaningful discussion (George, 2017a). Online critiques can lead to greater thought and honesty (Blythmann et al., 2007). Feedback is also available at any

time, rather than restricted to set class time, although this feedback can also have a slower response time (George, 2018; Shnabel & Ham, 2012).

Studies show that there are limitations to ITs and DE in design coursework. Many learners in design education have previously expressed a preference for face-to-face coursework (Soulels, 2012). In some research, being unable to see the work of peers was listed as a limitation (George, 2018). However, by using other methods, the exposure to the work and progress of other peers was listed as a benefit (Guler, 2015). Creating learning communities online can be difficult (George, 2018). Technology can be a limitation when it does not perform as intended (Bender, 2005).

Because of the advantages and disadvantages of online technology and in-class learning, flipped and blended coursework, which involves using both online technology and in-person class time, is a technique that is frequently used (McCarthy, 2010, Saghafi et al., 2012). Bender and Vredevoogd (2006) propose that blended learning will benefit studio classes in design fields. Many studies use blended techniques (Bender & Vredevoogd, 2006; George, 2018; McCarthy, 2012; Saghafi et al., 2012). Current research on IT in DE is summarized in Table 1.

Table 1

Summary of research done in DE in design education

IT Type	*Advantages*	*Limitations*	*Studies*
Social Media Platform	Meaningful discussion	Building a learning community	George, 2017 Guler, 2015 McCarthy, 2010 McCarthy, 2012 Schadewitz &
	Enhanced critique	Did not replace face to face interaction	

	Overcome social barriers	Preference for face to face	Zamenopoulos, 2019 Shnabel & Ham, 2012 Soulels, 2012
	Peer to peer interaction	Lack of focus, socializing without learning	
	Academic engagement		
	Mentoring		
	Collaboration		
	Interaction between institutions		
	Exposure to peer progress		
	Ease communication		
	Archiving (see past interactions)		
	Accessible		
	See other's process online		
Learning Management System	Good practical outcomes	Students not as responsive	Fleischmann, 2019 George, 2018 Karakaya & Senyapılı Li, 2007 Lahti & Hakkaranien, 2014
	Similar quality of work compared to face-to-face peers	Hard to work with technology	
	Flexible	Couldn't see the work of peers	
	Helpful and solution-driven feedback	Lack of learning community	
	Bring different disciplines together	Technology constraints	
	Learner satisfaction		
	Provide a realistic environment for virtual teamwork		
Traditional Communicative Technology (email, videoconference)	Availability of staff outside class time	Learning curve	Bender, 2005 Lauche, et al., 2008
	Multi-disciplinary	Cooperation, scheduling	
	Dispersed locations/	Lack of	

	universities	spontaneous practice	
	Decrease faculty workload		
	Record progress		
Multiple techniques	Anywhere, anytime	Lack of learning by doing	Saghafi, et al., 2012 Bender, 2003
	Time to reflect and research	Feeling isolation	
	Increase student learning	Technical problems	

There are both advantages inherent to different IT types listed in Table 1, as well as limitations. The research shows ITs can allow interaction to occur more flexibly. ITs allowed for students to still engage in interactive experiences like critique, and maintain quality learning experiences, while not being limited to a specific time or space (Fleschman, 2019: George, 2017; McCarthy, 2010,). Overall, the use of ITs can be an integral part of providing the social interaction that students need when in a DE environment yet, problems still exist in forming learning communities, and students' reported isolation (Bender, 2005; George, 2018; Souleles, 2012). More research is needed on how to create effective learning communities, that can be spaces where students can engage with each other and share their work and experience.

In addition, the literature has focused on techniques such as social media and learning management systems, but research does not include many newer, emerging forms of collaborative technologies. With the increase of remote work, there has also been an increase in the use and development of collaboration tools, such as project management software and team communication platforms (Rimol, 2021). Research

regarding the use of these technologies within the field of design education is warranted.

The Effects of the Pandemic on Online Learning

The Covid-19 pandemic pushed many classes into an online setting. However, there is a difference between the quick transition to online classes compared to traditional online learning. Hodges et al. (2020) point out that effective online education is very different than the "emergency remote teaching" that took place in the pandemic. Online education is traditionally rooted in a practice of substantial planning and design and is far different than the online instruction that occurred during the pandemic with little time for development (Adedoyin & Soykan, 2020).

The primary focus of this study is purposely constructed online courses. In the first section, the online course was taught by a professor well versed in online learning, with adequate time for preparation. This class is more comparable to traditional online learning than remote learning that often occurred during the pandemic. However, the second part of this thesis provides an example of how ITs can be integrated into a less purposeful situation and featured many of the characteristics of "emergency remote teaching."

CHAPTER III

METHODS

Learning from peers in processed-based work is an important part of education. The use of online techniques to facilitate interaction can be effective in DE design courses, as shown within the literature review. However, although some research regarding interaction exists, it is also a commonly listed limitation to learning in DE. This study seeks to fill in the gap within the literature of techniques to help students can engage with each other and share their work and experience online. George (2018) recommends the creation of a digital sharing space.

The purpose of this study was to implement an online digital sharing space that facilitates interaction between students and see if that interaction supports student learning. A digital sharing space was previously developed, and that work is included in Appendix A. This study focuses primarily on the implementation of that space. With this study, it provides an exploration of the utilization of outside spaces and collaborative technologies, to see if it is beneficial to integrate this type of interactive treatments into online studio coursework.

The primary focus of this study was providing learners the opportunity to see each other work and interact naturally while engaging in the process of design-based learning. This study seeks to answer the following research question: *How can social interaction, specifically focused on sharing and learning from peer-to-peer process-based work, be facilitated in an online environment in landscape architecture?*

Beyond the initial facilitation of online interaction, learning communities can

facilitate increased learning through the observation of others' work, and participation in a community that is more than a singular learner (Lave & Wenger, 1991). The premise is that students can do more with others (Vygotsky, 1980). A second research question demonstrates this idea: *Will the implementation of a dedicated digital sharing space with specific suggestions and parameters for frequent sharing enhance student performance and their satisfaction with the learning experience compared to traditional methods?*

Although this study primarily facilitated the testing of different technologies, it is also important to note that technology only acts as a supporter of pedagogy. In this regard, the information gained in this study is meant to have implications for the pedagogical implementation of DE interaction methods, rather than the support of any one technological method.

Implementation

Implementation of an online digital sharing space occurred in an online course of USU LAEP 2700, Site Analysis, in Fall 2020, taught by Prof. Benjamin George. The class was traditionally taught as a face-to-face studio class, but this semester was taught as a fully online asynchronous remote class, without scheduled or formal in-person interaction. Students were divided into two randomly selected groups, A and B. Students were informed of the study through an announcement in Canvas on October 2nd.

The study took place over the course of two class assignments. Each assignment was worth an equal number of points within the class and they were similar in scope and scale. There were some slight differences between the projects. The first assignment was frequently presented on two-page spread, and the second was presented on a single-page

spread. The second project also required more complex data analysis.

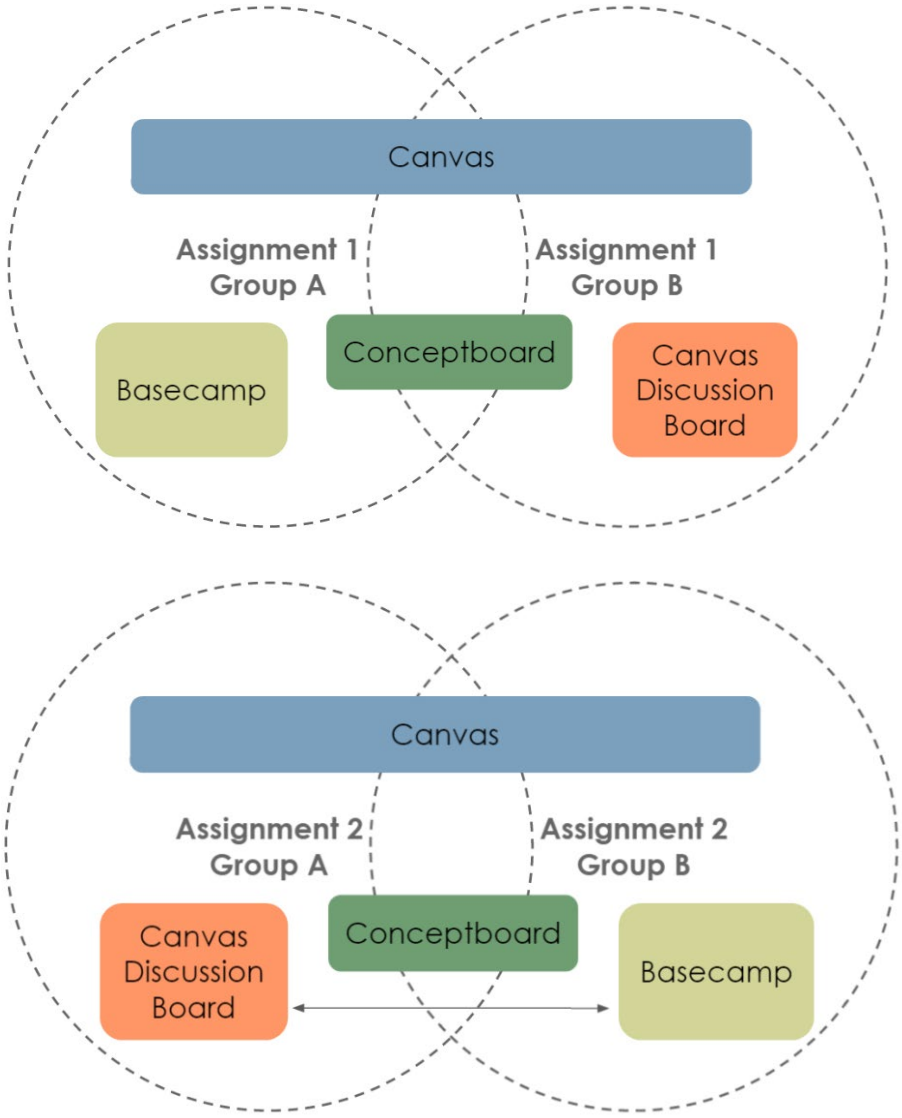
Both assignments were individual assignments, not group projects. The first assignment in the study, Assignment 6: Biological Analysis, was available starting October 5th and was due October 19th. The second assignment, Assignment 7: Geophysical Analysis, was available from October 19th and was due October 28th.

For the first assignment, Group A was given access to a digital sharing space that took place on a platform called Basecamp. Group B used a discussion board within the Canvas learning management system, where most of the classwork took place. For the second assignment, Group A was asked to revert to the Canvas discussion board and Group B was given access to the digital sharing space on Basecamp.

Students in both groups also had access to online critiques and work-sharing that was done primarily through the platform Conceptboard. This was initially not part of the study's design but was a method that was utilized previously in the class and continued during the study. Conceptboard acts as an additional digital sharing space. Due to its confounding effects on the outcomes measured in this study, its use will also be analyzed.

Figure 1

Project Set-Up



Explanation of Platforms

The following sections provide a brief overview of the format used in each platform.

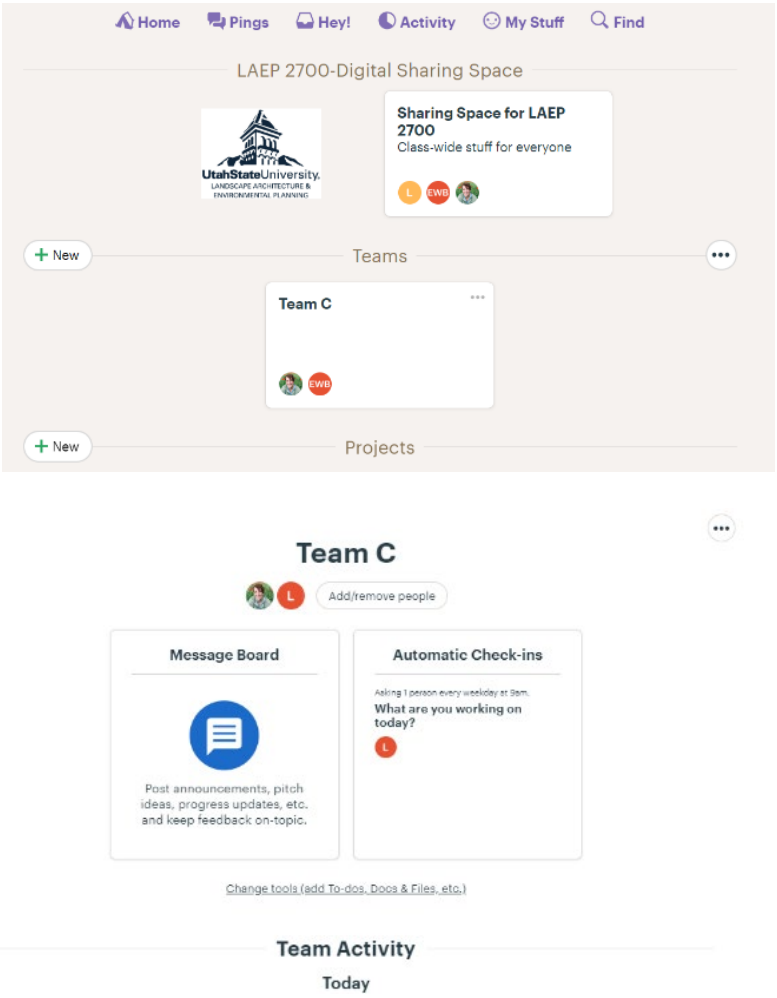
Basecamp

Basecamp is a commercially available software that is designed for remote collaboration. Many tools exist on the platform; specific tools were selected, and the space was set up for students' use in this project to function as a digital sharing space. The digital sharing space was designed to provide the opportunity for students to see each other's work and have open student-to-student interactions that discuss their work while in-progress.

Students were given access to Basecamp on the first day the assignment was available via an email sign-up. The email included a link to a webpage that gave an overview of the Basecamp digital sharing space. The webpage included a brief walk-through of the site, instructions on updating notification and profile settings, and a brief description of the tools such as the message board and automatic check-in. A few tips were given about using Basecamp and interacting with peers.

Students were divided into small teams within Basecamp, and their interaction occurred in a space for each team. They also had access to a space for all class members, but this was not utilized during the study. For the first assignment, there were four teams of 6-7 students. Based on participation in the first assignment, teams were changed to two teams of thirteen students for the second assignment.

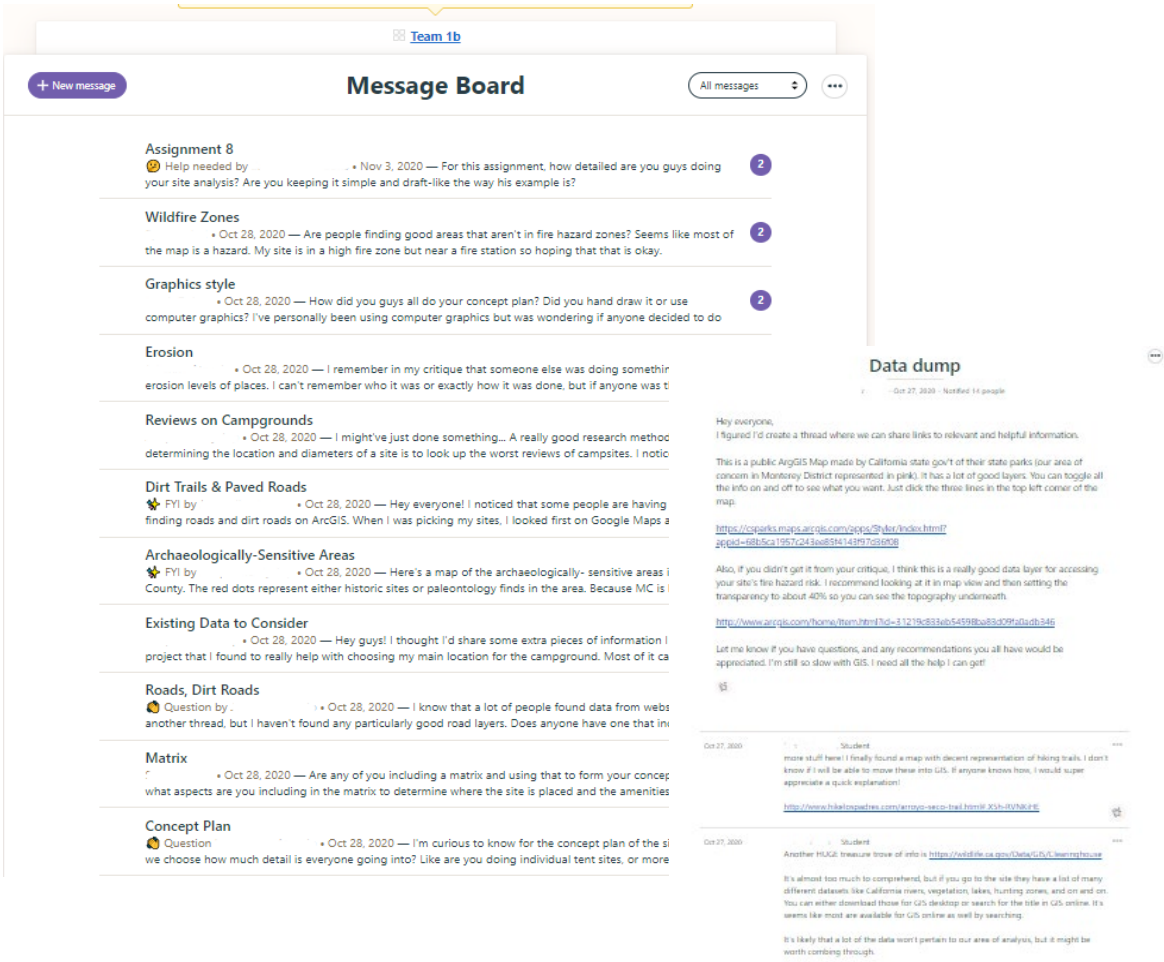
Figure 2
Basecamp Digital Sharing Space



The message board provided a place for students to start threaded conversations. After an initial post, students could comment on the post.

Figure 3

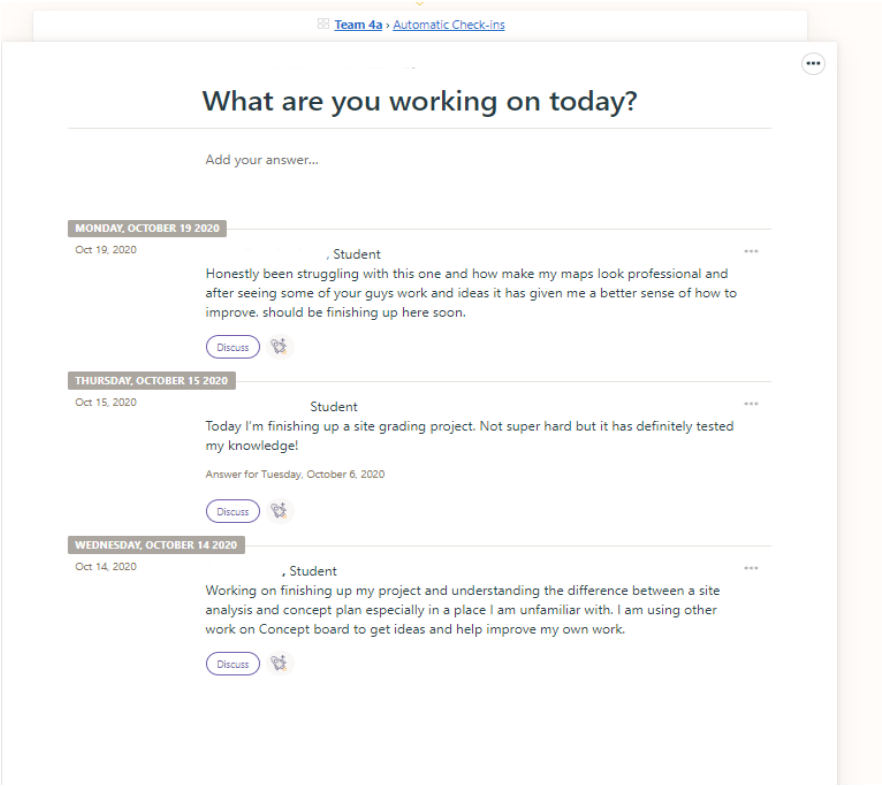
Basecamp Digital Sharing Space: Message Boards



The automatic check-in was sent to students' emails or notified within the Basecamp app. Students could respond to the check-in through email, or directly in Basecamp. After an initial post, comments could be left on the response to the check-in.

Figure 4

Basecamp Digital Sharing Space: Check-ins



File uploads and the inclusion of images were readily available on all posts. Students also had the option to turn on additional tools. One group utilized the Docs & Files sections to upload some examples of their in-progress work. Basecamp is available through a web browser, as a mobile app, or on a desktop computer. Students could update their preferences on all notifications through email or within the platform. More information about Basecamp is available in Appendix A.

Canvas

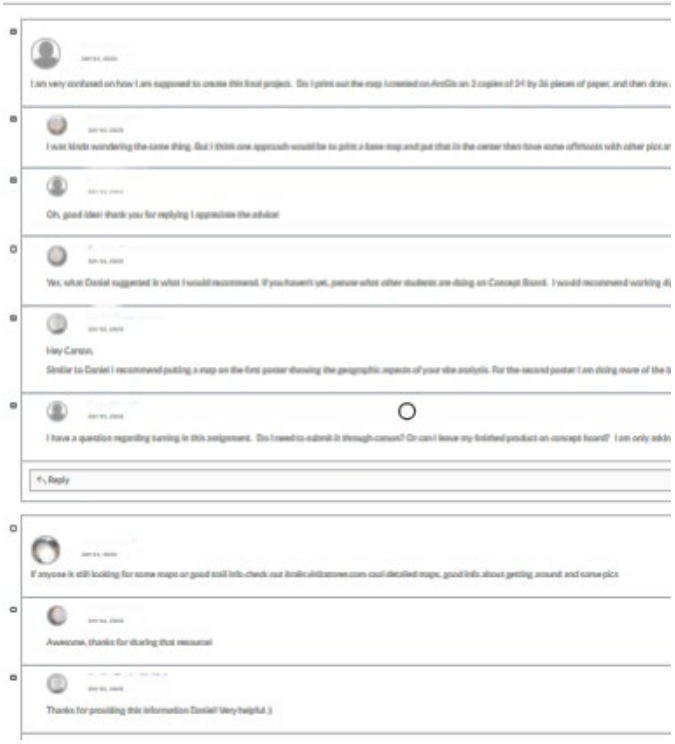
The Canvas discussion board was titled with the name of the assignment and had

a brief message inviting students to “post your progress and comment on your peers progress.” Students could comment and reply to others’ posts. Canvas was the primary learning management system for the class and included the course content and assignment information. Discussion boards were used previously for several class discussions.

Students could sign up for a critique by the professor or T.A. through a Google Doc spreadsheet that was linked on Canvas. Critique sessions involved 1-4 students within a 30-minute timeframe and were available 2-3 times during the assignment. Critique sessions utilized the work students posted on Conceptboard during the critique.

Figure 5

Canvas Discussion Boards

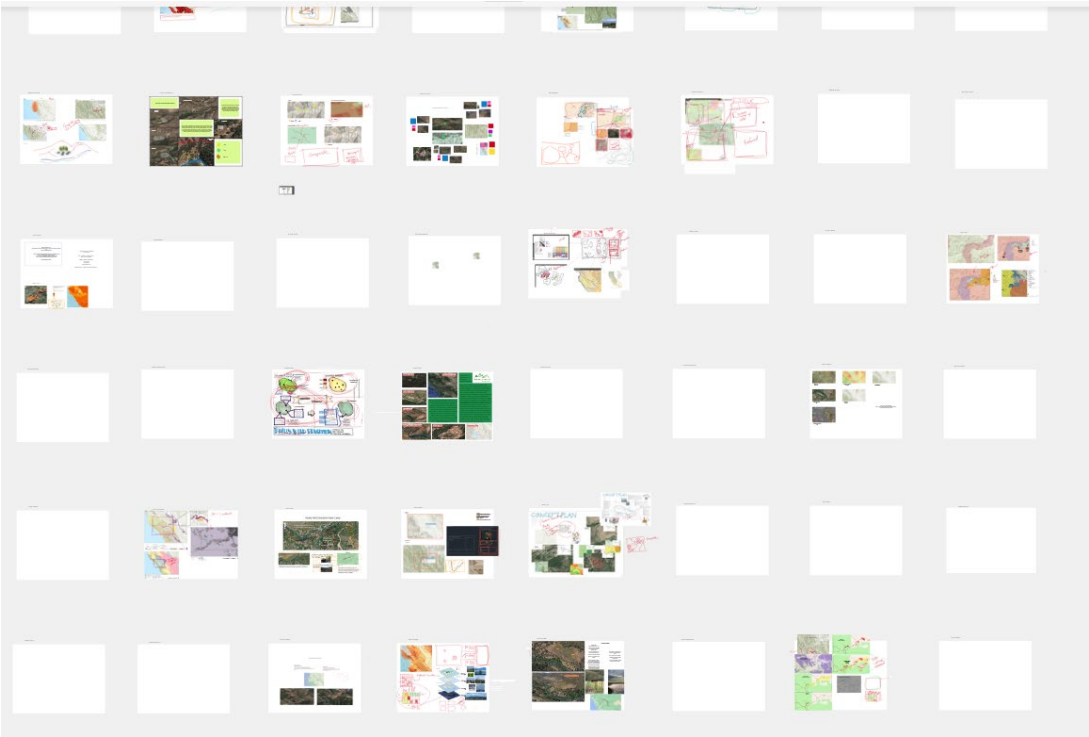


Conceptboard

A board within Conceptboard was set up for each assignment. The board was structured so each student had a section under their name to post their work. Students could upload images and other files, and anyone with access to the board could add comments or draw within the section.

Figure 6

Conceptboard



Differences Between Platforms

Some features were similar between Canvas and Basecamp. They both included threaded discussions. Basecamp is designed to be user-friendly and can be easier to navigate, see new updates, as well as upload and post new content as compared to Canvas discussion boards. For example, new content is at the top of Basecamp message boards but is at the bottom of Canvas discussion boards. Basecamp also included an automated daily check-in that was housed in a separate location from the message board. Basecamp allows easy search of the material and customizable notifications on new content that can be sent to email. Basecamp also allows the integration of more tools like a section for files.

Canvas was already integral to the course; Basecamp was a separate platform implemented only for student interaction. A primary difference was that within Basecamp, students had a team space for a smaller group of students, where the Canvas discussion boards were for the entire class.

Conceptboard functioned primarily as facilitation of synchronous critiques, and as part of that students posted examples of their work. Commenting is available, but not widely utilized. Conceptboard use was very structured in its design and utilization, as compared to Canvas and Basecamp.

As an overall comparison, Basecamp and Conceptboard represent the utilization of outside tools instead of the use of the integrated tool within the platform for the course. They are more feature-rich and customizable than the comparable Canvas discussion board. Basecamp and Conceptboard were used for more direct means than Canvas, such as the daily check-ins with teams and schedule critiques.

Student Expectations

Within both assignment descriptions, the following information was included: "For this assignment, some of you may be using Basecamp to encourage interaction. If you do not use Basecamp for this assignment, you will be using it for the next assignment. Those not using Basecamp will use a combination of Conceptboard and the discussion board on Canvas. As part of your participation grade in the course, for each of the next four assignments, you will be asked to interact with your peers on Basecamp, Conceptboard, or the course discussion board. The breakdown for measuring participation is as follows:

- Full credit: Three or more posts and substantial comments on others' work
- Partial credit: 1-2 posts, and few comments on other's work
- No points: Little to no interaction."

The interaction was incentivized for all students across all platforms. The students had also been previously told within the syllabus and during the first week of the course to participate in "studio culture." Students were invited to actively participate in the course through discussion, critique, and other opportunities, and weekly participation points were awarded.

Measures

To measure the facilitation of interaction and student performance and satisfaction, three primary measures were used: content analysis, blind review, and surveys. Facilitation of interaction was measured using content analysis and was

performed on Basecamp and the Canvas discussion boards used during the projects. The content analysis looked at the volume and type of content shared by students, and the number and type of interactions between students. Categorization of this content analysis focused on cognitive reflection, process-based sharing, critique, and collaboration. In addition, discussion board participation was graded according to a standardized rubric based on that developed by Roblyer (2014) that measured the timeliness, frequency, direction, and quality of the interactions and contributions.

Primary qualitative analysis of performance was obtained by students' grades of the assignment. Evaluation notes given during the grading process were also analyzed. Evaluation and grades were given by the professor of the course, Benjamin George, who did not know students' treatment groups.

Finally, a survey was distributed by email to students through Qualtrics after each project to determine students' perception and satisfaction of online interaction on the project. The survey is included in Appendix B.

CHAPTER IV

RESULTS

For the primary research question, *How can social interaction, specifically focused on sharing and learning from peer-to-peer process-based work, be facilitated in an online environment in landscape architecture,* this study demonstrates several methods of online interaction including the discussion boards used in Basecamp and Canvas, and the work posted within Conceptboard. These platforms will be the primary focus of the research.

To answer the question: *Will the implementation of a dedicated digital sharing space with specific suggestions and parameters for frequent sharing enhance student performance and their satisfaction with the learning experience,* the following results focus on students' grades, as well as answers to the survey distributed to students.

Overview

Forty-seven students participated in the assignments. Groups of 25 were set out initially. Those who did not complete the assignment were excluded. For the first assignment, 22 students were included in Group A and primarily used Basecamp, and 25 in Group B primarily used Canvas. Two people used both platforms and are included in both groups for assignment one. Two people also did not use the assigned platform (Basecamp) and are instead included in Group B (Canvas). For the second assignment, 21 students are included in Group B and primarily used Basecamp, and 25 students are included in Group A and primarily used Canvas. The following table provides an

overview of the platform used for the duration of the research project.

Table 2

Overview of Project

	1A (Basecamp)	1B (Canvas)	2A (Canvas)	2B (Basecamp)
Total # participants*	22	25	25	21
Conceptboard participants	11	17	10	8
Concept board comments	2	26	1	0
# Individual comments on discussion platform	93	82	64	100
Mean # comments /all	5	5.13	3	5.14
Median/all	5	5	2	6
Participants with no activity, any platform	1	3	10	4
Mean/active	5.47	5.88	4.11	6
Median/active	5	5	4	6
Mean grade	184	187	179	186

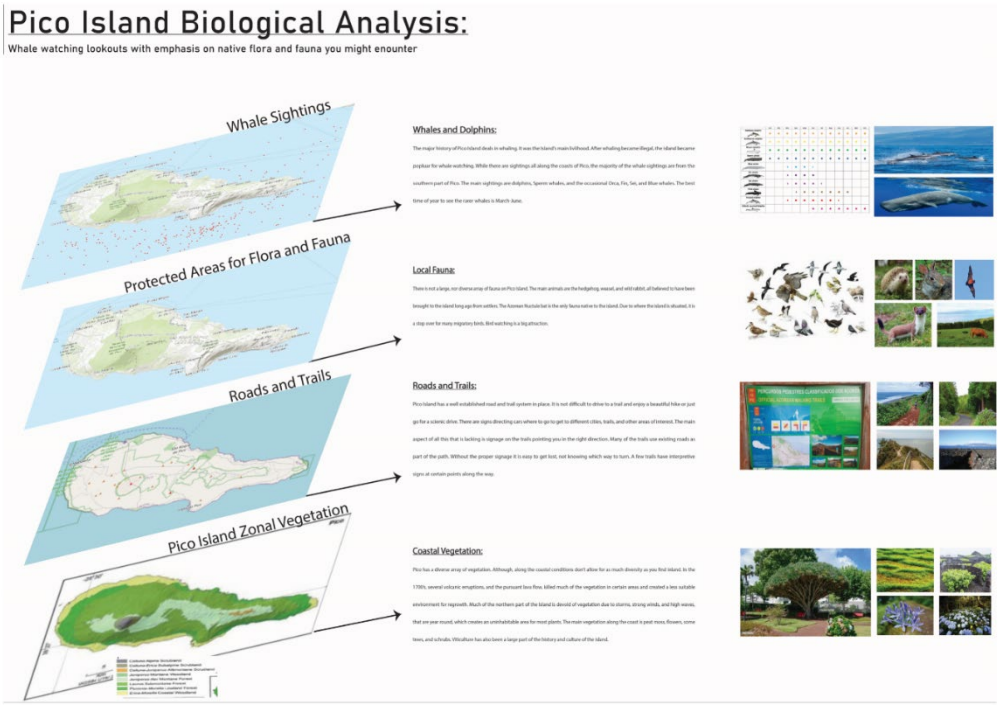
In addition to interaction on Canvas and Basecamp, students could use the online platform Conceptboard. On the first assignment, 28 students used Conceptboard, with 18 students on the second assignment. These students opted to use Conceptboard on their own regardless of their assigned group.

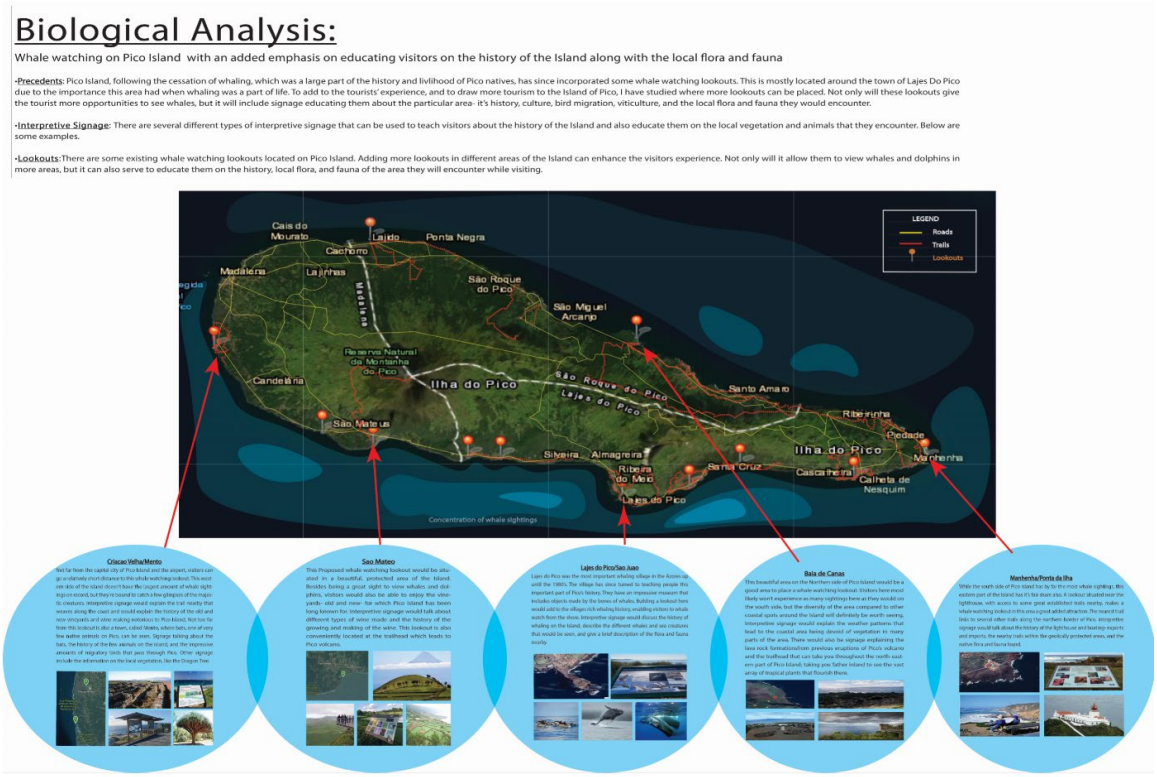
Example Work

The following figures illustrated students' work from the assignment. Examples are taken from the high and low end of graded work. A summary of notes from the grading process is provided.

Figure 7

Student Example Work, First Assignment

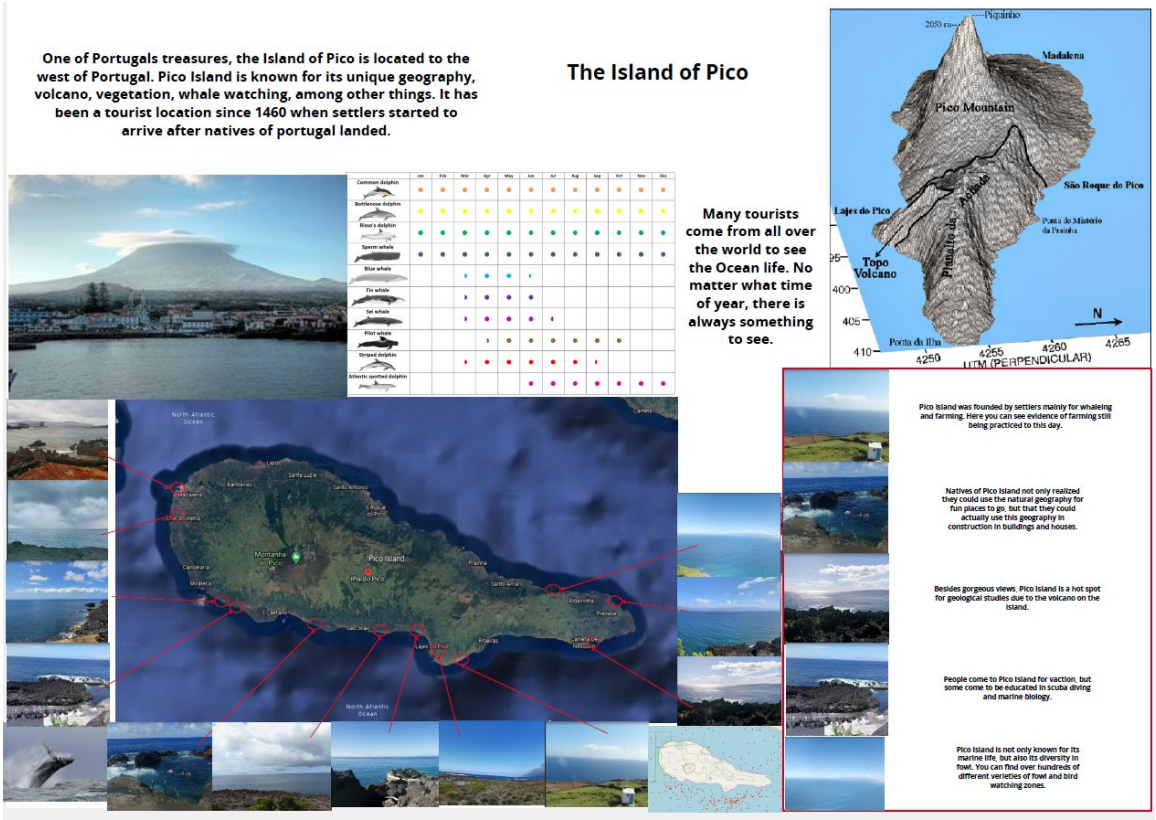




This student, a senior and non-traditional student, received a grade of 196/200. Grading notes included minor layout issues. The student was highly engaged in online platforms with 12 discussion board posts on Basecamp and posted their work to Conceptboard.

Figure 8

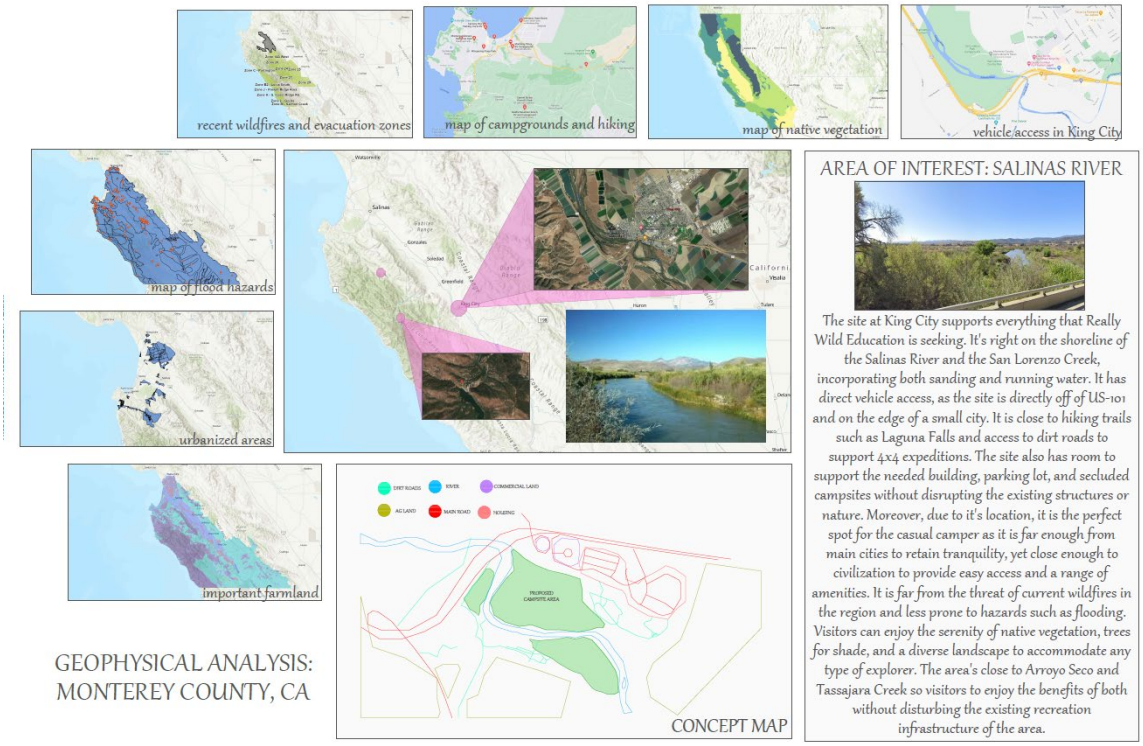
Student Example Work, First Assignment



This student, a junior, received a grade of 170/200. The submission was late, although no points were deducted due to ongoing concerns with Covid. The students had no measurable participation in online interaction.

Figure 9

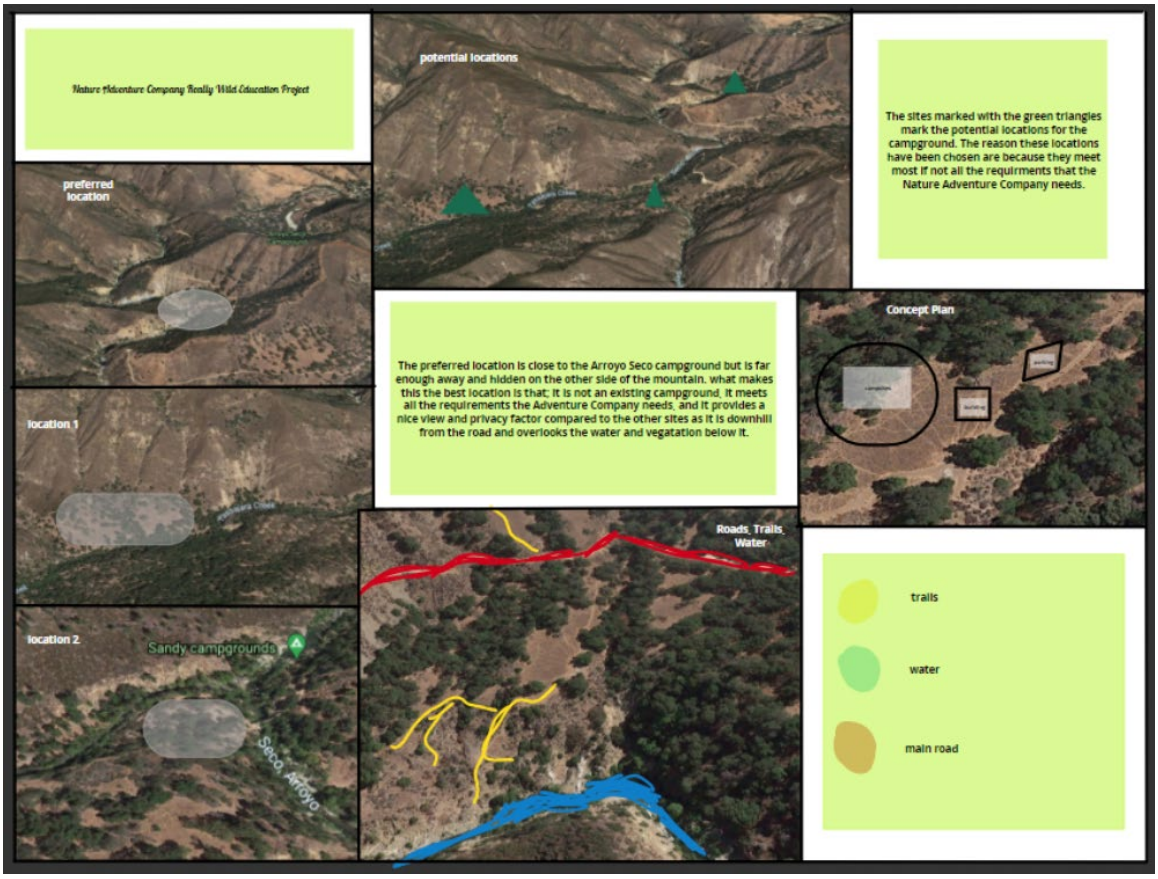
Student Example Work, Second Assignment



This student, a sophomore, received a 194/200 on this assignment. Grading notes indicated minor layout issues. The student made 10 discussion posts on Basecamp, with no Conceptboard use.

Figure 10

Student Example Work, Second Assignment



This student, a junior, received a grade of 158/200. Grading comments included layout issues and missing required content. There was no measurable online interaction.

Grade Notes

The notes on students' assignments after grading were analyzed. Notes included positive feedback, problems with layout, confusing or incorrect content, and work that was missing key elements of the assignment. Layout notes were most common, but occurred in both low and high scores, indicating that layout notes did not greatly impact

the student's ultimate grade. Positive notes occurred more frequently on higher scores. For low scores, comments often focused on content and the need for further expansion. This indicates that the low scores were primarily caused by not meeting all assignment expectations and having confusing or underdeveloped content. Grade notes were similar across all treatment groups.

Grades of Treatment Groups

The 21 students that used Basecamp (Group A) for the first assignment (M=184, SD=10.2) compared to the control group of 24 students using Canvas (Group B) (M=187, SD=7.7) had no significant difference in assignment scores, $t(37)=-1.0$, $p=0.31$. On the next assignment, with 25 students using Canvas (Group A) (M=179, SD=16.2) and 21 students on Basecamp (Group B) (M=186, SD=10.3) there was also no significant difference, $t(41)=-1.6$, $p=0.11$

The 28 students that used Conceptboard in the first assignment (M=190, SD=5.8) compared to the 17 students that did not (M=179, SD=9.3) had significantly higher assignment scores, $t(24)=-4.4$, $p<0.001$. On the next assignment, 18 students used Conceptboard (M=187, SD=9.8) and 28 did not (M=179, SD=15.5) and assignment scores remained significantly higher for those that used Conceptboard, $t(44)=-2.2$, $p=0.04$

One additional analysis was performed, comparing the grades of those who actively engaged in any platform compared to those with no platform use. This was not statistically significant in the first assignment, but there was a very low level of non-participants, (4 out of 45 total). For the second assignment, the 14 students who did not participate (M=172, SD=17.0) underperformed the 32 students who did (M=187,

SD=9.8) by a significant margin t(17)=-3.1, p=0.006.

For the following two charts, each assignment grade is presented three times. Once with all grades, the next split into Groups A or B, and finally as represented through Conceptboard use.

Figure 11

Grade Distribution for the First Assignment

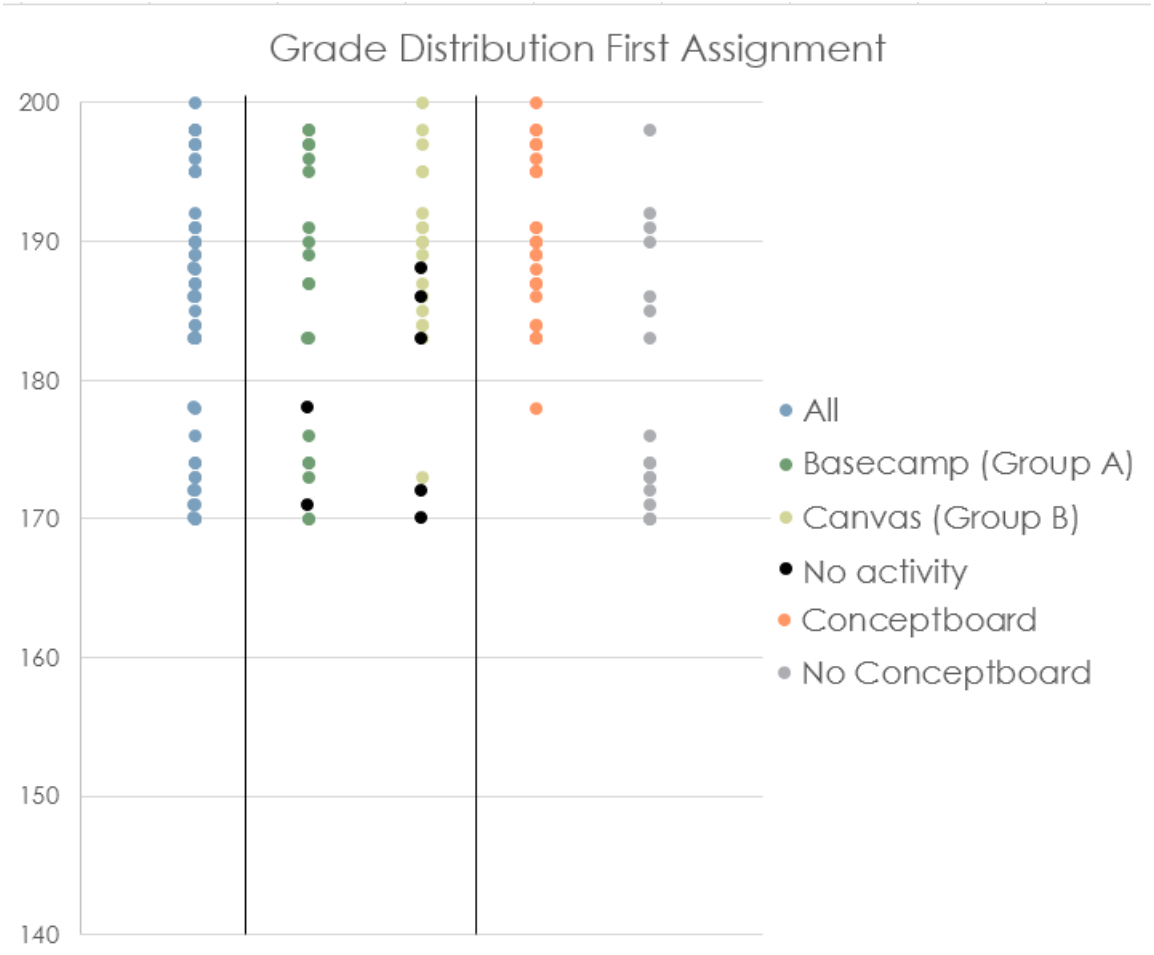
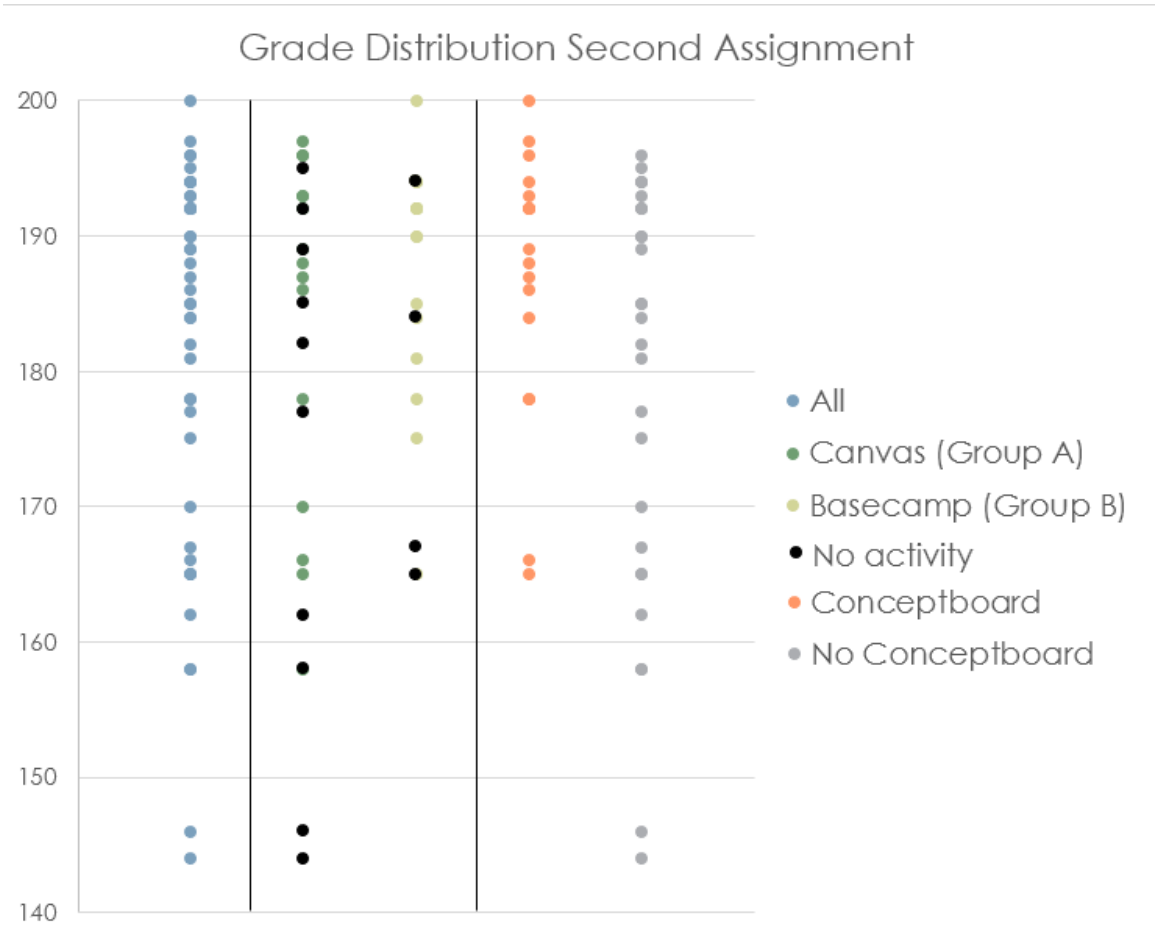


Figure 12

Grade Distribution for the Second Assignment



Final grades for the class are presented in Table 3. There is no significant difference in grades between users of Basecamp and Canvas, but significance in those that choose to use Conceptboard.

Table 3

Final grades of students by treatment group

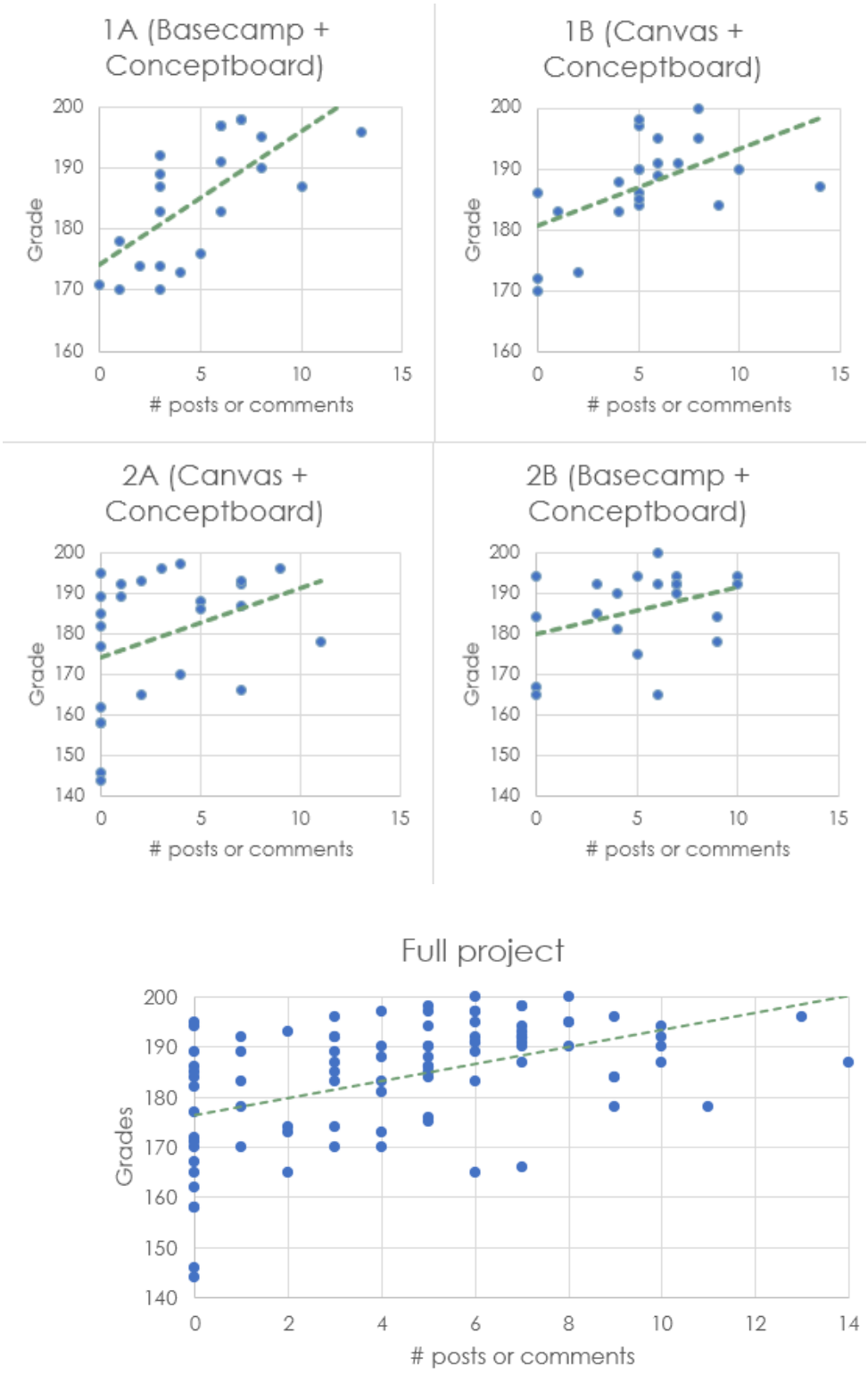
	1A (Basecamp)	1B (Canvas)	2A (Canvas)	2B (Basecamp)
Final grade in class	95.10	93.79	94.57	93.49
	Conceptboard, 1	No posts, 1	Conceptboard, 2	No posts, 2
Final grade in class	96.05	91.62	96.38	92.60

Correlation of Grades and Interaction

The grades and interaction levels of each student were correlated by comparing the assignment grade to the total number of posts and comments by the student. For the first assignment, Group A had a correlation coefficient of 0.66, and Group B had a correlation coefficient of 0.51, indicating a moderate positive correlation between grades and interaction. For the second assignment, the correlation coefficient was 0.35 for Group A and 0.36 for Group B, a weak positive correlation. Across the whole project, the correlation coefficient was 0.42.

Figure 13

Distribution of Grades Compared to Number of Posts and Comments



Active Participation

Participation within discussion boards varied. For the second assignment in the Canvas discussion board, participation was low. The other treatment types maintained a high level of participation.

Table 4

Active participation

	Percent of students who actively participated
Assignment 1 Group A (Basecamp)	91%
Assignment 1 Group B (Canvas)	80%
Assignment 2 Group A (Canvas)	52%
Assignment 2 Group B (Basecamp)	81%

Quality of Interaction

To quantify the quality of interaction, students' comments were analyzed based on the following rubric, which was a modification of that developed by Roblyer (2014).

Table 5

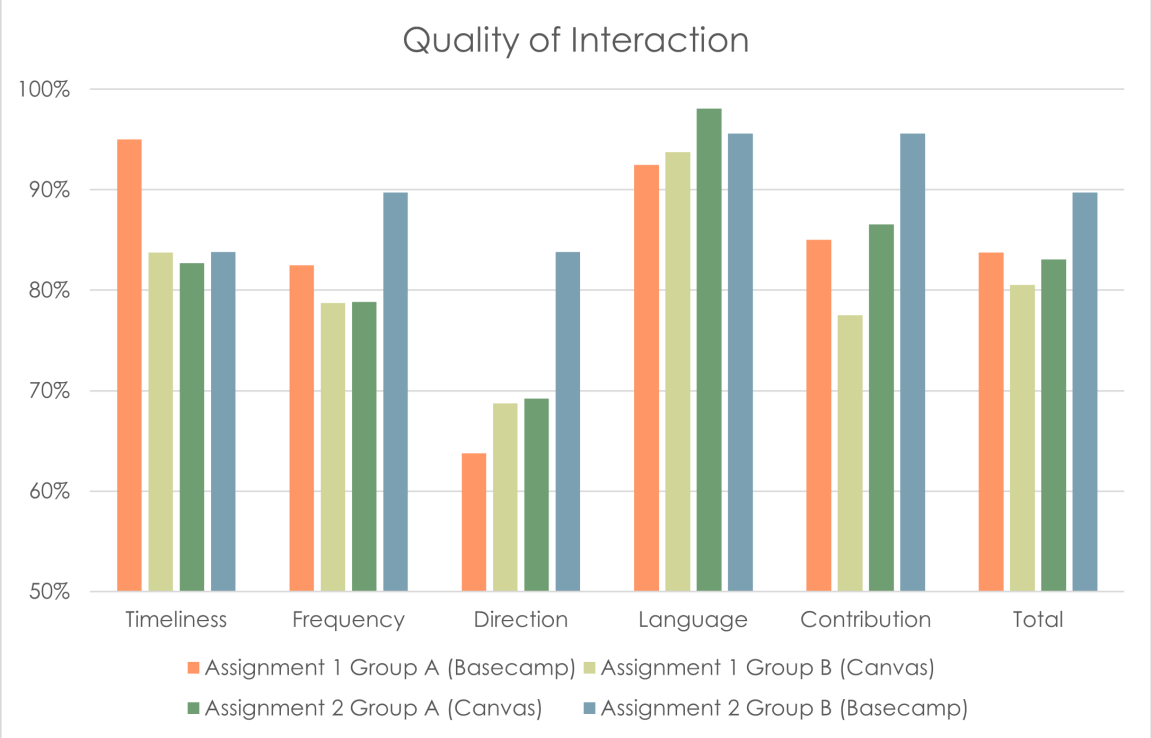
Rubric for student interaction quality

	A: Timeliness of Interaction	**B: Frequency of Interaction**	**C: Direction of Interaction**	**D: Language Quality**	**E: Quality of Contribution**
Basic: 1 point	Joins discussion late	Posts only one comment	Posts only own comments	Comments are poorly written and difficult to understand	Comments are general or unrelated
Low: 2 points	Joins the last day discussion is due	Posts two comments but only at one period of time	Posts own comments and respond once to another's comment	Comments are sometimes poorly written and difficult to understand	Offers comments somewhat related to the topic, but do not add to the discussion
Medium: 3 points	Joins at the end of the discussion period	Posts more than two comments but only at one period of time	Posts own comments and respond more than once to others' comments	Comments are usually understandable but display a lack of clarity	Offers comments related to the topic, but are not always helpful
High: 4 points	Posts well before the deadline	Posts more than two comments interspersed throughout the discussion period	Posts own comments, responds more than once to others, and also engages in back-and-forth discussion	Comments are always well formulated and articulate	Offer comments that are directly related to the topic and are helpful
Total Possible: 20 points	4pts	4pts	4pts	4pts	4pts

The following chart was completed by rating students' comments according to the preceding rubric. Each value is the average for students in a treatment group, presented as a percentage out of the total available points.

Figure 14

Quality of Interaction as Average Percent of Total



The categories do not exhibit any statistical significance when comparing treatment groups, except for the category "Direction" in Assignment 2. For the 17 students who used Basecamp (M=3.35, SD=.60) they outperformed the 13 students who used Canvas (M=2.77, SD=.44) by a significant margin, t(28)=-3.1, p=.004.

Other quality measures include word count which is presented in the table below. Word count was similar across all treatment groups.

Table 6

Average word count for posts

	Average Word Count
Assignment 1 Group A (Basecamp)	40.12
Assignment 1 Group B (Canvas)	39.34
Assignment 2 Group A (Canvas)	33.17
Assignment 2 Group B (Basecamp)	36.63

Correlation of Quality to Grades

After assessment of the general rubric, the correlation of the measures of quality to students' grades was analyzed. Students who did not participate in the discussions were removed.

Table 7

Correlation of quality measure to grades by group

Correlation of Grades to:	Assignment 1, Group A	Assignment 1, Group B	Assignment 2, Group A	Assignment 2, Group B	Full project
Timeliness	0.32	-0.01	0.01	0.07	0.07
Frequency	0.32	0.10	0.04	0.06	0.15
Direction	0.45	0.31	0.02	-0.13	0.23
Language	-0.06	0.35	-0.20	-0.11	-0.01
Contribution	0.69	0.43	0.05	0.42	0.33
Total	0.49	0.32	0.02	0.09	0.25

For this analysis, there is little consistent correlation between most measures of quality and students' grades. Contribution was the most consistently correlated to grades.

Type of Interaction

For the content analysis of the discussion boards on Canvas and Basecamp, comments and posts were coded into seven categories.

Table 8

Types of comments with examples

Type of Comment	**Example**
Ask for feedback	*This is my work in progress! Any layout suggestions? (with attachment of work)*
Offer Critique	*You've really done some research. It looks awesome. Lots of nice imagery and detail.*
Ask a question	*Has anyone considered any sort of matrix or bubble diagrams to include, or ways to do that online?*
Answer a question	*Sometimes Microsoft word or excel has graphs or charts you can transfer over to other files, that could potentially be helpful.*
Share a resource	*Hey guys! So alltrails.com has a huge list and maps of trails, it's basically google maps but for hiking trails. Hope that's helpful for people on the assignment.*
Progress update	*Working on finishing up my project and understanding the difference between a site analysis and concept plan especially in a place I am unfamiliar with. I am using other work on Concept board to get ideas and help improve my own work.*
Say thank you	*This is extremely helpful for the project! Thanks so much!*
Echo	*I am also going to do a similar thing. I agree that is the best way to better insight.*

Figure 15

Coded Comments for the First Assignment

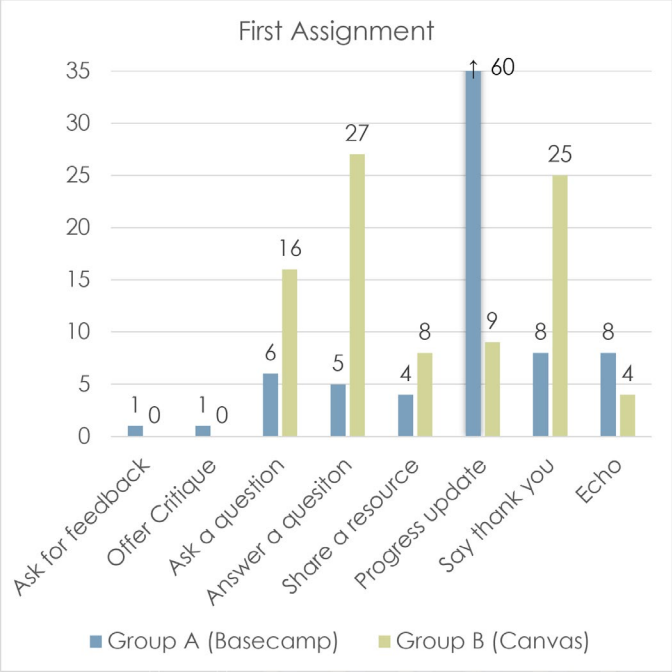
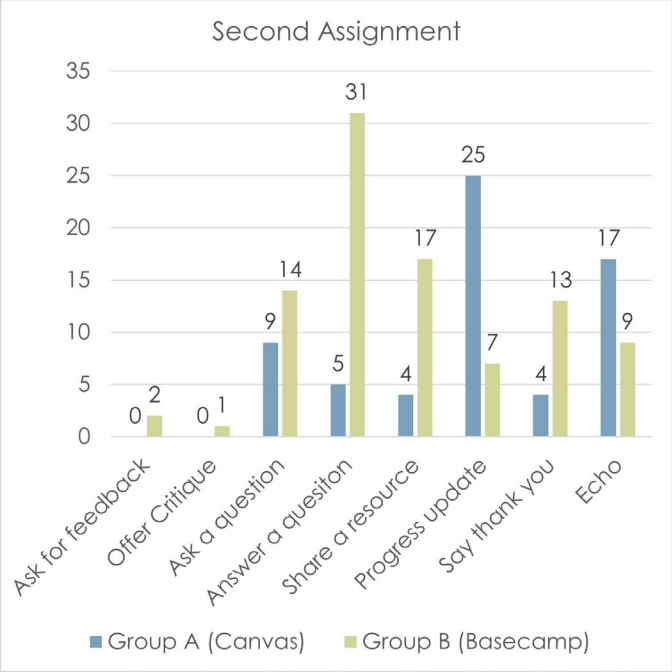


Figure 16

Coded Comments for the Second Assignment



The content of discussion boards appears to be more closely related by the group than by the platform. For Group B the most common category of coded comments included asking and answering questions during the first assignment. For the second assignment, the most common category of coded comments continued to be asking and answering questions, with a slight increase in resource sharing. Group A showed a majority of coded comments were progress updates when interacting on Basecamp for the first assignment. Progress updates continued to be the most common coded category in the second assignment for this group when on Canvas.

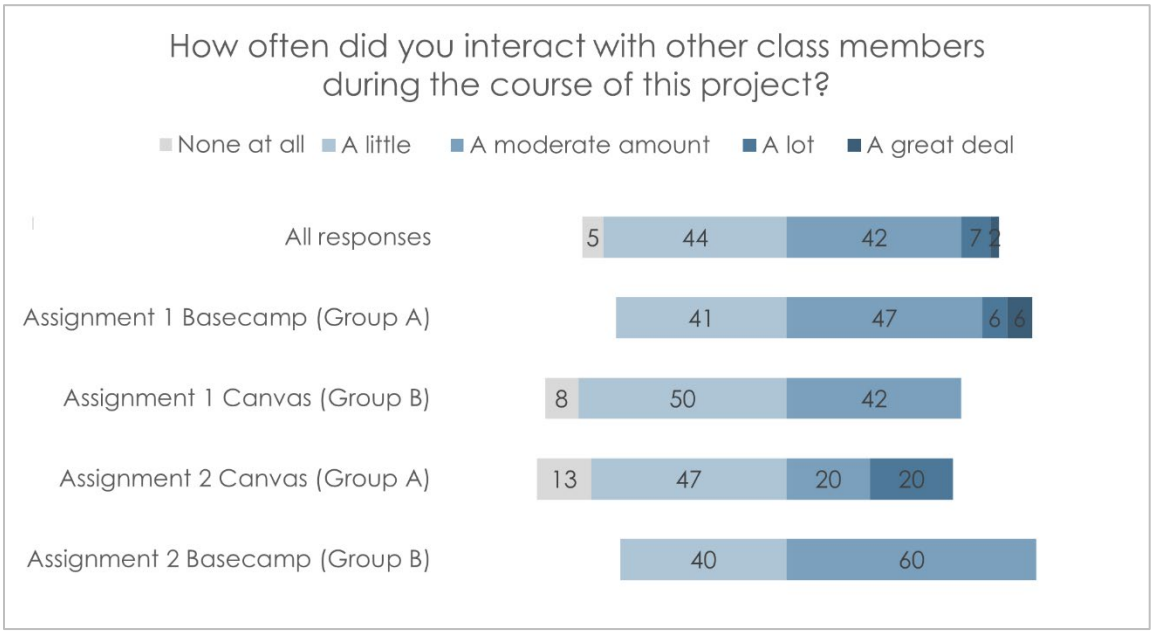
Survey

With the survey distributed to students, there were 29 responses for the first assignment, with 19 responses from Group A and 10 from Group B. For the second assignment, there were 30 responses with 15 from Group A and 15 from Group B. Twenty students responded to surveys for both the first and second assignment with 12 in Group A and 8 in Group B.

The survey included four questions that asked students to rate their social interaction and learning experience during the project. The following figures show the responses to these questions, presented as a percentage of respondents.

Figure 17

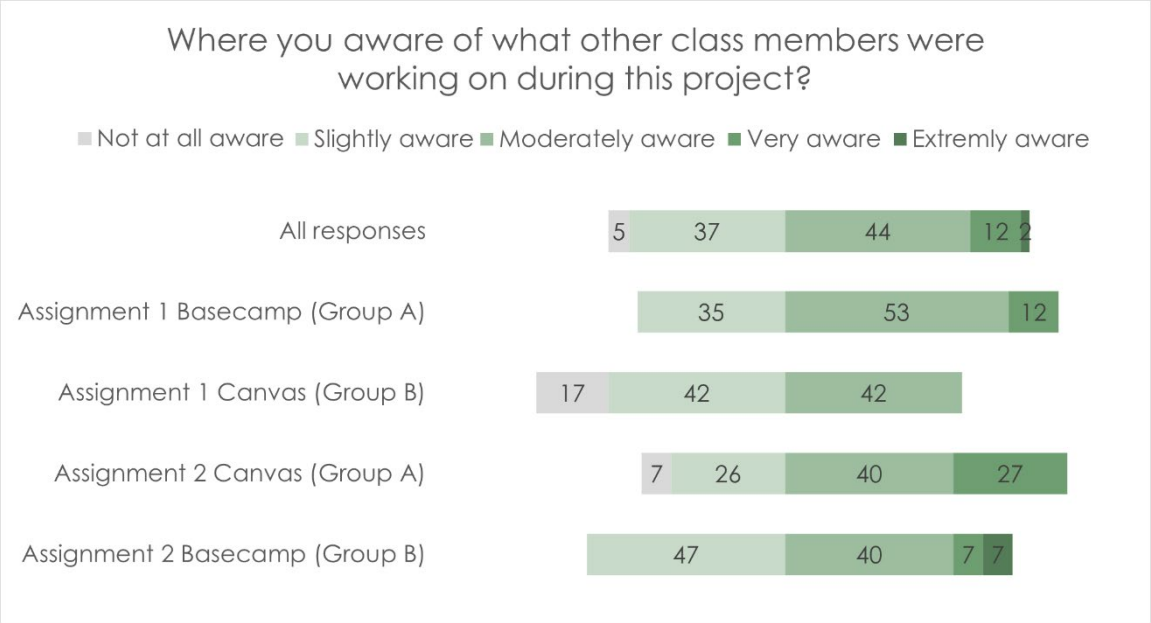
Survey Result: Social Interaction



Most students reported at least a little interaction with their peers. Overall students assigned to Basecamp reported higher interaction levels, with no students reporting no interaction. Canvas groups had more students responding with little to no interaction.

Figure 18

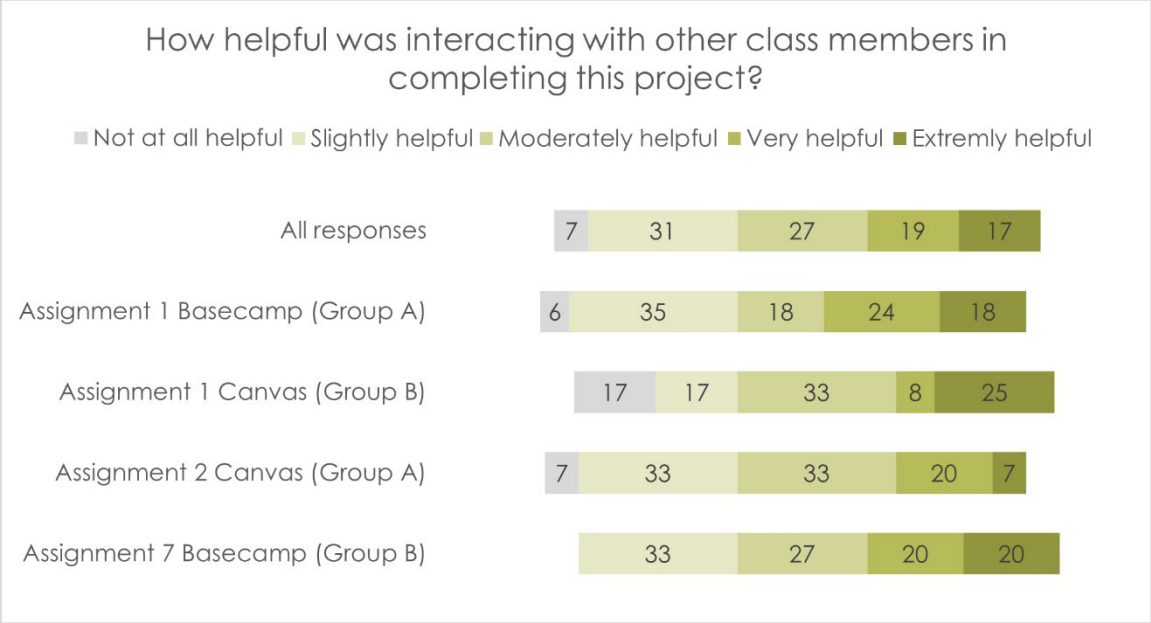
Survey Result: Awareness



There is a slight favorable trend to Basecamp for awareness of what other class members were working on. Only those in the Canvas group reported no awareness.

Figure 19

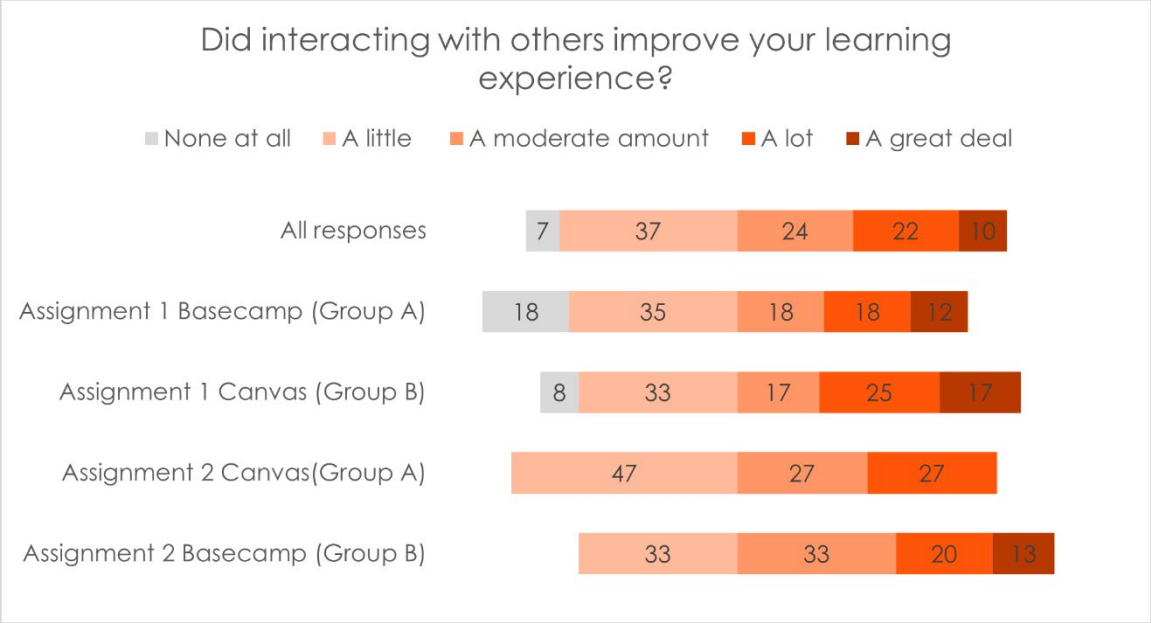
Survey Result: Helpful Interaction



Most students reported that interacting with other class members helped complete the project, with a sizable portion saying it was “extremely helpful.” There was no clear difference between treatment groups.

Figure 20

Survey Result: Learning Experience



Students reported a range of answers on how their learning improved with interaction. There was no clear difference between treatment groups.

How Students Interacted

Students were asked to indicate the number of times they interacted with other students by platform, including Basecamp (if available), Canvas, Conceptboard, as well as in-person and other communication. The average number of times they interacted per group, as well as which method they used by percent is presented below.

Figure 21

Number of Reported Times Interacted as an Average of All Responders

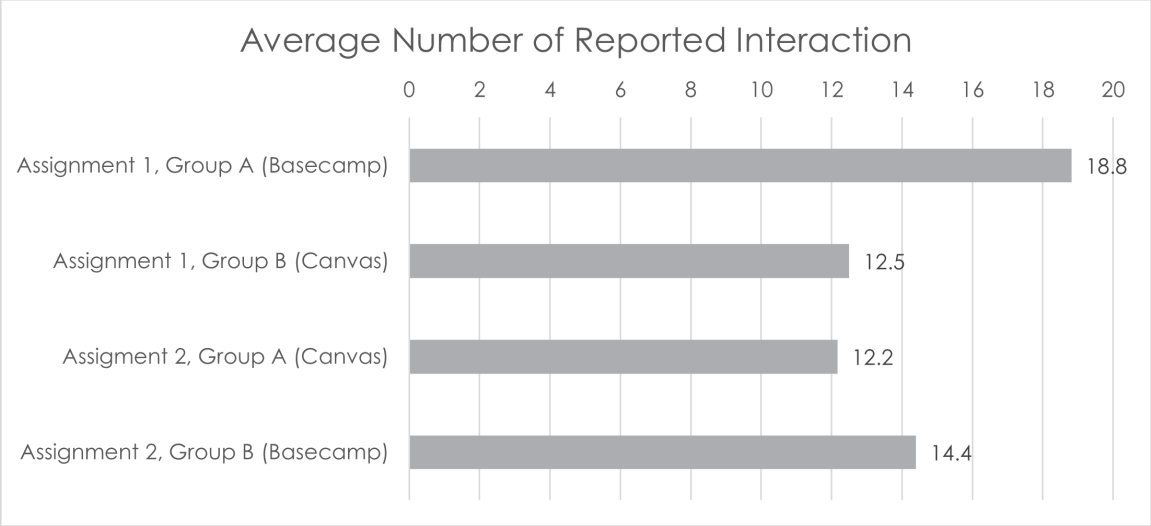
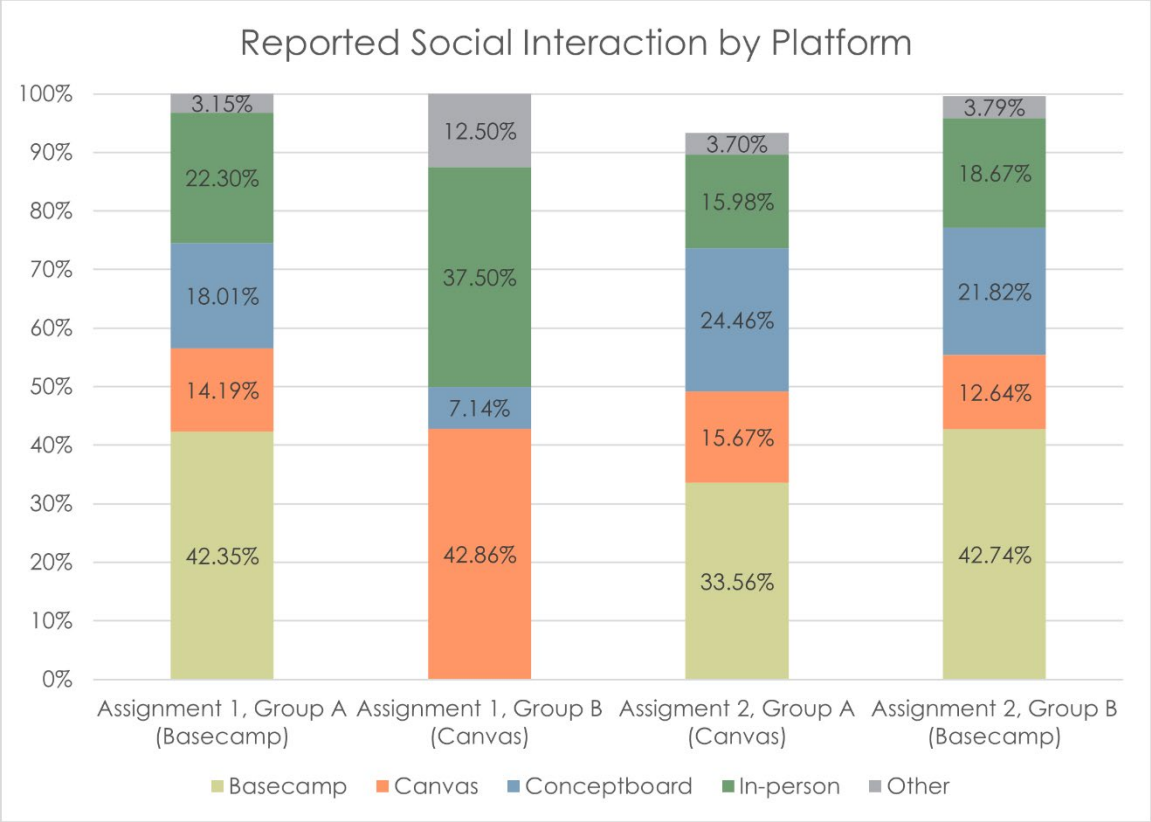


Figure 22

Reported Social Interaction as Percent of Reported Times



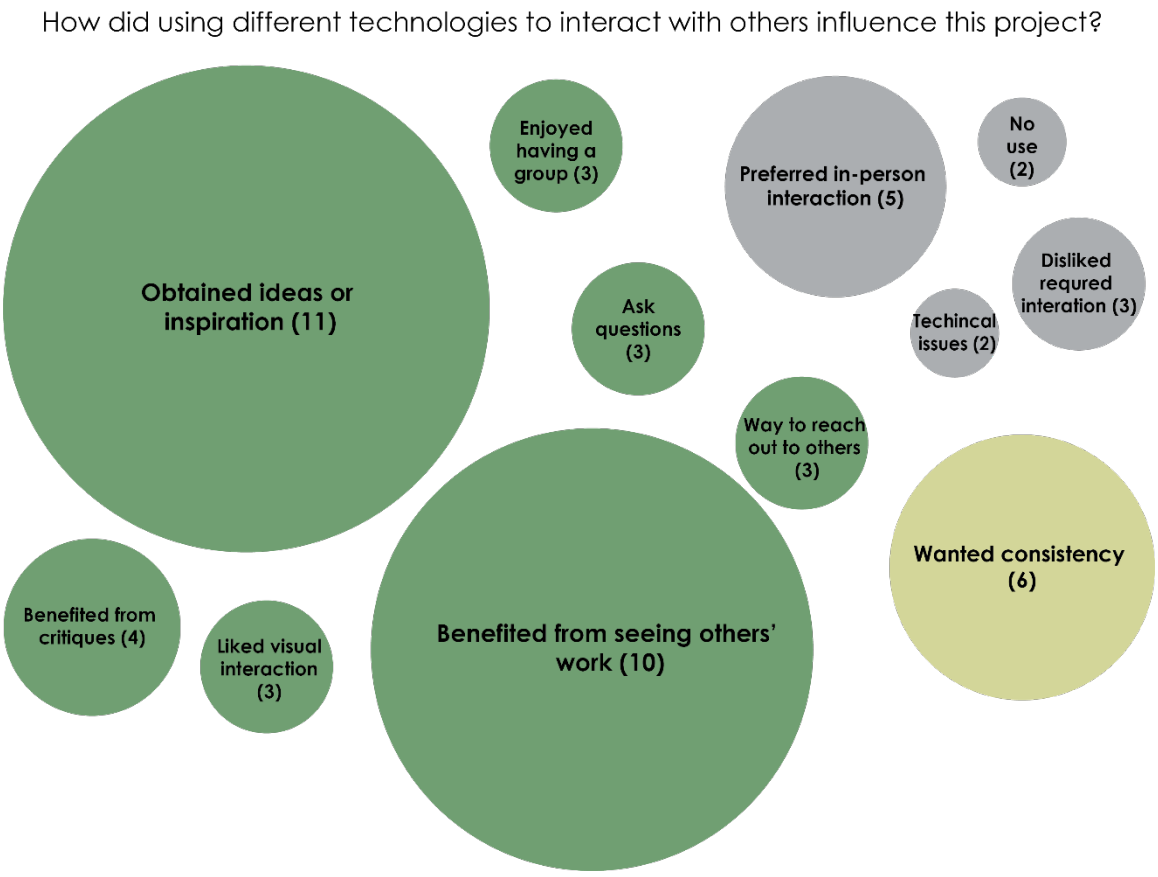
Most of the reported student interaction occurred on the platforms analyzed in this study (Conceptboard, Basecamp, Canvas). In-person interaction was also widely used. Four students reported use of a platform even without active posts by that student, indicating that non-direct, unmeasurable interaction still took place. Most students who did report alternative forms of interaction also has measurable interaction on online platforms, with only one student who reported in-person interaction with no measurable online interaction.

Feedback from Students

Students were asked to respond through a short answer to one question as shown in Figure 23. Comments were grouped according to themes, and the number in the figure shows the number of students who mentioned the topic. A total of 43 comments were analyzed.

Figure 23

Survey Result: Main Themes in Student's Comments



The most common theme within the comments was that students used online interaction, mainly to get ideas, ask questions, and check-in. Other common comments

included the basic theme that it was at times confusing to use multiple platforms and many students wanted more consistency. Some people mentioned that they still preferred in-person interaction.

CHAPTER V

DISCUSSION

The purpose of this study was to facilitate online interaction and measure the effectiveness of that interaction. The first discussion presented is about how students interacted and what factors went into that interaction. The second part of the discussion focuses on the measurable effects of that interaction.

How Students Interacted

The primary research question was *how can social interaction, specifically focused on sharing and learning from peer-to-peer process-based work, be facilitated in an online environment in landscape architecture.* Social interaction was facilitated through the primary use of three platforms, Conceptboard, Basecamp, and Canvas. Each platform had both benefits and drawbacks, as shown in Table 9.

Table 9

Comparison of Platforms

Platform	Type of Sharing	Structure	Limitations

Basecamp	• Discussion
	  ○ Provide progress updates
	  ○ Share resources
	  ○ Ask & answer questions
	• High participation
		• Open-ended, with some suggestions
		• Assignments to groups
			• Limited visual sharing

Canvas	• Discussion
	  ○ Ask & answer questions
	  ○ Share resources
	  ○ Provide progress updates
		• Open-ended	• Lack of meaning
			• No visual sharing

Conceptboard	• Share visual work • Critiques	• Clear structure through scheduled critique	• Low participation • Little asynchronous discussion

Conceptboard was used as a place to share visual work and get critiques on this work. This platform had a clear structure for posting and interaction, primarily done through scheduled critiques. Most visual work that was posted to a platform was shared here. It showed a positive impact, but also had the least amount of participation, with less than half of the students participating. There was little discussion involved in this platform beyond that which occurred in the critique sessions.

Canvas discussion boards enabled more asynchronous discussion throughout the

project. The expectations for this interaction were open-ended, and as such a bigger variety of interaction occurred, but also lacked any sharing of visual content or critique. Although many students used this platform, the participation also sometimes lacked meaning. For example, a large number of posts included simply saying “thank you,” without anything added to the interactive experience. The primary benefit of this platform included answers to questions, updates from students, and resource sharing.

Basecamp had the highest levels of participation. This platform saw the greatest degree of discussion throughout the project. A minimal amount of visual sharing occurred, and discussion was more focused on progress updates, resource sharing, and questions. Expectations for this platform were open-ended, although suggestions were given to students.

Effect of Different Platforms

Basecamp had some advantages over Canvas, including more interaction, especially in the second half of the study. The reason for such low participation within the Canvas board for the second assignment is not entirely clear, as the parameters for both assignments remained the same. Students who were assigned to Basecamp for the second assignment did have the reminder of actively participating by the invitation to sign up for Basecamp. Students who switched to Canvas did not have a similar reminder, and this might have contributed to the dwindling participation.

Basecamp showed a benefit for better direction and depth of interaction during the second half of the study. Students also perceived more interaction with their peers when assigned to use Basecamp. When students were assigned to Canvas, students had

less awareness of other peers' work. Other measures were similar between both platforms.

One unexpected result was that platform use did not necessarily directly influence the type of student interaction. Group A began the study on Basecamp. On this platform, progress updates were easily encouraged as students were asked, "What are you working on today?" The majority of posts were answers to this question. When students moved to a Canvas discussion board, the trend to report on what they were working on continued.

For Group B, which began on Canvas and switched to Basecamp, the majority of their interaction occurred through questions and answers. Questions were easily answered as the instructor was present and active on this discussion platform during this time. Even when they moved to Basecamp, they continued to post content similar to their initial experience in the first part of the study.

These results point to the possibility that the actual platform itself is not what engenders the type of interaction occurring, but rather the expectations and experiences the student first comes across. The use of the discussion spaces was more dependent on what students had already been doing, rather than what platform was being used. Students, who began in Basecamp and encountered a lot of progress updates, continued to use progress updates in the online discussion space even when it switched to Canvas. Conversely, students who encountered the primarily question and answer discussions in Canvas during the first assignment, continued to utilize this type of discussion even when changing platforms. Before this study, students had not been asked to engage in online discussion platforms that specifically asked for students to share about their work. The type of interaction students first experienced could have influenced students'

expectations. Students then used the space to reflect their expectations established in earlier interactions.

Instead of focusing on the platform used, ITs are more reliant on the expectations set, and the type of interaction students initially encounter and participate in. It is suggested that when designing and implementing ITs, monitoring should be used during the first part of the implementation to ensure that the desired interaction is taking place. Modifications and corrections of expectations should occur early to encourage good interaction. Future research could determine the effects of expectation and early interaction on the long-term use of ITs, regardless of the platform used.

Effect of Groups

One benefit of Basecamp that was presented by multiple students is summarized in this comment: “I must say that I liked having a group assigned on Basecamp. I felt like I had a group that helped each other out.” As part of the difficulty of online education is isolation, this is a positive result. One other commenter says, “I enjoyed being able to reach out and ask questions to my group or answer questions that they had. I didn't feel like I was all alone trying to figure out this assignment, and I didn't have to keep bugging the teacher or TA's.”

These assigned groups seemed to foster the desirable effect of belonging to a learning community (Schönn, 1987, Cobbs & Bowers, 1999). A smaller group, combined with a place for interaction, provided a place for students to reach out and interact with others. The formation of smaller learning communities within the larger class help facilitate desirable results in social interaction.

During the study, group size changed on the Basecamp platform, Originally, groups were 6-7 students, but it was changed to 12 students for the second assignment. Positive results were found from dividing students into groups. Class and group size has been explored by other researchers, and a commonly recommended size is around 12-15 students to encourage interaction, especially around topics that require higher-order thinking (Qiu et al., 2012, Taft et al. 2019, 2011). With larger class sizes, students were more likely to experience information overload, and students felt that smaller groups benefited from collaborative discussion (Qiu et al., 2012). This study supported that recommended size of around 12 students, avoiding a larger, impersonal class, and still having enough students to enable good participation.

Further Analysis of Student Interaction

Student interaction occurred for more than these three platforms, including interaction in person. Students mentioned interaction in-person, over Zoom, and through more traditional communication methods like text or email. What went on in these interactions is not quantified in this study, but it should be noted that the interactions that were measured are not exclusive of all interactions occurring. However, students who reported alternative forms of interaction were also generally engaged in measurable interaction in this study.

For both assignments, interactions were listed as requirements as part of the assignment, although actual grading did not include any measures of participation. Several students expressed dislike of the required participation. However, it probably did increase interaction that occurred, at least in online measurable platforms. Unfortunately,

no exact comparison exists for an assignment without required participation, and would be a point for further study.

In the class, outside of the duration of the study, discussion boards were only used for the assignment in this study, and at the beginning of the class. Basecamp was available for students' use after the study when work changed to group assignments. Basecamp was used briefly outside of the two assignments in this study but was not widely used or adopted. Conceptboard did maintain the most use and was in continuous use throughout the class.

Conclusion on Platform Use

With these observations, several conclusions can be made. First, the support and expectations given to students affect the interaction that occurs. Conceptboard was set up for critique and was consistently used that way. When Basecamp encouraged initial posts from students on progress updates, students responded and continued to use that type of interaction beyond that platform (see Figure 11 and 12). When little support and guidance occurred on Canvas it also led to lower quality interactions.

Next, the platform itself matters less than the expectations that are assigned to it. Basecamp users could engage in visual work-sharing and critique. It was not expressly presented that way, and that is not how students interacted on the platform, with only three posts sharing visual information. However, Conceptboard was set up and presented in a way directly related to visual work-sharing and critiques, and that's the type of interaction that occurred, with 28 and 18 students sharing some type of visual work for each of the assignments.

Last, consistency from the course onset results in better engagement. Conceptboard was introduced and utilized the entire course. Basecamp and Canvas discussion boards were not, and although some positive interactions occurred, they were not widely adopted after the study. Some students remarked that the experience that occurred during the study, of having multiple platforms presented to them, was confusing and they would prefer a more consistent approach.

It should be noted though, that the novelty of something might have a positive impact on interactions. For example, when Group B began using Basecamp, the interactions continued in a similar amount to the previous assignments' Canvas board. The average number of posts for active participants went from 5.88 to 6.00. Returning to the more familiar Canvas board had the opposite effect on students in Group A. The average number of posts per person decreased from 5.47 to 4.11.

One student had this insightful comment, "In an education environment I think that it is crucial that the professor and TA's are trailblazer in which they set the precedent of how a technology is used. If they can create a learning environment in which their students understand the benefits of a technology, and then they enforce the use of that technology through their own use of it, then that is how you really get it to take hold in the applications of students."

Even as much of the interaction on online discussion posts centered on giving updates, questions, and resources, this still had a benefit to students. One student commented, "This gave me a more in-depth look at what was expected. Some students mentioned points that weren't necessarily in the instructions of the project post but that I'm sure made my project a lot better. It's nice to share resources as well." Students

suggested including places for students to both share visual work, and the interaction that occurred in the discussion boards such as getting answers to questions and sharing resources. One student remarked: “I think a combination of both would be good. A comment board to ask questions and a project board to see what others are working on.”

Student Performance and Social Interaction

To answer the question, *will the implementation of a dedicated digital sharing space with specific suggestions and parameters for frequent sharing enhance student performance and their satisfaction with the learning experience,* analysis of grades and survey results were used. Determining the effects of students’ social interaction on their performance and learning experience is difficult to determine because of the number of factors involved. However, some analysis is still possible.

Students’ grades were higher when they used Conceptboard. However, this interaction was self-selected by the students, and those who were more engaged in the assignments were probably more likely to choose to use Conceptboard as well. Still, it does suggest that critique and visual work sharing can positively influence students’ performance. Within Vygotsky’s (1980) work, the help and guidance of more experienced peers or teachers is theorized to positively impact student’s performance. Conceptboard enabled an approachable process to critique students' work and provided this type of guidance. The critique was given by the professor or teacher’s assistant, resulting in a positive impact on the students’ work.

In addition, several students commented that viewing the work of their peers’ work on Conceptboard was helpful as they completed their assignments. From the survey

results, one of the most positive benefits of interactions was to gain ideas and inspiration: based upon other students' comments, this frequently occurred through referral to work posted on Conceptboard. This platform provided a place for peripheral learning, where students could see the work of their peers and learn from it (Hutchins, 1980).

For the discussion boards on Canvas and Basecamp, a positive benefit was observed to those who used the platform, with significantly higher grades for one assignment. There was a slight positive correlation between the amount of use and the quality of contribution. The discussion board offered another place where students could gain insight into how their peers were progressing on the project through sharing resources, answering questions, and gaining insight through progress updates.

When looking at the data it is apparent that many students achieved high grades, including grades from 85-95%, even without engaging in measurable online interaction. What is interesting, is that any grade below 80% only occurred on students that did not have any measurable interaction. When interaction levels were high during the first assignment, no student scored under 85%. This suggests that although many students are quite capable of achieving high scores on their own, students who struggle benefit from interacting with others online. Social interaction can help struggling students get the help they need to produce quality work.

Social Interaction vs. Isolation

Although the discussion boards did not have a high measurable impact on performance, they still positively impacted the students' perception of their learning experience. When asked to report on their interactions for this assignment, most students

responded quite positively. The majority of students were interacting with their peers, and also considered it valuable to their assignment completion. Despite the individual nature of the assignment, students frequently engaged collaboratively with their peers.

Returning to the idea of the horizon of observation (Hutchins, 1995), many students reflected that their interaction enabled more idea sharing and they benefited from seeing others' work. In contrast to previous work that has shown isolation from peers (George, 2017, b), no isolation was reported within the study, except by choice. In other words, students still reported no interaction, but acknowledged there were still opportunities to do so. The integration of ITs certainly helped students by providing a place to go to interact with their peers and avoid social isolation.

Most Influential Types of Interaction

Some inference can be made on the type of interactions that occurred that most positively influenced students' performance. Visual work-sharing primarily occurred on Conceptboard, which was also linked to high grades. When analyzing the quality of interaction, the factor most associated with performance was the quality of contribution, or offering comments that are directly related to the topic and are helpful. This is unsurprising, and previous research has shown that seeing the work and process of peers is important (George, 2018, Saghafi et al., 2012). Visual work-sharing rarely occurred on the discussion platforms, and only about half of students shared visual work across all platforms. For the quality of contribution, 86% of students shared work that would be considered helpful contributions. These results are promising, but there is certainly room for improvement. Further research could explore how to continue to encourage the

quality and visual nature of interaction, as well as increasing participation.

Factors that seemed to encourage good interactions included purposeful, directed interaction like what occurred on Conceptboard. Conceptboard had a very prescriptive type of interaction: posting visual work and engaging in critique. The discussion boards, which were more open-ended, did not always encourage purposeful interactions. Specific direction and encouragement by the instructor to engage in directed interaction and sharing visual work helps promote its adaptation. Increasing the quality of interactions within IT's, including the encouragement of visual, process-based work, could be explored with further research.

Limitations

This study is limited in that many factors go into the interactions between students, as well as their performance on assignments. Student interaction was not limited to the platforms presented. The nature of the study also created an awkward format for students, which could have easily been confusing and influenced results. Introducing and changing the platforms happened at a rapid pace and was different than the preceding and following course structure. The original study structure had to be modified due to development with the course (Conceptboard use was not an original part of the study design but greatly influenced the project).

Other factors could easily influence results. For example, the second assignment occurred in a shorter period than the first assignment. The scope of both projects, although similar, was not the same. In addition, Covid-19 presented a dynamic backdrop. Although the course was planned as a traditional online course and was not taught in an

emergency remote setting, many of the effects of Covid-19 still influenced the course. Students experienced changing environments and personal concerns that are far different than a traditional school semester.

Future Research

Several questions would provide interesting analysis for future research. This study looked briefly at the effects of expectation and early interaction on the use of an IT, regardless of the platform used. More research that explores the effects of early interactions on the long-term use of an IT would provide additional insight into what influences the types of interaction that occurs.

More research would also be warranted regarding the use of graded participation. Although participation was required, it did not factor into the grading of the individual assignments. It would be interesting to note the effect of weighted and required grading into students' use of collaboration technology and student performance.

Finally, future research can explore what methods would help to best increase the quality of interaction. The techniques used in this study did not facilitate visual work sharing from the majority of students. Further research can look at the best methods to facilitate a widespread adoption of visual work sharing.

Implications

Through the implementation of the platform, the interaction between students in an online digital sharing space did demonstrate support of learning. Students were able to engage in social, process-based learning. Although many improvements can still be

made, this study does provide an example of online social interaction and demonstrate several improvements to be made. When purposely used, the use of digital sharing spaces can be an effective tool to facilitate online social interaction.

CHAPTER VI

CASE STUDY

During the fall semester of 2020, I participated in a graduate-level studio class, LAEP 6200, Bioregional Analysis and Planning. The studio class is designed to be an intensive class focused on regional planning issues. The class collaborates with a community partner to provide problem-based learning, centered in a real context. For most of the duration of the class, the class worked on a multi-phase project for the community partner, resulting in a planning document at the end of the class. There were twelve students, two professors, one teacher's assistant, and 3-7 individuals from the community that worked directly with students.

This class is typically scheduled for two 4.5 hour studio classes during the week. During this time, the ever-changing dynamic of Covid-19 presented a challenge for classwork. The class format was in flux throughout the semester. It shifted from in-person classwork to hybrid learning and was, at times, completely online. Sessions were generally broadcast synchronously online, and in-person attendance occurred in part, or not at all. Very few class sessions occurred with all students and teachers in the same location. Project work frequently continued outside of class time. Class collaboration with a community partner was done entirely online.

At the beginning of the project, the need for collaborative software became apparent. Zoom was used for synchronous collaboration, but additional resources were needed for enhanced collaboration: file sharing, asynchronous communication, and task management. Initially, Conceptboard was available for use and was adopted somewhat to

enhance collaboration. At my suggestion, the class also adopted Basecamp to assist with the additional collaborative needs. A combination of Zoom, Conceptboard, and Basecamp provided the collaborative software needed throughout the class. Figure 24 provides a visual breakdown of the software and their usage for collaborative efforts.

Figure 24

Case Study Report

Note on Implementation

A reflection on how different collaborative software was introduced and used in this class provides insight into the future adoption of ITs. New software is not always readily used by students. In this case, I ended up serving as a trailblazer to introduce students to the platforms, push for its adoption, and demonstrated its advantageous use. Due to my interests and research, I was aware of many software platforms and how they could be utilized for online collaboration. But most students are unaware of the breadth and depth of software available and often end up defaulting to what they have had previous experience with unless pushed to do something different.

For this class, I understood the advantage of collaborative software and began introducing students to it by implementing it in my workflow and collaborative efforts. At the beginning of the class, much of the activity on the platforms was done by me. I compiled class notes, set tasks and due dates, uploaded files for use, and laid out information on boards. After seeing the advantages of using collaborative software, students adopted it for their own use.

Often, it is felt that students will readily know how to collaborate online, but I have found that it is not the case. Students need to be taught the available software and how to utilize it for productive workflows, online interaction, and design collaboration. Without trailblazers that demonstrate and push for the adoption of new technology, it will be underutilized in favor of more traditional techniques.

Benefits of Collaborative Software

The following section discusses the observed benefits of the collaborative software used in this case study.

Collaboration with Outside Partners and Professors

A major benefit of using Basecamp is that it easily allowed collaboration between students, professors, and community partners regardless of time or space. Anyone who needed access to information, was involved in the process, or provided feedback could be given access to Basecamp. This allowed everyone to see and collaborate on the work as it was happening. Within Basecamp, professors were able to monitor student workflow and give suggestions as the work progressed. Suggestions were given outside of normal class time or scheduled critique, allowing for timely feedback. This collaboration was often informal but valuable to the student workflow.

Conceptboard also allowed an additional place to share work. Work was often presented using Conceptboard, allowing students to display in-progress work and engage in critiques. Conceptboard also enabled the layout of more formal presentations to community partners.

Task Management

Basecamp to-do lists allowed students to layout steps for the project and assign tasks. This feature was used frequently throughout the semester to break down tasks and facilitate good project management between students. Students who used this feature were able to keep track of the progress of others and be aware of the expectations for

their own work.

The task management on the platform did not replace frequent synchronous check-ins between students to monitor the progress of the group and ensure that the work was being completed. At times, the to-do lists were used to layout out a project but abandoned later in favor of synchronous check-ins and verbal work assignments.

File Sharing

One of the primary uses of Basecamp was file-sharing. Many files needed to be shared between students, and Basecamp provided the capacity to share a large number of files. Sharing files on Basecamp also allows commenting on the files, a feature that was used frequently for quick critique, feedback, and clarification. Tagging through the comments allowed files to be found by those who needed them.

This program did not allow cloud-syncing on students' computers but did allow files to be updated to new versions. One challenge was simply keeping all the files organized between users, although search and tagging features ensured nothing got permanently lost.

Asynchronous Discussion

Although much of the class discussion occurred through scheduled class time, additional communication was necessary. Basecamp provided a place for asynchronous communication. Two different features of Basecamp were used, the campfire chat and message board. The campfire chat allows for more casual conversations, and the message board allows for formal threaded discussions. They allowed people to stay in contact and

keep each other updated as work progressed. Message boards were used to share resources, give feedback, make plans for future work, and any other necessary information. Campfire also allowed informal synchronous communication when people were working on the same things at the same time. The ability to return to and reference these communications on an ongoing basis was helpful to students.

Synchronous Online Design Discussion

One challenge in participating in design over an online environment is the ability to visualize what is being worked on. In-person studio classes allow for the use of drawing and laying out projects. To facilitate this kind of discussion online, Conceptboard allows much of the functionality of a whiteboard, wall, and drawing mediums. During the class, Conceptboard was used to layout large amounts of work, draw concepts, give feedback on existing work, and prepare work for final presentations and review. The work done in these sessions was also available for later use and review, regardless of where a student might be.

Flexibility and Autonomy

Every group and individual tends to approach and use technology differently. This class was no exception. Three different groups worked on the project, and each used technology differently. One group used Basecamp extensively for discussion, file sharing, and task management. They often worked asynchronously and used Basecamp as a tool to keep everyone on the same page. Another group usually met in person. They still used Basecamp for file sharing and Conceptboard for design layout. The final group

worked primarily on Conceptboard and used synchronous discussions over Zoom. The ability of technology to allow for different methods of work provided a benefit to students. Because Covid created such a dynamic, ever-changing environment, implementing different platforms provided a way for students to continue to work on the projects. Each group had autonomy in the way they used technology, and each approached it a bit differently in a way that worked for their situation and preference.

Benefits and Drawbacks

At times, keeping things organized was a struggle, and it could be easy to miss necessary communication or miscommunicate. But technological tools like Zoom, Basecamp, and Conceptboard allowed the project and class to continue in an ever-changing environment that did not allow for normal in-person learning. All the tools were used extensively to complete the project. The benefits of these tools included having a variety of ways to communicate, where information was retained for further use. They facilitated the completion of a large planning project.

CHAPTER VII

CONCLUSIONS

Previous research has shown that process-based learning is an essential part of design studio coursework (Broadfoot & Bennett, 2003). Students need peer interaction and academic engagement (McCarthy, 2010). They benefit from critique, meaningful discussion, and feedback (George, 2017a). This study supports these claims, with student performance increasing with exposure to critique and social interaction with peers.

One of the most significant differences between DE and traditional coursework is that social interaction occurs organically in traditional coursework but must be intentionally implemented in DE. Because social interaction does not happen organically in DE, it is more likely that students will not have opportunities for social learning, and the loss of those opportunities impacts their education. Nevertheless, social interaction is possible utilizing ITs, and these ITs can have additional benefits beyond simple discussions. Studio coursework would benefit from the implementation of more ITs, regardless of whether the course occurs over DE, in-person, or through a hybrid method. Benefits include sharing digital work, interaction that occurs regardless of time or space, increased collaboration capacity, improved performance, and increased awareness of others' work.

Within the studies done here, ITs were intentionally implemented, and when those ITs had a clear purpose and expectations, they resulted in positive learning outcomes. This intentional implementation allowed social interaction to continue to happen, even when classes were primarily online. Although DE can make social interaction less

organic, the use of ITs shows that social interaction is still possible and can occur in a variety of effective ways that help student learning. The lack of social interaction does not have to be a barrier to the adoption of DE; rather, by the intentional implementation of ITs, social interaction can continue to occur.

The ITs used throughout this study included methods using the platforms Basecamp, Conceptboard, and Canvas. More technologies exist that enable a wide range of features. What platform is used matters less than that something is used that supports the type of interaction needed. For studio coursework, this generally involves visual work sharing. Traditional learning management platforms are often poor at this type of sharing, so other technologies that integrate increased capacity for sharing and discussing visual work are often necessary.

One of the struggles with integrating ITs is their adoption by students. ITs are frequently underutilized through low participation or low-quality interactions. To counteract this difficulty, it is suggested that good interaction is taught through modeling and implementing proper expectations. Teachers, as well as students, can act in the role of trailblazers that demonstrates how to use technology for quality interaction, showing the benefits, and promoting their use. The following list presents suggestions on how to encourage good interaction for peer-peer processed based work:

- Create expectations to share visual work and provide a place for students to reach out to others through discussion.
- Have consistency in the platforms used: introduced novelty in the type of interactions.
- Prioritize expectations and modeling of the type of interactions.

- Assign smaller groups for large classes, with an ideal group size of around 12.
- Allow in-person interaction when possible.

There are still benefits to providing a space for interaction, even if some of the interaction is low quality, or the space is underutilized. Students benefit by having a place to reach out and avoid feelings of isolation. As the purpose of the space is clearly demonstrated, students gain benefits from the relevant interactions that occur. Overall, this study supports previous research that ITs can increase collaboration and creativity when used for clear means (Wang, 2011).

With the growth of DE, and the continued growth of technology used in Landscape Architecture, social learning that occurs in online IT is important. The methods and recommendations presented can be implemented in DE, as well as implemented in other situations, including as a complement to traditional studio work, and through flipped and blended learning environments.

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APPENDICES

Appendix A: Creating a Digital Sharing Space

Description of Project

To begin my project, I met with the course instructor where the digital sharing space would be implemented. We discussed the type of work done in the course, and objectives and expectations for the digital sharing space. After this discussion, I began to work on a prototype in Adobe XD. The idea of this prototype was to explore what the space would look like and how it would function.

After completion of the prototype, I shared it with three current landscape architecture students and two friends and asked for feedback. A few people asked why there was a need for a specific space like this rather than using Canvas or Google Drive, although they also liked many features that were not available in either. Most people found the space intuitive, simple, and organized and liked the ability to comment and explain what was shared. They wanted a space that was easy to add files to and had an engaging feed that was easy to get caught up on the new activities.

Because I am not a computer programmer, for the next part of the activity I researched technology and platforms that existed that could be used as the sharing space. I quickly realized that I needed firm criteria to evaluate each option. With input from the interaction with my professor and students, I created the following list of criteria in the space:

- Functional ability
    - Upload a variety of file types easily including hand drawings, photoshop files, and CAD drawings

    - Share and comment on visual and complex work
    - Highly visible, open interactions
    - Flexible, able to be controlled by students
    - Show process-based design work
    - Based on asynchronous communication
- Easy to use
    - Learn to use it quickly
    - Upload and share files easily
    - Find recent and relevant updates
    - Natural interaction with others
- Useful
    - Support course learning objective
    - Increase the quality of work
    - Engaging

I researched a wide range of possibilities and eventually explored the following: Basecamp, Slack, Padlet, Discord, Box, Google Drive, Microsoft Teams, Dropbox, and Conceptboard. I created a basic sharing platform with each and tried the space out, as well as evaluated it based on the criteria I set up.

Conceptboard, Padlet, Slack, and Basecamp were the best possibilities that matched by objectives. At that point, I began to involve others and asked three people to user test the platforms and see which one would work best. All of them worked great, but two were preferred by most users: Conceptboard and Basecamp.

I decided to focus on Basecamp over Conceptboard for the following reasons:

- Easier to share a wider variety of files
- Includes easier text-based communication, allowing for discussion on research and design
- Easier to see what people are up to, for example, new information added
- Linear, organized flow
- Greater capacity for notifications and email reminders to encourage utilization of the platform, for example, a set reminder asking students what they are up to
- Mobile version, allowing students to take pictures of paper drawings and share more readily
- Allows customization and autonomy with how people want to use it, as well as a broader toolset
- Easy to pick up and learn: in under five minutes people were effectively using the space
- Less technical issues
- Ability to still use Conceptboard through links on Basecamp if desired

In short, Basecamp met my objectives better. After this decision, I created a more defined sharing space on Basecamp, customizing it to the needs of my project. To design the space more effectively, I created a list of interactions that occur between students in traditional studio coursework, based on my own experience and observations, specifically focused on the class for implementation.

1. Casual observations and discussion of others' work
2. Ask questions including technical, content-related, & clarifying questions
3. Critical analysis of others' work

4. Share resources that aid in the completion of the project

Each type of interaction was considered and aided in the development of the sharing space.

I then created a webpage for students explaining how to use the sharing space (available at https://sites.google.com/view/studiospace/work-sharing/intro-to-basecamp). After this, I performed three more user tests and modified a few minor things based on those user tests. The students who used the space found it effective. I did have one student who had used Microsoft Teams with one class, and had several concerns with how that functioned, and noticed that most of her concerns were resolved with Basecamp. These concerns included the ability to stay organized, easy access for everyone, and working effectively with a group.

After this last round of user testing, I presented my recommendation to the professor as well as my reasoning behind choosing this space and got his approval. I wrote a resource for creating a digital sharing space, including how I set up this space in Basecamp. I finalized the space for implementation in the class by removing data uploaded during user tests, finalizing the layout, and resetting who had access to the space. I also created a video explaining the space for use in the class as requested by the professor.

Explanation of the Digital Sharing Space

The space is set up in two blocks. The first block enables class-wide sharing and has three tools: a chat for questions, a message board for resources, and a file section for use as needed. The class will also be divided into smaller teams. These teams will be

asked to engage in work-sharing with each other. To enable this, they have a check-in which will remind them daily to share what they are working on, and a message board that will allow for analysis of their work.

As part of the course, students are graded on participation. During their use of this space, graded participation will continue. Students will be expected to upload and comment frequently. Participation points will be evaluated based on the following scale:

- Full credit: Three or more posts and substantial comments on others' work
- Half credit: 1-2 posts, and few comments on other’s work
- No points: Little to no interaction

Appendix B: Survey

Please complete this short online survey.

This research seeks to determine the effectiveness of student interaction in online coursework. Specifically, we are interested in learning about how providing a place to share work and discuss this work with other students influences student learning potential.

Your participation is voluntary. If you agree to participate, your responses are anonymous and kept confidential and the results of the research will be presented in a way where individual respondents cannot be identified. By continuing you acknowledge that you are over 18 years old.

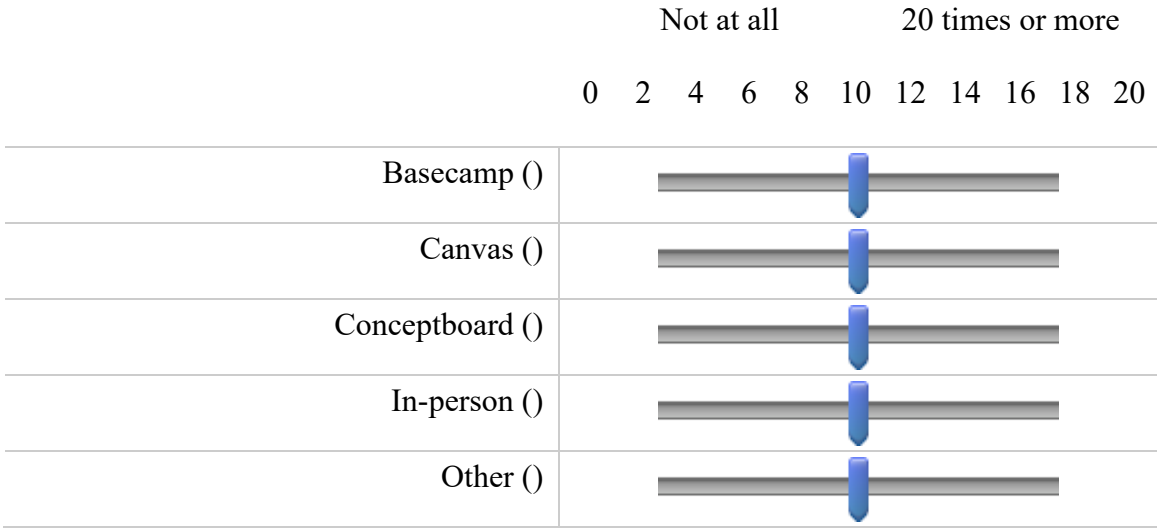
If you have any questions, don't hesitate to email: gardenwithliz@gmail.com

For more information see: Letter of Information

Q1 How often did you interact with other class members during the course of this project?

- ○ None at all (1)
- ○ A little (2)
- ○ A moderate amount (3)
- ○ A lot (4)
- ○ A great deal (5)

Q2 Please indicate how frequently you used the following *to interact with other class members* during the course of this project:



Q3 Were you aware of what other class members were working on during this project?

- ○ Not at all aware (1)
- ○ Slightly aware (2)
- ○ Moderately aware (3)
- ○ Very aware (4)
- ○ Extremely aware (5)

Q4 How helpful was interacting with other class members in completing this project?

- ○ Not at all helpful (1)
- ○ Slightly helpful (2)
- ○ Moderately helpful (3)
- ○ Very helpful (4)
- ○ Extremely helpful (5)

Q5 Did interacting with others improve your learning experience?

- ○ A great deal (1)
- ○ A lot (2)
- ○ A moderate amount (3)
- ○ A little (4)
- ○ None at all (5)

Q6 How did using different technologies to interact with others influence this project?

_____

_____

_____

_____

_____

Q7 What is your sex?

- ○ Male (1)
- ○ Female (2)
- ○ Other/Prefer not to answer (3)

Q8 What is the current standing in school?

- ○ Freshman (1)
- ○ Sophomore (2)
- ○ Junior (3)
- ○ Senior (4)
- ○ Graduate student (5)

Q9 What is your ZIP code?

_____

Q10 What is your year of birth?

_____

Q11 Was this course required for your major or intended major?

- ○ Yes (1)
- ○ No (2)