Intentional Active Learning in Online Courses: An Exploration of the Integration of Active Learning Through the ICAP Framework in Online Course Design and Its Relationship with Students, Instructional Designers, and Faculty

by

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ABSTRACT

This mixed methods action research study set out to solve the problem of practice involving a faculty member's struggle to maintain active learning teaching and strategies during the transition of face-to-face to online modalities. Using a self-developed intervention called the Active Learning Course Planning Map, a new instructional design model is presented with a case study discussing the implications of use in an online course design and development process. Additionally, the faculty perspective was explored using the Active Learning Course Planning Map that encouraged active learning through reflection and collaboration between an instructional designer and faculty member. Initial findings suggested that the use of the Active Learning Course Planning Map, along with the collaborative work with an instructional designer was an asset that helped in the planning and execution of online courses.

DEDICATION

I dedicate this achievement to my daughter and my husband.

To my daughter, I started this journey when you were just two years old. During this time I have watched you blossom and grow into the kind, smart, and loving child that you are today. My hope is that this achievement helps you to see that you can do anything you set your heart and mind to achieve.

To my husband, thank you for being extremely supportive of my dream to become a doctor and picking up the slack during my late nights of reading and writing. Your unwavering support has meant the world to me.

I love you.

ACKNOWLEDGEMENTS

As a student of ASU, I acknowledge that the Tempe campus sits on the ancestral homelands of those American Indian tribes that have inhabited this place for centuries, including the Akimel O'odham (Pima) and Pee Posh (Maricopa) peoples.

> *"In keeping with the design aspirations of the New American University, ASU seeks to embrace our place, connect with tribal communities, and enable the success of each American Indian student. We reaffirm the university's commitment to these goals and acknowledge that everyone, the entire ASU community, is responsible for their achievement."*
>
> - President Crow, August 31, 2015

I want to extend my gratitude to my committee for their guidance in my research and for taking the time to serve as committee members.

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CHAPTER 1

INTRODUCTION AND DISSERTATION OVERVIEW

Introduction

Education has been my passion for over 15 years. As a 17-year-old high school senior, I had the opportunity to intern in a local fourth grade elementary classroom as a teaching assistant. This life-altering experience began my passion to advocate for equal educational opportunities amongst students regardless of their background. After completing my undergraduate degree in elementary education, I began my career as a middle school math and science teacher. During this time, I was often called upon to provide professional development opportunities for teachers to help reach struggling students. After three years in the classroom and a graduate program in educational technology, I found my true calling in the online learning field as an instructional designer (ID).

Today, I am an ID at The University of North Carolina at Charlotte (UNC Charlotte). In this position, I support 12-15 faculty members a year in the creation of online courses that encourage interaction and engagement, while providing an equitable chance for all students to learn. Over the past seven years as an ID, I have witnessed firsthand the struggles faculty members face when transferring their face-to-face courses to the online modality. This confusion and struggle has been exacerbated by the 2019 novel coronavirus (2019-nCoV) or COVID-19. In December 2020, the first cases of an unknown virus were discovered in Wuhan, Hubei, China (Huang et al., 2020). The intensity of the virus along with the speed of transmission forced institutions, including UNC Charlotte, to transition their face-to-face courses to online versions using

emergency remote teaching (Burke, 2020; Murphy, 2020). It is important to note that emergency remote teaching differs from online learning in that it is meant to be a quick and temporary transition that supports learning without the creation of a true online learning environment. In a normal design and development process, faculty work collaboratively 1:1 with an instructional designer over the course of 16 weeks where course objectives, alignment, and intentional design is conducted.

In the shift to emergency remote teaching in March 2020, the official design process implemented during online course development was absent. Thus, a faculty member's experience of remote teaching during an emergency was different from the typical experience of developing an online course with an instructional designer. Faculty members were inexperienced with transitioning their courses to the online modality, causing them to rely on lectures and multiple-choice tests. There was little to no active learning in their online courses (Burke, 2020; Hodges et al., 2020). The stark contrast between modalities in teaching and learning strategies affected the quality of the instruction (Hodges et al., 2020).

This action research study works to address the active learning gap in online courses while exploring online course design and development in relation to students, faculty, and instructional designers.

Dissertation Structure

Following the cyclical pattern of action research, this dissertation study consisted of three cycles to solve a specific educational problem of practice (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014). Each cycle of research informed the next cycle, beginning with two cycles of reconnaissance and ending with a dissertation

cycle (Buss, 2018). Due to the unique outcomes of each cycle of study, the results of this dissertation will be presented with chapters representing articles that will be submitted to journal publications. The format of the dissertation includes:

- Chapter 1. Introduction and Dissertation Overview
- Chapter 2. Initial Cycles of Reconnaissance Research
- Chapter 3. Article #1: The Collaborative Active Learning Instructional Design Model (CAL-ID): A Collaborative Effort to Increase Active Learning in Online Course Design
- Chapter 4. Article #2: Exploring the Intentional Integration of Active Learning in Online Courses: The Faculty's Perspective
- Chapter 5. Discussion of Contribution to the Online Learning Field

Problem of Practice

It is impossible to directly transfer face-to-face teaching and learning strategies to the asynchronous online modality. Learning outcomes and objectives do not change, but the instructional materials, learning activities, and assessments may drastically be altered. A faculty member's lack of experience with teaching online can make this transition even more difficult, especially when asked to design an online course without the support of an instructional designer. Instructional designers are defined by their awareness and knowledge of learning theories, instructional design models, emerging educational technologies, and problem solving (Chartier, 2021).

Faculty often struggle transitioning face-to-face courses to the online modality, with active learning strategies and assessments presenting the greatest difficulty. When considering specific teaching and learning strategies, learning activities and assessments

using active learning have been the greatest difficulty (Khan et al., 2017; Sanga, 2017). Active learning can be defined as "instructional activities involving students in doing things and thinking about what they are doing" (Eison & Bonwell, 1991). The faculty I have partnered with understand the need for active learning and often use problem solving, case studies, and group work in their face-to-face courses. However, active learning is often overlooked or removed during online course design and development. Instead, faculty focus on developing lectures and assessments, with little scaffolding to help support the students to move from learning to application. Furthermore, there are few online courses developed at our institution that contain activities that align with the students' chosen professions and also improve the students' identity in their chosen fields. This study will work to address this problem of practice with the intention of improving online courses for UNC Charlotte students.

Larger Context

The History of Distance Education and The Evolution of Online Learning

The first documented instances of distance education, in the form of correspondence courses, occurred in the 1960s (Scigliano, 2000; Zawacki-Richter & Naidu, 2016). In the mid-1990s, the development of the World Wide Web and faster computing power caused distance education to evolve into online learning (Perry & Pilati, 2011). No longer were courses done through correspondence, but completed online using computer systems and the internet.

Online learning can be defined as "instruction through a connection to a computer system at a venue distant from the learner's personal computer" (Larreamendy-Joerns & Leinhardt, 2006). In today's online classrooms, Learning Management Systems (LMS)

are often used to present course materials to students. They include, among others, Blackboard, Canvas, Brightspace, and Moodle. A LMS provides institutions with the opportunity to provide quick feedback to students, streamlined grading, and improved communication and interactions between faculty members and students (Ippakayala & El-Ocla, 2017).

Because online learning is convenient and provides new opportunities, enrollment in online courses was predicted to "grow during the coming years as more students demand[ed] it and as more faculty accept[ed] it" (Perry & Pilati, 2011). In 2016, overall college enrollments had fallen flat or, in some cases, slightly decreased (Lederman, 2018b). Overall, the number of students enrolled in a college or university in Fall 2017 fell 0.44% from enrollments in Fall 2016 (Lederman, 2018b). Despite this decline of student enrollments, online student enrollment increased (Lederman, 2018a). The percentage of students enrolled in fully online programs rose from 14.7% in 2016 to 17.6% in 2019. Students who attended both online and face-to-face classes increased from 16.4% in 2016 to 19.7 percent in 2019. Finally, students taking at least one online course grew from 31.1% in 2016 to 37.2% in 2019 (Lederman, 2018b; U.S. Department of Education, National Center for Education Statistics, 2022). The data suggests that student enrollments in online courses will continue to increase at colleges and universities.

Online Learning Stakeholders' Perspectives

At the inception of distance education, academics and researchers focused on creating general definitions of distance education and identifying differences between traditional educational practices and distance education. They sought to legitimize the

field of distance education and distance education faculty members as academic professionals (Zawacki-Richter & Naidu, 2016). More recent research surrounding online learning starts with the student. Faculty and instructional designers in higher education have a responsibility to ensure that students receive a quality education that is as rigorous as the face-to-face offerings.

Adding to recent research surrounding creating high quality online courses, this study focuses on exploring relationships among students, instructional designers, and faculty through the intentional integration of active learning using the Interactice-Constructive-Active-Passive (ICAP) Framework (Chi, 2009; Chi & Wylie, 2014).

Student Perspectives. Online learning allows educational opportunities to be provided to populations who may not have had access to them in the past, whether from a lack of proximity to educational institutions or full-time work and family commitments that prevented a learner from attending face-to-face courses (Larreamendy-Joerns & Leinhardt, 2006; Perry & Pilati, 2011; Zawacki-Richter & Naidu, 2016). Multiple studies have shown students are attracted to online courses because they are convenient (Phirangee, 2016); online courses can be accessed from anywhere and at any time. These benefits allow students to work at their own pace and are ideal for students who cannot attend classes in person (Perry & Pilati, 2011; Phirangee, 2016). Online learning requires students to be self-motivated and learn concepts on their own, due in part to the lack of face-to-face interaction between students and faculty member (H. E. Clark, 2020; Perry & Pilati, 2011). However, research has shown that overall perceptions of student learning are directly related to the instructional strategies and course design utilized (Yang, 2017).

Instructional strategies, course design, and instructor presence must align with and scaffold the students' familiarity with the content and technologies utilized (Yang, 2017).

Faculty Perspectives. There have been many debates over whether online learning reflects the "characteristics of an academic discipline of its own" (Zawacki-Richter & Naidu, 2016, p. 251). In 2011, "fewer than one-third of chief academic officers surveyed believe their faculty accepts the value and legitimacy of online education" (Perry & Pilati, 2011, p. 101). Additionally, 70% of surveyed faculty members did not place the same value on earned online degrees versus traditionally earned degrees (Perry & Pilati, 2011). Even 10 years later, in the midst of the COVID-19 pandemic, some faculty members continued to believe that online learning is not a strong alternative to face-to-face delivery, and that face-to-face courses do not transfer successfully to the online learning environment (Hodges et al., 2020; Seaman et al., 2021). One study found that time constraints, instructional challenges, and a lack of support were the greatest factors in faculty's resistance to change (Shadle et al., 2017). Faculty members stated they did not feel the need to change their teaching styles because they already received high scores on student evaluations (Shadle et al., 2017, p. 5). Further, faculty cited a lack of support and resources from the university for experimentation with new teaching styles (Shadle et al., 2017). However, Seaman et al. (2021) found that faculty members are "cautiously optimistic about the future of online education" (p. 24). This cautious optimism suggests that with the proper support in place, such as collaboration with an instructional designer, faculty may be open to the integration of active learning in online courses.

Instructional Designer Perspectives. Since the beginning of online learning, instructional designers have pursued best practices for teaching online (Perry & Pilati, 2011; Zawacki-Richter & Naidu, 2016). One strand of research is focused on bridging student-faculty and student-student interaction gaps in the online setting (Zawacki-Richter & Naidu, 2016). Faculty can work with instructional designers to build interaction opportunities through two-way communication and learner support (Zawacki-Richter & Naidu, 2016). Thus, "it is clear that efforts toward promoting such components are worthwhile for faculty members who seek to replicate the positive components of the classroom experience that can be lacking in the online realm" (Perry & Pilati, 2011, p. 100).

Local Context

Distance/Online Education at UNC Charlotte

Center for Teaching and Learning (CTL). Beginning in 1998, the Center for Teaching and Learning (CTL) has been an integral part of enhancing the University's excellence in teaching and learning with a mission of providing "enterprise level instructional technologies, and champion[ing] the advancement of scholarly teaching" (University of North Carolina at Charlotte, n.d.-c, para. 1). CTL priorities include enhancing the use of constructive and active learning strategies in face-to-face and online courses through the use of professional development and collaboration to assess program needs to support high-quality teaching and learning (Ives & Steinbrenner, 2005; University of North Carolina at Charlotte, n.d.-c). Within this priority, CTL "promotes best practices of teaching excellence in both traditional and online pedagogy" (University of North Carolina at Charlotte, n.d.-c, para. 4) through the creation of the course

production team (CPT). The CPT consists of instructional designers and media specialists. Online courses are then developed collaboratively with distance education (DE), program chairs, and faculty members. (University of North Carolina at Charlotte, n.d.-d).

My Role Within the Center for Teaching and Learning. CPT is a sub-group of CTL that works with faculty members to design and develop online courses. 50-60 courses are created each academic year. As one of four instructional designers on the team, I have direct interaction with 12-15 faculty members each year to develop online courses. My job consists of supporting faculty members through the development process and encouraging opportunities for active learning strategies online to create high-quality course experiences for our students.

Quality Matters. To ensure excellence in their online courses, the University formally adopted Quality Matters (QM) in 2010 (University of North Carolina at Charlotte, n.d.-f). QM is a nationally recognized, formal certification process for creating quality online courses (Quality Matters, n.d.; University of North Carolina at Charlotte, n.d.-f). The process for QM certification involves a quality standards rubric, internal peer-review with feedback, and official submission for certification. This process ensures alignment between course objectives, instructional materials, and graded activities (Quality Matters, n.d.; University of North Carolina at Charlotte, n.d.-f). Furthermore, it provides opportunities for the University's online courses to be nationally recognized (University of North Carolina at Charlotte, n.d.-f). Since 2015, the University has increased its QM Certified courses each year for a current total of 72 as of Summer 2022 (University of North Carolina at Charlotte, n.d.-h).

The QM Higher Education rubric suggests integrating active learning strategies into online courses. Specifically, standards 5.2 and 6.2 explicitly state active learning with references to learner activities and course tools, respectively. According to QM, "active learning involves learners engaging by 'doing' something, such as discovering, processing, or applying concepts and information" (Quality Matters, 2020, p. 25). In this approach, faculty work to guide students to take responsibility for their own learning. Furthermore, "tools used in the course help learners actively engage in the learning process rather than passively absorb information" (Quality Matters, 2020, p. 29). As such, the adoption and use of the QM Higher Education rubric has helped promote and support the University's overall mission of integrating active learning strategies (University of North Carolina at Charlotte, n.d.-c).

Course Development. CTL, in collaboration with the distance education office and program chairs, collaborates with faculty members in a 16-week, cohort-based QM course development process. During the process, faculty members work one-to-one with an instructional designer to create a course that meets QM Standards and student readiness. Instructional designers at UNC Charlotte utilize techniques such as backwards design (beginning with objectives and moving backwards from assessments to instructional materials) (Drysdale, 2019; G. P. Wiggins & McTighe, 2005) and the AGILE model (an iterative process in which the instructional designer defines scope, breaks deliverables into smaller tasks, provides in the moment feedback and implements changes) (Clark & Gottfredson, n.d.; Drysdale, 2019; Torrance, 2014). Online faculty developers are recruited by the distance education office for each course and compensated for their work (University of North Carolina at Charlotte, n.d.-e).

Instructional Designer and Faculty Relationships. Designing for online learning requires attention to time-consuming tasks, including planning, organizing, and structuring courses (Baran et al., 2011; Perry & Pilati, 2011, p. 101; Zawacki-Richter & Naidu, 2016, p. 251). However, in a study by Perry and Pilati (2001), a factor impacting faculty reported they were not given adequate time or tools "with the pedagogical and technological training necessary to maximize the online experience for both teachers and students" (p. 101). An instructional designer can collaborate with faculty to build active learning strategies and interaction opportunities into the content (Zawacki-Richter & Naidu, 2016). Thus, "it is clear that efforts toward promoting such components are worthwhile for faculty members who seek to replicate the positive components of the classroom experience that can be lacking in the online realm" (Perry & Pilati, 2011, p. 100).

Obstacles for Online Courses at the Institution

As discussed, one of the main goals of the University's CTL is to promote active learning in face-to-face and online classrooms (University of North Carolina at Charlotte, n.d.-c). To help meet this goal, CTL created the Active Learning Academy (ALA) in 2014 for faculty members, which has had 278 participants to date. The ALA is primarily focused on face-to-face classrooms (University of North Carolina at Charlotte, n.d.-a). In the Fall of each year, members of the ALA cohort meet to discuss active learning in classrooms and support one another in the implementation of associated pedagogical techniques. Additionally, active learning webinars and workshops are provided throughout the year.

Once the ALA was formed, a group of faculty members in STEM fields began studying their own courses and found issues with student success rates, grade distribution, and student withdrawal rates. To help combat these problems, faculty members collaborated to create the "Transforming STEM Teaching and Learning Academy". The academy sought alternatives to lecture-based instruction, such as active learning. Participating faculty were asked to make a one year commitment. Within the academy, faculty created learning communities to collaboratively create solutions in specific face-to-face STEM courses that are struggling with student success in their respective departments. (Asala, Bates, & Stamper, personal communication, November 11, 2020).

Driving Theories for Dissertation

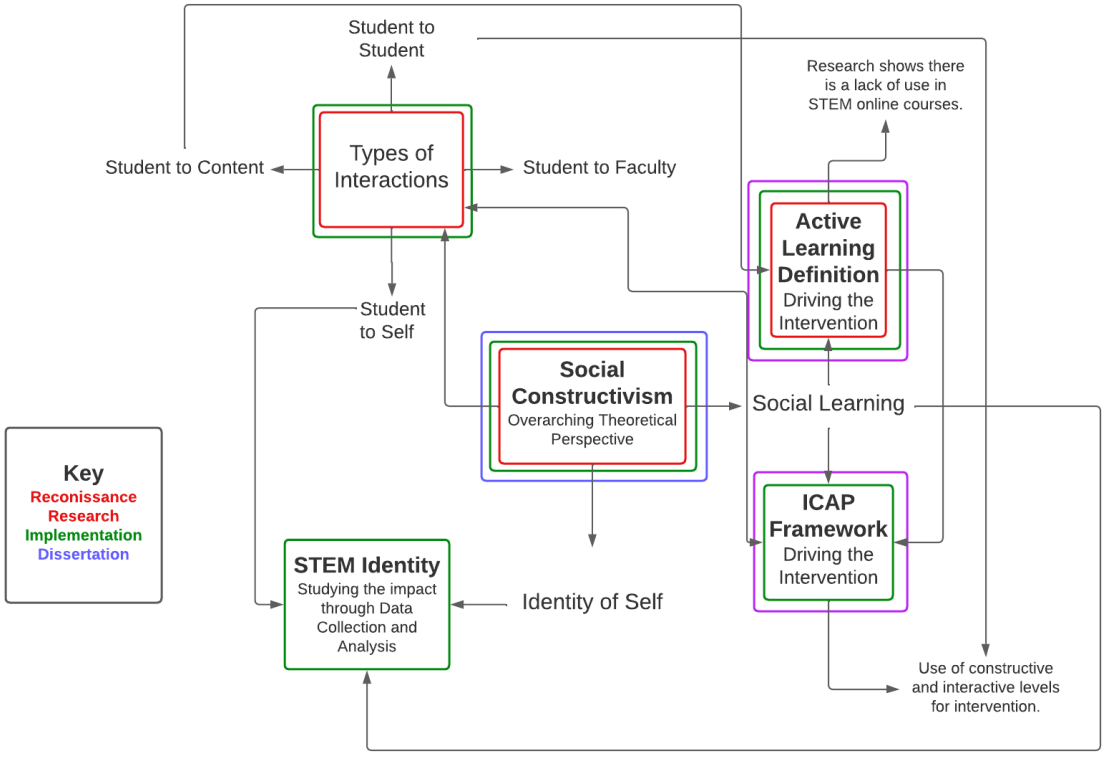
This section discusses the driving theories presented throughout each action research cycle of the dissertation. Theories will be explored in more depth in each associated cycle of research.

The overarching theoretical perspective guiding this study is Vygotsky's (1978) Social Constructivism theory. In this study, I have broken Social Constructivism into three categories: social learning theories, interactions, and identity of self. Bonwell and Eison's (1991) Active Learning theory and Chi's (2009) Interactive-Constructive-Active-Passive (ICAP) framework are two social learning theories that frame the teaching and learning techniques driving the interventions in this study. Tenets from both theories work together to create theoretical, evidence-based strategies to increase active learning in an online course. The theory of STEM identity (Carlone & Johnson, 2007; Starr et al., 2020) has helped create the survey tool for data

collection and analysis purposes during an initial cycle of research. This theory, based on self-identification, helped inform the measurement of intervention effectiveness of the intervention and the relationship between active teaching and learning strategies in an online STEM course. Instruments also were used to understand students' STEM identity before and after participating in the intervention. Figure 1 is a visual representation of the connections between the guiding theoretical perspectives and the study, including the intervention, data collection, and analysis.

Figure 1

Definition, Map, and Alignment of Driving Theoretical and Conceptual Perspectives



Note. This diagram representing the alignment of theoretical and conceptual frameworks driving the study.

An Epistemological Discussion of Social Constructivism vs. Sociocultural Theory

Epistemology is the theory and study of knowledge, while social epistemology is the study of how knowledge is transmitted socially (Stone, 2008; Watson, 2016). In early cycles of this action research study, sociocultural theory was the driving theoretical approach. However, upon much research and reflection, I found that the tenets of social constructivism better aligned with the goals of this action research study.

Scholars continue to debate the similarities and differences between the two theories, specifically in regards to their epistemological underpinnings. The

epistemological differences between sociocultural theory and constructivism begin with understanding of how learning occurs (Cobb, 1994; Packer & Goicoechea, 2010). Sociocultural theory assumes high-level learning is more successful in collaboration with others (Delahunty et al., 2014), transmitted through language and culture (Vygotsky, 1978). Sociocultural theorists such as Lave, Brown, and Rogoff have argued that interactions between novice and expert causes transformation of learning (Tenenberg & Knobelsdorf, 2014). Constructivists believe that knowledge is situated in context and unique to each and every learner. Concepts are presented with multiple perspectives such as reading about the concept, writing about the concept, drawing pictures representing the concept, and/or conducting a hands-on experiment (Schunk, 2012).

A lesson designed by a sociocultural theorist might pair students in groups by ability, whereas a constructivist theorist would first focus on the learning done individually before introducing the perspectives of peers. Furthermore, a sociocultural theorist may explore the impact of culture on student learning, while a constructivist theorist would focus on the impact of a student's prior knowledge on learning.

Connecting to the ICAP framework, learners focus on inferring, integrating, and organizing their knowledge during the constructive level (Chi, 2009). During the interactive level, learners "create processes that incorporate a partner's contributions" (Chi, 2009, p. 77). These slight epistemological differences between social constructivism and sociocultural theory have led me to choose social constructivism as the driving theoretical perspective due to its better alignment with the ICAP Framework tenets of constructive and interactive levels of learning. In the next chapter, I will discuss

how I applied these driving theories into my initial cycles of action research for this study.

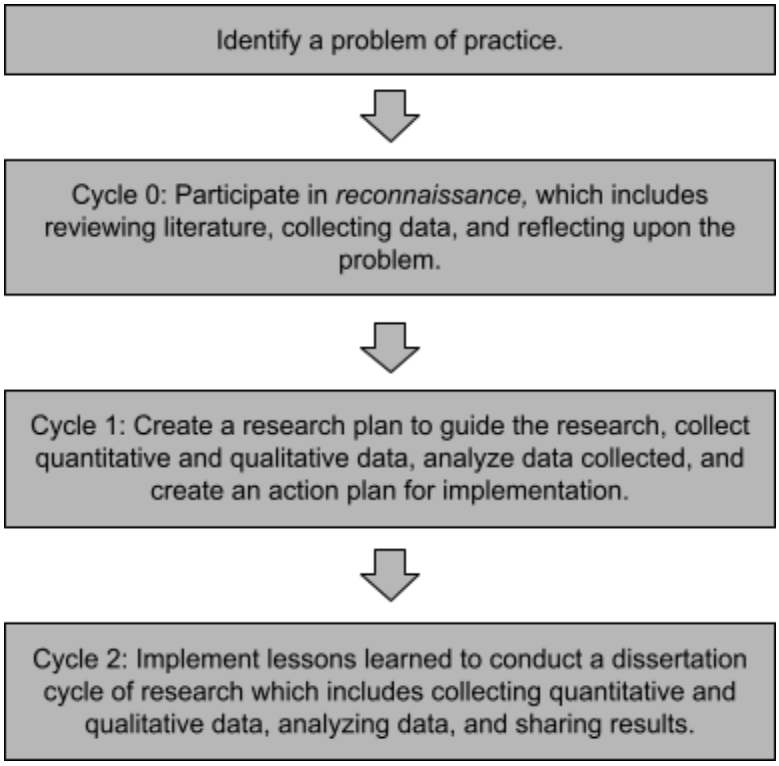
CHAPTER 2

INITIAL CYCLES OF RECONNAISSANCE RESEARCH

Action research is a cyclical process used to solve a specific educational problem (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014). Practical action research involves practitioners and problems of practice in their own workplaces (Plano Clark & Creswell, 2014). A practitioner studies local problems, becoming a "practitioner-as-researcher" (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014). The outcome of practical action research is a plan of action developed through a process of data, conducting analysis, and reporting results. This resulting action plan, including new processes, new practices, or pilot programs, is shared with stakeholders and to a larger audience at conferences or in educational journals (Plano Clark & Creswell, 2014). In this chapter, I will present the two cycles of research used for reconnaissance, or the collecting of data, to reflect upon the true problem of practice. Refer to Figure 2 for the steps involved during action research.

Figure 2

Action Research Steps



Note. Adapted from Creswell and Guetterman, 2019 and Plano Clark and Creswell, 2015.

Action Research Cycle 0 - Reconnaissance

The goal of the initial reconnaissance study (referred to as Cycle 0 going forward) was to explore current active learning and interaction techniques, including their frequency, with faculty members involved in the online course design and development process at UNC Charlotte during Fall 2020. An additional goal was to explore the faculty members' and students' thoughts, beliefs, and attitudes towards active learning and interactions in online courses. Research questions included:

1. **Research Question #1**: What are the current techniques used for active learning and interaction in online courses at UNC Charlotte?

2. **Research Question #2:** How frequently do students at UNC Charlotte participate in interactions in online courses?
3. **Research Question #3**: What are the thoughts, feelings, and attitudes of students and faculty members towards interactions in online courses at UNC Charlotte?

Methods

Mixed Methods Action Research (MMAR) gives researchers the opportunity to see things from multiple perspectives (Ivankova, 2014). This Cycle 0 action research study aimed to collect both qualitative and quantitative data in a sequential format with an emphasis on qualitative data (Ivankova, 2014).

Participants

Faculty Interviews. Cycle 0 data collection consisted of three qualitative interviews with UNC Charlotte online faculty members who were actively involved in the online course design and development process during Fall 2020. The three faculty interviewed were from Arts and Architecture, Cato College of Education, and Liberal Arts and Sciences. Each faculty member had at least one year of experience teaching undergraduates online and was in their first Quality Matters online course development cycle.

Students. The three faculty members distributed a survey to their students using the Announcement tool in Canvas, the UNC Charlotte's Learning Management System. Out of the potential 437 students sample size, 33 students responded for a 7.5% response rate.One responder was under 18 years old, leaving the sample size at 32 students.

46.9% of the 32 respondents were in their first year of classes at the University. 53% reported having 0-3 online courses in the past. Most attended Belk College of

Business, Cato College of Education, College of Health and Human Services, or College of Liberal Arts and Sciences.

Instruments

Faculty Interviews. Faculty interviews were conducted using the faculty interview protocol (see Appendix A). Each interview lasted 30-35 minutes and occurred virtually through Zoom. Interviews were audio recorded and transcribed using Happy Scribe and then reviewed by the researcher for accuracy.

Student Survey. The student survey was adapted from Australasian Survey of Student Engagement (Carr et al., 2015). The survey included 27 questions that asked students to rank their responses on a scale of *never* (1), *sometimes* (2), *often* (3), and *very often* (4). The questions were organized into three sections. Part one included questions related to active learning, student interaction, and faculty interaction; part two asked about relationships built in courses and part three focused on skills learned through student engagement. See Appendix A for a detailed survey protocol.

Procedure

First, qualitative interviews were conducted with the three participating faculty to learn their thoughts, feelings, and attitudes towards implementing active learning techniques and interactions in online courses. After collecting and analyzing the qualitative data, quantitative data were collected to build upon the previous data (Ivankova, 2014). A student survey was adapted from the Australasian Survey of Student Engagement (Carr et al., 2015). This survey was used to gain the students' perspective on active learning and interaction in online courses. More specifically, this survey measured the experiences, relationships built, and skills that students gained in online courses.

Finally, the qualitative and quantitative data were integrated to provide a full picture of current practices at UNC Charlotte in regards to active learning and interaction in online courses.

Data Analysis

To begin analyzing the qualitative interview data, I uploaded the interviews into HyperResearch. Next, I began creating a code book and analyzed the qualitative interviews using line-by-line coding, focusing closely on responses that related to my initial research questions (Charmaz, 2014; Ivankova, 2014). After a deep line-by-line coding of each interview, I moved to a constant comparative method, allowing me to compare the three faculty members' thoughts, feelings, and beliefs towards active learning and interaction in online learning (Charmaz, 2014). To begin, I cateogrized the line-by-line codes into smaller groups, such as types of active learning/interaction, limitations of online learning in terms of active learning/interaction, and skills learned through active learning/interaction. Themes emerging from these categories included differing definitions of active learning amongst the faculty members, the importance of building community through interactions, and the use of the three types of interactions: student-to-student, student-to-faculty, and student-to-content.

Next, I used SPSS and my original survey coding to analyze the student survey, translating each response category into a code for easier analysis (Ivankova, 2014). I then merged the survey questions into average variables using central tendency according to the original survey dimensions being studied: active learning, student interaction, faculty interaction, and skills (Ivankova, 2014). Finally, using a combined mixed methods data analysis, I compared data generated from faculty members' interview responses with data

from the students' survey responses (Ivankova, 2014). In addition to answering the research questions, this analysis helped identify whether or not students' experiences aligned with the intentions of faculty members.

Results of Cycle 0 Research

Current Active Learning Techniques and Interactions at UNC Charlotte. All three online faculty interviewed stated they provide active learning opportunities. One faculty member went as far as to state "the only kinds of assignments where you can see any evidence that students have learned or have even interacted with the content is if there's some kind of active element to it," such as discussion, note taking, and small group work. These findings suggest that some UNC Charlotte online courses are being developed to include what participating faculty defined as active learning opportunities for students. Surveyed students appeared to agree, ranking their experiences with active learning in online courses as an average rating of 2.69 out of 4 (between *sometimes* and *often*).

Thoughts, Feelings, and Attitudes of Students and Faculty Members Towards Interactions. Participating faculty made a distinction between student-to-student interactions and student-to-faculty interactions in online courses. In faculty interviews, there was heavy discussion surrounding faculty follow-ups and communication. Themes included the use of feedback, thinking ahead about how students can contact them, and the importance of open communication. While all faculty members described using discussion boards in their online courses, one out of the three faculty members did not expect student interaction within the discussion boards, stating "my number [of students in the course] is perhaps prohibitively challenging" and "the class size is too large." All

three faculty members discussed the use of synchronous interaction through Zoom and the benefits of "actually seeing each other," but none of them actually used this tool in their courses. These findings are supported by student interpretations of relationships built within online courses. When surveyed about relationships between peers and faculty, on average students ranked their relationships higher with faculty members than with their peers. Since faculty often respond to student inquiries and emails, this indicates that the expectation of peer responses used in online courses have the potential to contribute to students' feelings towards the relationships built in their courses.

Cycle 0 Discussion

Faculty members interviewed at UNC Charlotte struggled with defining active learning. Two faculty requested a definition of active learning before answering and one faculty member stated "I always struggle with that question because I [because I] never really know if I know what active learning is." This struggle could have an impact on their ability and confidence to integrate active learning techniques into the online classroom. To better support faculty members' integration of active learning in online courses, UNC Charlotte should adopt a clear definition of active learning.

As discussed earlier, students' experiences in courses are enhanced when they interact (McGorry, 2003; Truhlar et al., 2018); their feelings towards the relationships being built were stronger when the conversation was reciprocated by a peer. Going forward, UNC Charlotte may need to encourage faculty to require student responses in discussions as a best practice and remove barriers to ensure this type of active learning can occur. However, high course enrollment numbers could inhibit the quality of student interactions that improve peer relationships in online courses.

Lessons Learned from Cycle 0

I was excited to come across the Australasian Survey of Student Engagement (Carr et al., 2015), although I recognized the survey was too long and many of the domains covered did not directly align with my research questions. This led me to adapt the survey to better fit my needs. However, when it came to analyzing the data, I wish I had made better notes about choosing the questions I did and had created new domains for analysis. Because I had not done this, I had to retrofit the questions into domains for better data analysis. This made things quite difficult and caused me to question the reliability and validity of the adapted survey. For the dissertation cycle's measuring tool, I took the time to find a better fitting survey that did not have to be adapted. Additionally, I made sure that the question items were coded and categorized ahead of time to ensure that the data related to and truly measured the constructs addressed in my research questions.

Cycle 0 findings also suggested that students' feelings towards relationships built in the classroom were strongest when the interactions were reciprocated. In subsequent cycles of research, I ensured that interactions between students were scaffolded with relevant discussion questions that encouraged conversation and self-reflection in the hopes of strengthening this feeling of connectedness.

Action Research Cycle 1 - Implementation of Active Learning in an Online Course

Purpose

The purpose of implementing active learning in an online course (referred to as Cycle 1 going forward) is to explore the relationship between active learning strategies in

an online STEM course and students' STEM identity. This study sets out to answer the following research questions:

- **Research Question #1:** What is the relationship of students and their STEM identity after implementing active learning strategies at the constructive and interactive levels of the ICAP framework in an online STEM course?
- **Research Question #2:** What insights can we gain about students' STEM identity in an online STEM course through student reflection journals?

Supporting Literature

Science, Technology, Engineering, and Mathematics (STEM). Depending on the scholar, STEM can be defined in two ways. Commonly adopted by K-12 schools, the first definition is the integration of science, technology, engineering, and mathematics across the curriculum with the incorporation of each discipline into one another (Xie et al., 2015). In the second definition, STEM includes any course that falls within the four core STEM areas: biological sciences, physical sciences, engineering, mathematics and related fields that include "research, innovation, or development of new technologies using engineering, mathematics, computer science or natural sciences (including physical, biological and agricultural sciences)" (Homeland Security, n.d., para. 5; McComas & Burgin, 2020; University of North Carolina at Charlotte, n.d.-g; Xie et al., 2015). For the purposes of Cycle 1, the latter definition, which has been adopted by UNC Charlotte, will be used.

Students and STEM Identity. When students choose a major or minor for their higher education, they become part of a disciplinary community (Goldschneider, 2019; Goldschneider et al., 2020). A disciplinary community is formed by the sociological

interactions amongst professionals and/or learners who have similar interests in a specific subject with the intent of furthering the curriculum and promoting it to all (Costa & Lopes, 2016; Goodson & McClaren, 1993). In the case of science, technology, engineering, and mathematics (STEM) topics, students become part of the STEM disciplinary community.

STEM identity is a sub-theory of social identity and science identity (Carlone & Johnson, 2007; Starr et al., 2020). According to the theory of STEM identity, interactions and collaboration within the STEM disciplinary community lead to members to feel a sense of identity (Dou et al., 2019; Goodson & McClaren, 1993). Thus, community building in STEM programs can foster STEM identity formation, potentially impacting their aspirations and success in the STEM fields (Dou et al., 2019; Schunk, 2012; Starr et al., 2020).

A quantitative measurement tool was created to measure participating students' STEM identity in this study. A student's STEM identity can be heavily influenced by how they view themselves compared to their peers and their accomplishments in STEM fields (Carlone & Johnson, 2007; Starr et al., 2020). Carlone and Johnson (2007) argued that as students engage in scientific disciplinary practices, their STEM identity becomes stronger. This stronger STEM identity has the potential to lead to higher academic achievements in STEMs field and a feeling of belonging amongst their peers (Starr et al., 2020).

Research on STEM identity only emerged within the last decade. Hence, there is a lack of literature that describes it specifically (Herrera et al., 2012). However, there are many studies that draw on science identity, and social identity theories (Hazari et al.,

2010; Herrera et al., 2012). This research project draws upon similar theories to hypothesize the components of a students' STEM identity For example, Starr et al. (2020) studied the impact of integrating science experiences on STEM identity and motivations for 1,079 undergraduate students in introductory biology courses with both lecture and active learning options. The researchers used pre and post surveys, to measure the level of student interactions with science practices, classroom climate, STEM identity, STEM motivation, STEM career aspirations, and their recognition of themselves as scientists. Starr et al. found that performing science practices increased students' STEM motivation and identity and tendency to view themselves as scientists. This study was essential to my research because I adopted its survey as the measurement tool for determining students' STEM identity before and after the intervention.

In other important research, Kelly et al. (2020) studied two cohorts of participants. The first cohort consisted of 121 undergraduate students who were studying in STEM fields. The second cohort consisted of 58 STEM professionals. Using the Professional STEM Identity Status questionnaire, they measured how each of these groups of participants viewed their STEM identity. Overall, the STEM professionals scored higher on the survey than the STEM undergraduate students, with significantly higher scores in affirmation, in-depth exploration, and commitment. Furthermore, participants were asked about the groups in which they belong. Out of the 26 participants identified as having a high STEM identity, 21 listed STEM (Kelly et al., 2020). These results suggested that being part of the STEM disciplinary community is associated with high STEM identity. This finding reiterates the importance of providing students the opportunity to participate in a disciplinary community. These experiences in college may

have the potential to increase students' STEM identity and better prepare them for a career in the STEM field.

Interactions in Online Learning Courses. The translation of interaction from face-to-face to online courses has become a major focus for research (Zawacki-Richter & Naidu, 2016). According to Zawacki-Richter and Naidu (2016), interaction is a "social process that is facilitated by interaction among participants" (p. 249). Due to the distance created between the student and the faculty member, online learning "demands and needs innovative solutions" (p. 253). Unfortunately, online courses tend to have high drop-out rates in comparison to their face-to-face counterparts. The sense of separation and lack of community in online courses has been considered a factor (Phirangee, 2016). Furthermore, "the United States Distance Learning Association has indicated that interaction is an integral component of quality distance education, including online education" (Truhlar et al., 2018, p. 290).

Benefits of Interaction. Interactions can be categorized in three groups: student-to-faculty member, student-to-student, and student-to-content. McGorry (2003) explained "learning experiences should support interaction between professors and their students and between students themselves" (p. 163). There are many types of student-to-student interactions available in online courses including groupwork and teamwork, synchronous sessions with breakout room discussions integrated, discussion boards, peer critiques, pair-shares, and peer reflection. During this study, implementation of student-to-student interactions through group reflections will be the primary focus.

Studies have found that interaction in online courses can lead to an increased feeling of community (Phirangee, 2016), as well as "increased academic achievement and

greater retention rates" (Flottemesch, 2000, p. 46). Student-to-student interaction also has been shown to increase motivation. A recent study found that implementing at least one category of interaction can increase student learning, with student-to-student and student-to-content interactions having the largest impact (Truhlar et al., 2018). Participation with peers in the online setting has been found to increase critical thinking and problem-solving skills (Flottemesch, 2000). Research has shown that interactions among students bring new perspectives and help the learner refine and construct their own knowledge (H. E. Clark, 2020). Students enrolled in courses without intentionally integrated student-to-student interaction opportunities have felt a lack of peer relationship building, coupled with feelings of isolation (Flottemesch, 2000).

Methods

Cycle 1 utilized convergent parallel mixed methods design which involves "quantitative and qualitative data to develop complete and valid conclusions" (Plano Clark & Creswell, 2014, p. 392). In this research design, quantitative and qualitative data are given equal priority and collected concurrently then triangulated for drawing conclusions (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014).

Participants

Purposeful sampling (or purposive sampling) is used when researchers purposefully select the sites and participants for data collection (Plano Clark & Creswell, 2014). Nonprobability purposive sampling is used when researchers choose participants because they are convenient and "most appropriate for the study" (Plano Clark & Creswell, 2014). In Cycle 1, participants included seven graduate students working towards the applied artificial intelligence graduate certificate at UNC Charlotte. Enrolled

students were expected to have a basic understanding of Python coding to be able to problem solve and locate areas of broken code. Four out of the seven enrolled students voluntarily opted to become participants in the study by submitting an ungraded Canvas assignment. Students' backgrounds varied between transitioning from the Bachelor's to a Master's, as well as industry professionals. Industry professionals were already working in careers and wished to upgrade their capabilities to move into a different position.

Instruments

Pre- and Post-survey. Attitudinal measures are meant to "measure participants' feelings towards topics" (Plano Clark & Creswell, 2014, p. 241) and often ask participants to "rate their level of agreement" with a statement. The original survey influencing this study appeared in Starr et. al (2020). It consisted of 38 questions measuring STEM identity and STEM motivation based on classroom experiences. The survey was first conducted in an undergraduate biology class with 1,079 students. Findings suggested that the use of science practices in the classroom increased students' STEM motivation and identity (Starr et al., 2020).

Adapted from Starr et. al (2020) with influences from Singer et. al (2020) and Stake and Mares (2001), the pre-survey used in Cycle 1 measured students' thoughts and beliefs about their own STEM identity. The survey was broken into three constructs: STEM identity (12 questions), STEM career aspirations (4 questions), and STEM motivations (6 questions). Responses were ranged on a Likert scale of *strongly disagree* (1) to *strongly agree* (6). The post-survey added an additional construct of classroom climate (10 questions). These questions set out to measure how the specific classroom

experiences in the online computer science course contributed to students' STEM identity using the same Likert scale. See Appendix A for the specific measurement tool.

Students completed the pre-survey in the first two weeks and post-survey within the last two weeks.

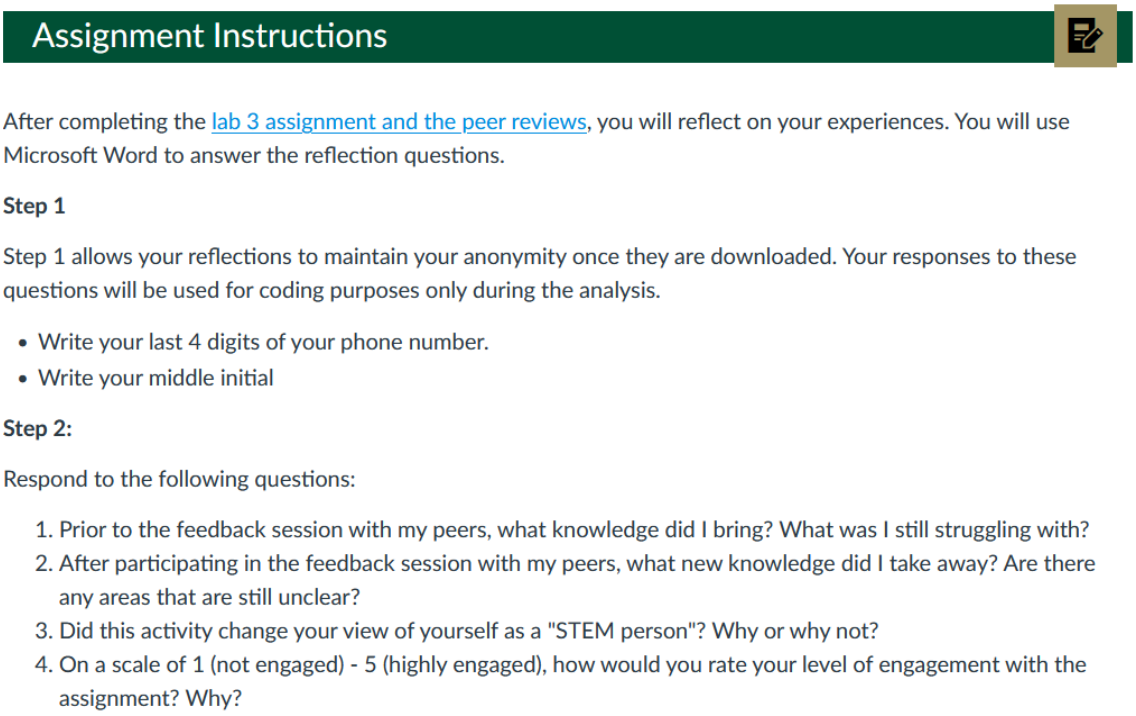
Reflection Journals. Reflection can be a powerful tool used for personal growth (Ryan, 2013). It has the potential to help an individual understand life experiences and increase meaning as experiences and thoughts are consciously understood (Hegel, 1949, as cited in Ryan, 2013). To address Research Question 3, students reflected on their experiences with their lab assignments for the course and associated peer critique. As the research question implies, the goal of these reflections was to gather insight directly after students participated in the constructive and interactive levels of the ICAP Framework. See Figure 3 for the reflection questions used in the study.

Reflection Questions 1 and 2 related to the exploration of students' feelings towards the constructive and interactive levels of the ICAP framework (Chi, 2009; Chi & Wylie, 2014). These questions aimed to address students' experiences with the application of the ICAP framework at the constructive and interactive levels in an online course. Students reflected upon the specific knowledge they brought to the peer interactions (constructive) and the knowledge gained through the peer critiques (interactive). Reflection Question 3 aimed to explore students' feelings towards their STEM identity directly after participating in the assignment. This allowed for a more detailed account of the direct relationship between a students' STEM identity and participation in an active learning technique driven by the ICAP framework. Finally, Reflection Question 4 asked students to evaluate their engagement level with the

assignment. The aim of this question was to compare the level of engagement responses with the responses of the other reflection questions to analyze potential relationships.

Figure 3

Student Reflection Journal Prompts



Assignment Instructions

After completing the lab 3 assignment and the peer reviews, you will reflect on your experiences. You will use Microsoft Word to answer the reflection questions.

Step 1

Step 1 allows your reflections to maintain your anonymity once they are downloaded. Your responses to these questions will be used for coding purposes only during the analysis.

- Write your last 4 digits of your phone number.
- Write your middle initial

Step 2:

Respond to the following questions:

1. Prior to the feedback session with my peers, what knowledge did I bring? What was I still struggling with?
2. After participating in the feedback session with my peers, what new knowledge did I take away? Are there any areas that are still unclear?
3. Did this activity change your view of yourself as a "STEM person"? Why or why not?
4. On a scale of 1 (not engaged) - 5 (highly engaged), how would you rate your level of engagement with the assignment? Why?

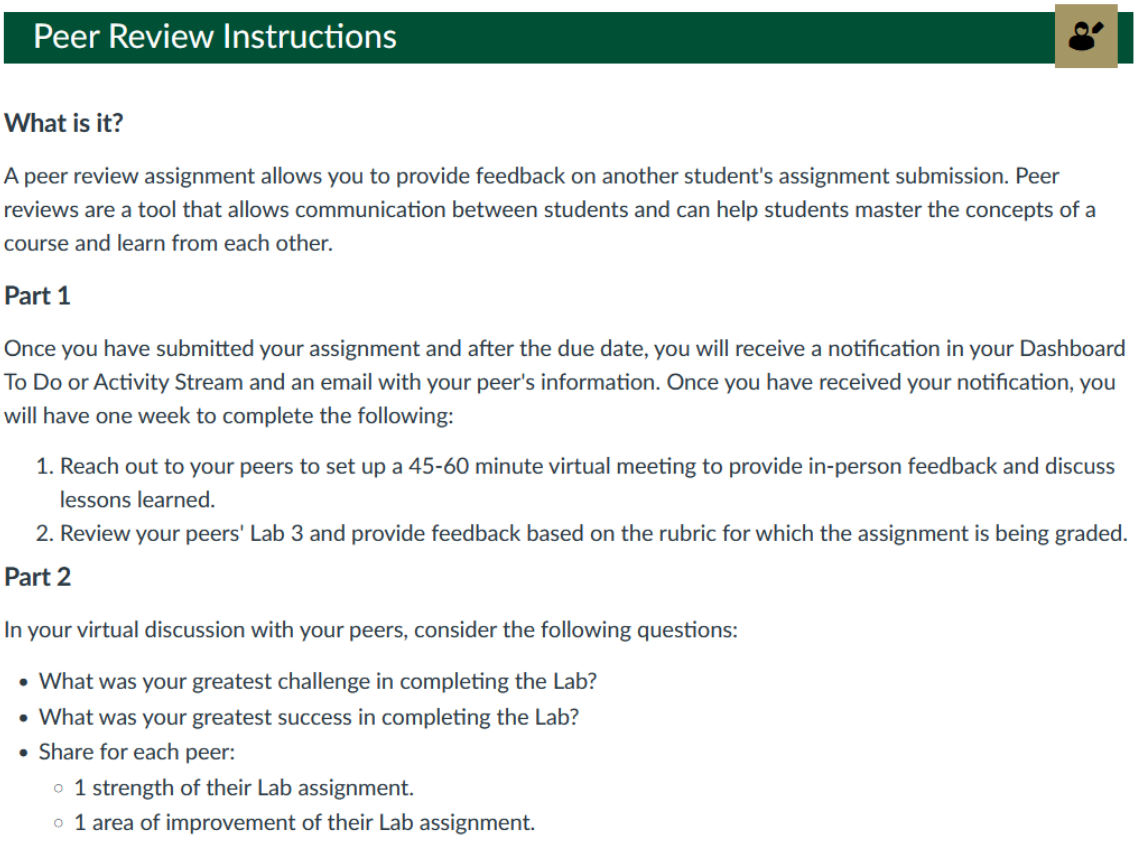
Procedure

Cycle 1 took place in an online computer science course at UNC Charlotte. The online computer science course had been developed as an asynchronous online STEM course with intentionally designed active learning assignments. Using the constructive and interactive levels of engagement within the ICAP Framework (Chi & Wylie, 2014), students worked towards constructing new meaning in their knowledge building of the content. The course was broken up into eight modules over the course of a 7.5-week semester. In Modules 3 and 5, students individually worked through Labs 3 and 5. Each

lab was meant to provide hands-on practice on key concepts covered in the Module and was the cumulative assignment for each Module. Lab 3 asked students to apply adversarial search algorithms to write their own programming code so that a user could play Connect 4 against an AI opponent. Lab 5 required students to implement reinforcement learning solutions in Python to train and test a model using Pong. By the end of the assignment, students each created their own AI program that plays a game by itself using the AI gym libraries. After students submitted their labs, they were assigned to peer groups of two other students through the Canvas Learning Management System peer review tool. Students received a notification in their Dashboard "To Do" or Activity Stream, a class announcement, and a message in the course Slack channel. Students then used these channels to provide peer feedback to their peers and meet virtually (see Figure 4 for the specific requirements of the peer review assignment). After students participated in their peer review, they reflected individually on the entire process of their lab assignment.

Figure 4

Student Peer Review Expectations and Directions



Peer Review Instructions

What is it?

A peer review assignment allows you to provide feedback on another student's assignment submission. Peer reviews are a tool that allows communication between students and can help students master the concepts of a course and learn from each other.

Part 1

Once you have submitted your assignment and after the due date, you will receive a notification in your Dashboard To Do or Activity Stream and an email with your peer's information. Once you have received your notification, you will have one week to complete the following:

1. Reach out to your peers to set up a 45-60 minute virtual meeting to provide in-person feedback and discuss lessons learned.
2. Review your peers' Lab 3 and provide feedback based on the rubric for which the assignment is being graded.

Part 2

In your virtual discussion with your peers, consider the following questions:

- What was your greatest challenge in completing the Lab?
- What was your greatest success in completing the Lab?
- Share for each peer:
  - 1 strength of their Lab assignment.
  - 1 area of improvement of their Lab assignment.

Data Analysis

Quantitative Analysis. First, I downloaded data from both the pre and post intervention surveys from Qualtrics and uploaded into SPSS. Once the data were in the system, I organized them and reviewed them for inconsistencies. Missing data points were transformed to ensure accurate analysis. Next, I merged the survey questions for both the pre and post intervention surveys into average variables according to the original survey constructs being studied: STEM identity, STEM career aspirations, and STEM motivation. Due to unexpectedly limited enrollment in the course, only one student

completed the post intervention survey. Therefore, the analysis used only descriptive statistics of the pre and post intervention survey rather than a repeated-measures *t*-test.

For the post survey, the active learning constructs including classroom climate and recognition as a scientist were also merged into average variables. Data from the classroom climate construct was analyzed and compared to the results of the descriptive statistics to draw conclusions about the active learning strategies used in the course.

Qualitative Analysis. To analyze the reflection questions, I downloaded the student responses from the Learning Management System and uploaded them to a Google Drive Folder only accessible by myself. Files were renamed with the labels of "Student 1, Student 2, Student 3…". After I downloaded the files, I did a preliminary exploratory analysis (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014) removing any references to specific people and places. I then uploaded the files to Nvivo and conducted a line-by-line coding analysis using in vivo codes. Given the reflective nature of the data, in vivo codes worked to "preserve the participants' meanings of their views and actions in the coding itself" (Saldaña, 2021, p. 41). Once the reflections were coded, they were merged to "reduce redundancy among the codes" (Plano Clark & Creswell, 2014, p. 361). These codes were then reviewed for common relationships and grouped into major themes (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014).

Mixed Methods. Once both sets of data were analyzed, I triangulated the results from the descriptive statistics of the pre- and post-survey results with the student reflection journals to support trends in the survey results with qualitative themes from the student reflection journals (Cresswell et al., 2007). These results were then used to respond to the research questions.

Results

Pre-survey. The pre-survey, conducted at the beginning of the semester prior to any interventions, had a total of $n = 7$ participants with a response rate of 100%. Construct 1, measuring the level of STEM identity, had a response mean of 4.33 and *SD* of .99, or slight agreement with having a STEM identity and a large dispersion of responses. Construct 2, measuring the level of STEM career aspirations, had a response with a mean of 4.39, or slight agreement. However, with a *SD* of 2.05, responses for Construct 2 were highly dispersed between strongly disagree and strongly agree. Finally, for Construct 3, measuring the level of STEM motivation, participants responses had a mean of 5.17 and $SD = .51$, or a high level of agreement with having STEM motivation. Results show that prior to the course with an Active Learning intervention, students had a high range of responses between slight disagreement and agreement for identifying with a STEM identity. See Table 1 for pre-survey data results.

Table 1

Pre-survey Constructs Descriptive Statistics

	n	Min	Max	Mean	Std. Deviation
Pre_Construct1_STEM Identity	7	3.08	5.83	4.3333	.99187
Pre_Construct2_STEM Career Aspirations	7	.00	6.00	4.3929	2.05070
Pre_Construct3_STEM Motivation	7	4.40	6.00	5.1714	.50897
Valid *n* (listwise)	7				

Post-survey. The post-survey, conducted at the end of the semester after students had completed the course with an Active Learning intervention, had a 33% response rate with a total of *n=1* participants, due to the student withdrawal rate. This participant responded to the same questions and constructs as in the pre-survey. For Construct 1, measuring the level of STEM identity, the participant responded with a mean of 4.17 or slight agreement with the identification of having a STEM identity. For Construct 2, measuring the level of STEM career aspirations, the participant responded with a mean of 5.25 or agreement with having STEM career aspirations. Finally, Construct 3 measured the level of STEM motivation. The participant responded with slight agreement with having STEM motivation. See Table 2 for data analysis results (standard deviation was not calculated due to limited participant response rate).

Table 2

Post Survey Constructs Descriptive Statistics

	n	Min	Max	Mean	Std. Deviation
Post_Construct1_STEM Identity	1	4.17	4.17	4.1667	-
Post_Construct2_STEM Career Aspirations	1	5.25	5.25	5.2500	-
Post_Construct3_STEM Motivation	1	4.60	4.60	4.6000	-
Valid *n* (listwise)	1				

Pre- and Post-survey Comparison. In comparing pre- and post-survey results, I eliminated responses from participants' who did not complete the post-survey using their

unique identifier. This left a comparison of one participant's pre- and post-survey responses. Using SPSS, I conducted a pair samples *t*-test.

Table 3

Paired Samples Statistics

		Response	*n*	Std. Deviation	Std. Error Mean
Pair 1	Pre_Construct1_STEM Identity	4.2500	1[a]	.	.
	Post_Construct1_STEMIdentity	4.1667	1[a]	.	.
Pair 2	Pre_Construct2_STEM CareerAspirations	5.0000	1[a]	.	.
	Post_Construct2_STEMCareerAspirations	5.2500	1[a]	.	.
Pair 3	Pre_Construct3_STEM Motivation	4.8000	1[a]	.	.
	Post_Construct3_STEMMotivation	4.6000	1[a]	.	.

Table 4

Post Survey Active Learning Constructs Descriptive Statistics

	n	Min	Max	Mean	Std. Deviation
Post_Construct4_ Classroom Climate	1	4.00	4.00	4.0000	-
Post_Construct5_Recognition as a Scientist in the Classroom	1	3.40	3.40	3.4000	-
Valid *n* (listwise)	1				

Student Reflections. Out of the seven originally enrolled students, three completed both lab assignments presented at the constructive and interactive levels of the ICAP framework. Overall, students struggled with the lab assignments. This was made clear in the reflections with references to the amount of time and effort that each lab took and still being unable to complete the assignments. The mental effort may have influenced students to rate their level of engagement with the assignments at *highly engaged* (5) because of the "literal days of manhours invested in the assignment." Students' prior knowledge brought to the peer interactions ranged from "a lack of knowledge compared to my peer" and "how the complete program was supposed to run." The interactive piece of the assignment was beneficial for students to compare notes on the assignments. See Table 5 for specific quotes from this reflection question. Finally, in each reflection, all three students stated that the lab assignments had no impact on their identity or view of themselves as a STEM person.

Table 5

Student Reflections Regarding Interactions with Peers

Reflection Question	After participating in the feedback session with my peers, what new knowledge did I take away? Are there any areas that are still unclear?
Student #1	**“**After talking with my peer, I took away that I understood and could have probably done well on this assignment if I had done it.”
Student #2	“I learned how to do the GUI using the TKinter to have a second window to house all the additional buttons in. I am still unclear on the state tracking because neither of my group members got to that point in their programs.” “What I did get was reaffirmation that the assignment was frustrating and it was way too time consuming to train the models.”
Student #3	“I realized, after the peer had pointed it out, that the things I had become hung up on were worth considerably less points than the thing I got hung up on at the last minute and probably could have resolved, if I’d had more time. They also explained that my recreating the entire GUI was wasted effort since we were apparently supposed to modify the existing GUI of a previous assignment. I’m vaguely aware of how that GUI works but the way the lab was worded still leaves me unclear on how to create menus or radio buttons.” “It was a particularly productive feedback session. I had not previously heard of the “Stable Baselines” implementations and, seeing the success they achieved, would most likely convert to it on a future project. It wasn’t productive in helping my particular situation, since they diverted from the route I have taken. So my current lab is still incomplete and will most likely remain so.”

Discussion

Due to the low number of participants and students enrolled in the course, it is difficult to make generalizations regarding the implementation of active learning strategies at the constructive and interactive levels of the ICAP framework in an online

STEM course. However, in this computer science course, the intervention had no reported impact on students' STEM identity. For example, the single student's STEM identity, who completed both the pre- and post-survey, actually decreased from a 4.25 to a 4.17. Additionally, each student's reflection stated that the lab assignments and peer interactions did not impact the views of themselves as STEM people. Despite this, we can conclude that the peer interactions after completing a tough assignment can be beneficial for students. There were references to conversations about the frustration in attempting to complete the lab assignment and learning from one another in how to complete parts of the assignment they struggled with to be successful.This suggests that speaking with peers after conducting their lab allowed students to share ideas, help one another, and teach new perspectives for completing the assignment.

Looking Ahead to Dissertation Cycle

Findings from Cycle 0 suggest that faculty members at UNC Charlotte struggle with defining what active learning strategies are, especially in the online classroom. In the final cycle of this action research study, it was imperative for me as the instructional designer to provide faculty with a specific definition and framework for active learning. During the Cycle 1 study, I looked very closely at the course curriculum map and suggested where active learning strategies would be most beneficial. This caused a major focus on attempting to fit assignments that met the constructive and interactive levels of the ICAP framework. In Cycle 2, ICAP was used as a framework and an opportunity for faculty self-reflection. A tool was created that incorporated a definition of active learning and required faculty to identify the level of engagement for each learning activity

according to the ICAP framework. This alternative focus allowed for a new instructional design model to be formed.

CHAPTER 3

ARTICLE #1: THE COLLABORATIVE ACTIVE LEARNING INSTRUCTIONAL DESIGN MODEL (CAL-ID): A COLLABORATIVE EFFORT TO INCREASE ACTIVE LEARNING IN ONLINE COURSE DESIGN

This is the draft of an article that I intend to submit to the Journal of Applied Instructional Design (JAID). This article presents the Collaborative Active Learning ID Model (CAL-ID) using reflection of an instructional designer during the implementation of the first iteration of the tool. Please feel free to visit JAID's guidelines for submission.

Abstract

The Collaborative Active Learning Instructional Design (CAL-ID) Model proposes a new instructional design model that encourages collaboration between a subject matter expert and instructional designer, active learning, and a thorough planning and design phase. In this article, I describe the components of the model for application as well as a case study to demonstrate how the model was used during an online course design and development process. The goal of this model is to help increase active learning in online courses and create a balanced, collaborative experience between a subject matter expert and instructional designer in a design and development process.

Keywords: *instructional design, online learning, practitioner, instructional design models, ICAP framework*

Introduction

Instructional designers (IDs) are essential to the development of online courses at higher education institutions. Their work is often defined differently depending on the department, division, or institution with which they work (Beirne & Romanoski, 2018; Intentional Futures, 2016). In a 2016 survey, Intentional Futures (2016) reported that

instructional designers' work involves designing, managing, training, and providing support for faculty and subject matter experts (SME) at institutions. Additionally, an instructional designer can be defined by their awareness and knowledge of learning theories, instructional design models, emerging educational technologies, and problem solving nature (Chartier, 2021). For the purposes of this article, an instructional designer is a professional who "works directly with faculty to provide pedagogical and instructional design consultation to support effective and innovative delivery of academic credit courses to online students" (University of North Carolina at Charlotte, n.d.-b). Instructional design is enacted collaboratively between the ID and SME in a constrained timeline, such as a semester-long project. Through this process, an entire online course is created and launched to students in a subsequent semester. In this article I will present a self-developed instructional design model called the Collaborative Active Learning Instructional Design Model (CAL-ID). As an ID, I use this model in my own design and development process at a higher education institution in the United States. By sharing this model, my goal is that it can be utilized by instructional designers at institutions that have implemented an online course design and development system as described.

Online Course Design and Development Process

Across the country, online courses at higher education institutions are developed in a variety of different ways. Throughout my 10 years in education, I have observed three distinct versions of online course development:

1. Faculty members create their own courses with little to no technical and/or instructional design support.

2. Instructional designers work as consultants to help solve technical and online pedagogical issues.
3. Instructional designers and faculty members work collaboratively over a set number of weeks to design and develop an online course.

For this collaborative model, the third type of online course design and development will be adopted.

In this version of development, an instructional designer and a faculty member work closely over the course of a semester (16 weeks). These 16 weeks can be divided into two phases: planning and development. The planning phase lasts about four-six weeks. When working with faculty members, I often define this phase as the "thinking" phase, as we are not building the actual course quite yet. Instead, the planning phase consists of creating a curriculum map that aligns directly with the course to be built. In this curriculum map, the faculty member and ID identify the topic to be studied, the objectives or content to be covered, the instructional materials needed, including readings, videos, and interactives, and identify the assessments that directly align with what the students will learn. Planning often takes place in weekly meetings. These meetings consist of check-ins and problem-solving discussions of how to present content and/or assess students in an online format. Once the curriculum map is finalized, we move to the development phase. The development phase lasts approximately 10-12 weeks and consists of creating the course in a Learning Management System. The level of detail in the curriculum map often dictates the length of the development phase. The more detailed the curriculum map, the less time it takes to create the course. Once the course is created, it is ready for students to be enrolled.

The model presented in this article is to be used during the planning phase. The goal of this new instructional design model is to encourage a high level of detail and organization of information to make the planning phase smoother and more efficient in online course design and development.

Active Learning in Online Courses

In the modality transition from face-to-face to online, faculty members often struggle to create learning activities and assessments using active learning strategies for teaching (Khan et al., 2017; Sanga, 2017). Active learning can be defined as "instructional activities involving students in doing things and thinking about what they are doing" (Eison & Bonwell, 1991). A faculty member's lack of experience with teaching online can make this transition even more difficult, especially when asked to design an online course without the support of an instructional designer. In addition to helping make the planning phase more efficient, the proposed model also encourages reflection regarding the types of and amount of active learning strategies.

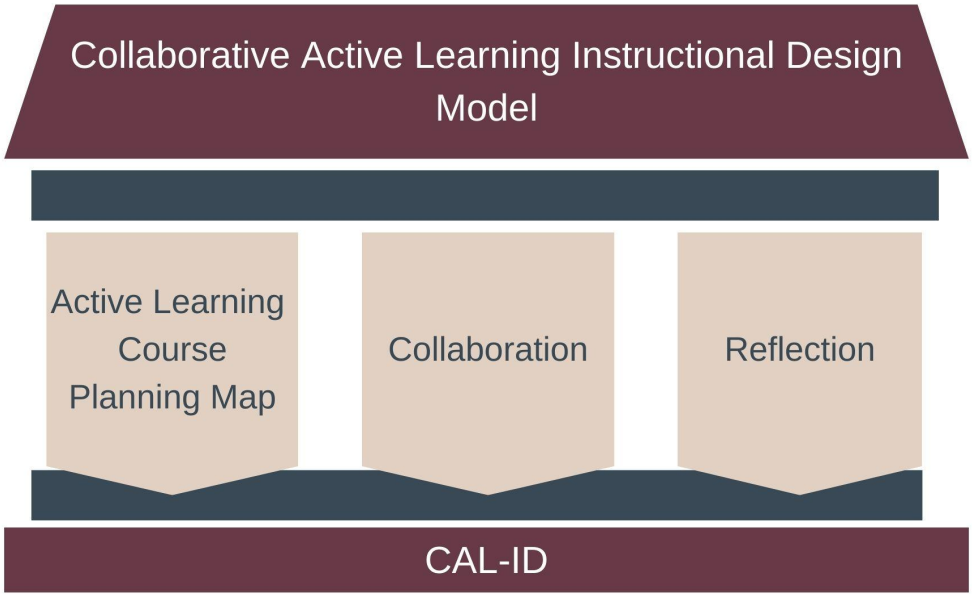
The Collaborative Active Learning Instructional Design Model (CAL-ID)

During a collaborative online course design and development process in Spring 2022, I used a podcast, *Be an Instructional Design Rockstar*, to share my thoughts, feelings, and reflections using a course planning map I developed, titled *Active Learning Course Planning Map*. To analyze these reflections, I first transcribed each episode of Season 2 and uploaded these into a single Google Doc. After transcribing, I conducted a brief preliminary exploratory analysis (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014) to begin looking for emerging themes. Once the data were initially reviewed, I uploaded the podcast transcripts into NVivo as a single file. Two cycles of

coding aligned with grounded theory were conducted. First, a line-by-line initial coding or - *open coding* - was completed. This allowed me to "remain open to exploring whatever theoretical possibilities" may have emerged from the data (Charmaz, 2014, p. 116). Initial coding helped me look for similarities and differences throughout the design process from the instructional design perspective (Saldaña, 2021). After the line-by-line coding, I reviewed the codes and merged any that seemed extremely similar. Looking for themes and creating a grounded theory, I conducted a theoretical coding analysis (Charmaz, 2014; Saldaña, 2014). Four themes emerged: a. working with the *Active Learning Course Planning Map*; b. collaboration between ID and faculty; c. use of reflection; and d. limitations. From these themes I have created the Collaborative Active Learning ID Model (CAL-ID) based on three pillars: the *Active Learning Course Planning Map* tool, collaboration, and reflection.

Figure 5

CAL-ID Model



Active Learning Course Planning Map

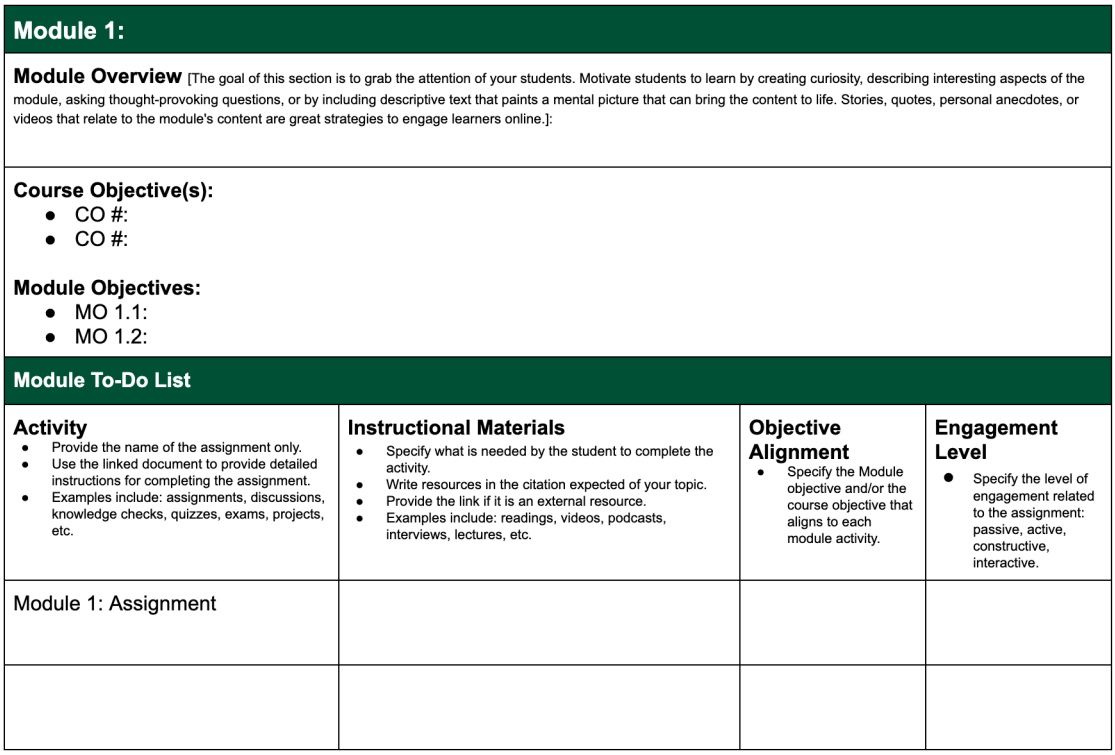
The *Active Learning Course Planning Map* was created during the Fall 2021 semester by the Course Production Team at UNC Charlotte. This document intentionally aligns course objectives, activities, and assessments. There are spaces in the map to list course objectives, module titles/topics, module overviews, module objectives, assignment names, instructional materials, and objective alignment identification. While filling out the *Active Learning Course Planning Map*, it is essential for the ID to present pieces in steps. For example, IDs should encourage SMEs to begin with course objectives, then create a modular outline with module objectives that directly aligns with the overall course goals. Once these are established, the ID and SME create a plan for instructional materials and assessments for each module. Thinking about how the course objectives, learning objectives and assessments align is easier than trying to develop everything at once.

To help increase the use of active learning strategies in the course, each activity and assessment is labeled with a level of engagement from the Interactive-Active-Constructive-Passive (ICAP) Framework. The ICAP framework is made up of four modes of engagement: interactive, constructive, active, and passive (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). The ICAP framework provides "specific domain-general guidelines for creating more engaging lessons as well as modifying existing activities to increase engagement" (Chi & Wylie, 2014, p. 220). This gives SMEs a concrete categorization for levels of students' engagement with each instructional material, activity, and/or assessment. The ICAP Framework can help guide and define specific engagement opportunities incorporated into the course (Chi, 2009; Chi et al.,

2018; Chi & Wylie, 2014). It is important to note that while the ICAP framework is a categorization of active learning, it does not prescribe an amount or percentage of engagement at each level that should be used in the course. Instead, the ICAP framework is used as a reflective tool during course design to analyze the amount and types of active learning represented in the course.

Figure 6

Active Learning Course Planning Map



Module 1:

Module Overview [The goal of this section is to grab the attention of your students. Motivate students to learn by creating curiosity, describing interesting aspects of the module, asking thought-provoking questions, or by including descriptive text that paints a mental picture that can bring the content to life. Stories, quotes, personal anecdotes, or videos that relate to the module's content are great strategies to engage learners online.]:

Course Objective(s):
- CO #:
- CO #:

Module Objectives:
- MO 1.1:
- MO 1.2:

Module To-Do List

Activity • Provide the name of the assignment only. • Use the linked document to provide detailed instructions for completing the assignment. • Examples include: assignments, discussions, knowledge checks, quizzes, exams, projects, etc.	**Instructional Materials** • Specify what is needed by the student to complete the activity. • Write resources in the citation expected of your topic. • Provide the link if it is an external resource. • Examples include: readings, videos, podcasts, interviews, lectures, etc.	**Objective Alignment** • Specify the Module objective and/or the course objective that aligns to each module activity.	**Engagement Level** • Specify the level of engagement related to the assignment: passive, active, constructive, interactive.
Module 1: Assignment			

Collaboration

The second pillar of CAL-ID is collaboration, specifically between the instructional designer and the subject matter expert (SME). During meetings, the ID works to create a positive, problem-solving oriented relationship with SMEs. Conversations between the ID and SME are collegial. During the design and

development process, the SME focuses on providing course objectives, content, and assignment instructions. At the same time, the ID designs and provides guidance for online pedagogy strategies. As the SME works through the *Active Learning Course Planning Map*, the ID provides timely feedback and plans discussions based on the course progress. The ID also works as a project manager to ensure that the course development meets certain milestones to ensure a successful launch of the course.

Reflection

During the design and development process, reflection is essential for both the SME and the ID. The SME uses the *Active Learning Course Planning Map* to reflect on the presentation of content, scaffolding of assignments from beginning to end, and the variety and types of active learning in the course. The ID will also use the *Active Learning Course Planning Map* to regularly reflect on the alignment between components of course including course objectives, instructional materials, assessments, and active learning strategies. Furthermore, the ID will reflect on strategies used for creating a positive working relationship with the SME. For example, SMEs come to the process with a variety of working styles, backgrounds and experiences working in the online course modality. Additionally, courses arrive with various levels of completion prior to coming through the process. Due to these circumstances, it is essential for the ID to adapt their approach towards each project and SME to ensure successful completion.

Using the Model in Practice

The CAL-IL Model was first implemented in Spring 2022 was the first semester during a design and development process. During this semester, I worked on five courses with six faculty members to build online courses. Each course had been taught in the past

and had great foundations in the types of resources and activities being used to teach the content. All five courses already had some level of active learning. Using the *Active Learning Course Planning Map*, I identified that three out of the five courses already had all four levels of engagements described by the ICAP Framework. For those courses, we worked to refine the levels of engagement available and added more instructor presence and/or media. For the courses missing a level, we collaborated on ideas to add student interaction through peer review, virtual discussions, and other tactics. The ICAP Framework became a tool to convey examples of active learning strategies that faculty members could use in their online courses and to help clarify the types of activities and assessments being planned for the course.

By having faculty members reflect on the student engagement level for each activity within the course, I had a greater picture of the alignment between objectives, instructional materials, and learning activities within the course. This then helped make our consultation meetings more about problem solving than providing information or clearing up confusion. Using the CAL-ID Model, consultations with faculty members became deeper and richer leading to a more well-rounded online course with various strategies for engagement and alignment.

Faculty Perspectives

After the initial implementation of the *Active Learning Course Planning Map*, I gathered feedback from the collaborating faculty members through conversations. As a whole, we realized the importance of reflection during the course design and development process. Four faculty members spoke to how much they thought about what students struggled with currently, and how to scaffold and present their content in a way

that promotes student success. This reflective response aligned with my own experience of our collaborative design meetings. Often our meetings concerned "how do I do this…?" in the online format. Through these collaborative meetings, one faculty member realized that their current presentation of content was not working. They then decided to streamline their content, use less textbook related content, and provide more tutorials for students. Additionally, faculty spoke to how reflecting on their teaching strategies using this framework helped them see where learning could be improved and consider how to incorporate more interaction. In one of my last consultation meetings, we reviewed a discussion forum where students posted questions and the faculty member would respond to the whole class in video format. The faculty member was debating between passive and active levels and explained why the xperience could be considered both. At that moment, I realized the faculty member had internalized the framework and was using it to improve their course.

Lessons Learned

To use the CAL-ID Model successfully, the SME and the ID must work on the course plan consistently each week, working through the *Active Learning Course Planning Map.* This phase (defined as the design phase) lasts approximately five-to-six weeks. First, staying on track during this time allows for greater reflection, alignment between activities and engagement levels, and opportunities for feedback. Without consistency, stakeholders are unable to mindfully reflect and discuss the specifics of the course before it is launched. Second, following the *Active Learning Course Planning Map* pillar in the CAL-ID Model means courses cannot be built directly into the Learning Management System (LMS). Stakeholders must plan the course using the *Active*

Learning Course Planning Map prior to developing the course in the LMS. Courses built directly into the LMS can use the reflection and collaboration pillars, but will not fully benefit from the CAL-ID Model. In future studies, I plan to explore the long-term effects of using CAL-ID in course design on student success and satisfaction.

Final Thoughts

The integration of the Collaborative Active Learning Instructional Design Model (CAL-ID) has the potential to increase awareness of the types and amounts of active learning in online courses. As discussed, subject-matter experts often struggle with creating learning activities that encourage more than just reading and watching a video (Khan et al., 2017; Sanga, 2017). The CAL-ID model provides a planning template, the *Active Learning Course Planning Map*, for subject matter experts and instructional designers to complete during the planning phase. Using this planning template encourages subject-matter experts (SMEs) to first consider their current learning activities and assessments and reflect upon the engagement level using the ICAP framework. Check-in meetings between the SME and instructional designer can then be more focused on how to increase levels of engagement and brainstorming teaching and learning strategies that the SME may not have considered. Additionally, the CAL-ID planning template provides an organizational structure for a smoother and more efficient development phase in the online course design and development process. My hope is that the implementation of the CAL-ID will encourage improvements to online courses that will help students succeed.

CHAPTER 4

ARTICLE #2: EXPLORING THE INTENTIONAL INTEGRATION OF ACTIVE LEARNING IN ONLINE COURSES: THE FACULTY'S PERSPECTIVE

This is the draft of an article that I intend to submit to the Online Learning Journal (OLJ). This mixed-methods research article explores the faculty perspective during an official design and development process using the Active Learning Course Planning Map. Please feel free to visit the OLJ's guidelines for submission.

Abstract

This mixed methods action research study explores the faculty perspective during an online course design and development process. Using a curriculum map that encourages active learning through reflection and collaboration between an instructional designer and faculty member, this study presents faculty member's thoughts, feelings, and beliefs towards intentionally and mindfully integrating active learning teaching and learning strategies into an online course. Initial findings suggest that using the *Active Learning Course Planning Map*, along with collaboration with an instructional designer helped in the planning and execution of online courses.

Keywords: *instructional design, online learning, ICAP framework, active learning, online course development*

Introduction

At the University of North Carolina at Charlotte (UNC Charlotte), designing and developing an online course takes time, planning, and collaboration. This is done in semester cohorts with faculty working directly with an assigned instructional designer. Each cohort lasts about 16 weeks with the first six-to-ten weeks focused on planning and the remaining time on developing the course. This study took place during the design

phase of the Spring 2022 cohort and set out to explore the relationship between the faculty member and the instructional designer (ID) while designing and developing an online course. During this time, I as an instructional designer worked directly with six faculty members to create five courses in the sociology, political science, and education departments. To help with the creation and thought process, I utilized a self-created document, the *Active Learning Course Planning Map*. This article presents and discusses the faculty perspectives of this process gathered through a survey and interviews.

Role of the Researcher

As the acting instructional designer, my role in this study involved being a participant, an observer, and a data collector. As a participant, I worked closely with the six participants (faculty members) who were developing an online course at UNC Charlotte during the Spring 2022 cohort. During this process, we collaborated to ensure that the learning objectives, instructional materials, graded learning activities, and assessments were aligned to help measure students' learning in relation to the course learning outcomes. As an observer and data collector, I adapted and created data measurement tools to collect both quantitative and qualitative data. For this study, I adopted a post-intervention survey to measure faculty responses and used interviews to explore the experiences working with me as the instructional designer. Finally, my role as the data collector involved ensuring participant confidentiality and data security as well as analyzing the final data to draw conclusions and respond to the research questions.

Review of Related Literature

Social constructivism and constructs of active learning are the driving theories for this study. Given the collaborative nature of online course design and development at

UNC Charlotte, the instructional designer and faculty members learn from one another throughout the process. To help consider and reflect upon the levels of engagement in the online course, I created the *Active Learning Course Planning Map* using tenets of the ICAP framework. This literature review describes each of these theories, how they have been applied in similar studies, and how these helped shape the development of this study.

Discussion of Social Constructivism

Social constructivism is based on the constructivist works of Piaget and Vygotsky (Amineh & Asl, 2015; Kim, 2001; Liu & Chen, 2010; Schrader, 2015; Schunk, 2012). Constructivism assumes individuals form and construct their own knowledge through what they learn and understand, with the help of their past experiences (Amineh & Asl, 2015; Schunk, 2012; Vygotsky, 1978). More specifically, it involves the construction, creation, and invention of individual knowledge and meaning-making (Liu & Chen, 2010; Schunk, 2012). Constructivism holds that reality does not exist outside its construction through human activity (Animeh & Ask, 2015; Kim, 2001).

Social constructivism considers the impact of knowledge created collaboratively and culturally. It assumes that groups of people create the properties of the world, and therefore, reality cannot be discovered individually, but is created collaboratively (Amineh & Asl, 2015; Kim, 2001). It regards knowledge is a byproduct of social and cultural interactions among groups. Meaningful learning takes place through the interactions and social experiences of individuals (Amineh & Asl, 2015; Kim, 2001). It assumes that learners are active within these experiences (Schunk, 2012). Through these interactions, individuals make meaning of this learning and assimilate it into their own

knowledge (Amineh & Asl, 2015; Kim, 2001). Thus, social constructivism promotes the use of curriculum and collaboration that actively involve participants through "social interaction" (Schunk, 2012, p. 231).

Limitations of Social Constructivism. Social constructivism assumes that learning only occurs when learners participate in social and active learning. Krahenbuhl (2016) described this as the need for physical activity for engagement and learning to occur. During the online course design and development process, there is an abundance of thinking and planning on the faculty's part prior to actually building the course. Although there are not physical, hands-on activities occurring, faculty members are still learning the process of curriculum design and best practices for online pedagogy. Due to this, we will assume that the relationship between the faculty and instructional designer represents a social learning allowing learning on the faculty's part to occur, regardless of the level of tangible discovery that occurred.

The reliance on social learning and building upon an individual's prior knowledge risks that participants may not draw the desired conclusions and/or create misconceptions in regards to the knowledge gained (Ford, 2010; Krahenbuhl, 2016). This means that faculty takeaways and lessons learned may be limited by their experiences with course design and active learning. Therefore, it was essential for the instructional designer to correct misconceptions and bridge the gaps of knowledge as the cohort progressed.

Related Studies. Using a case study research design, Lee (2018) explored what online courses with constructivist approaches, specifically Communities of Practice (CoP), could become when working to expand the boundaries of learning within the Learning Management System (LMS). CoP can be defined as ‘‘groups of people who

share a concern, a set of problems, or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis'' (Wenger, 1999, p. 4). Lee (2018) studied three online courses: one no CoP, one with the intent of building a CoP, and one built by applying the dual layered CoP model. Lee (2018) focused on one student in each course with similar professional and personal backgrounds. Lee found that authentic relationships and connections help sustain constructivist learning. This study suggests that the relationship built between the faculty member and instructional designer during the design and development process needs to be collegial and authentic. While the goal is to create an online course, the process must include respectful conversations and problem solving to allow learning to occur between the ID and faculty member.

Barak and Green (2021) studied the impact of a social constructivist pedagogical approach in an online research ethics course. Participants included 345 science and engineering graduate students in two courses: one with social constructivist approaches (N=175) and one control group with conventional approaches (N=170). The course built with social constructivist approaches incorporated the C3 instructional model, which includes collaborative learning, case-based learning, and contextual learning (Barak & Green, 2020). Through a pre-and-post intervention test measuring learning outcomes as well as in-depth interviews, Barak and Green (2021) found that learning occurred for both sets of students. However, students in the course with social constructivist approaches gained a greater procedural and epistemic knowledge of ethics and were able to apply the concepts of ethics and problem solve ethical issues in real-world scenarios. Furthermore, Barak and Green's (2021) study reiterated the need for social interactions

amongst students to share experiences and knowledge. These findings are important to the present study, as they reiterate the need for discussion between a faculty member and instructional designer during the design and development process of an online course. Consultation meetings allow both parties to bring their own experiences and perspectives to the course development process to discuss and problem solve possible active learning teaching and learning strategies. This allows a collegial relationship between the faculty member and ID and a learning opportunity for both parties.

Active Learning

Literature has shown that for retention of knowledge to occur, students must do more than just listen. They must actively take notes, problem solve, and/or engage in discussion (Eison & Bonwell, 1991). These instructional activities can be categorized as active learning, "involving students in doing things and thinking about what they are doing" (Eison & Bonwell, 1991, p. iii). One way to categorize active learning is through the levels of engagement employed. For this study, the Interactive-Constructive-Active-Passive (ICAP) framework has driven how the ID described these levels of engagement within an online course.

Interactive-Constructive-Active-Passive Framework

The Interactive-Constructive-Active-Passive (ICAP) framework is an empirically grounded framework that focuses on the students' own levels of engagement and works to define and guide engagement opportunities students can have while learning the content of a course (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). ICAP is divided into four modes of learning: interactive, constructive, active, and passive. The four modes build upon each other to increase learning and promote a deeper understanding of the

content with higher level thinking (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). The ICAP framework provides "specific domain-general guidelines for creating more engaging lessons as well as modifying existing activities to increase engagement" (Chi & Wylie, 2014, p. 220). Along with social constructivism, the ICAP Framework guides the teaching and learning techniques utilized in the intervention for this study. The following section will discuss the definition and limitations of the ICAP Framework and relation to this study.

Discussion of ICAP Framework. The ICAP framework relies upon three assumptions: a. students' behaviors and products determine the students' level of engagement, b. students' behaviors and products determine the cognitive-knowledge process change, and c. the correspondence between students' behaviors and knowledge change is not perfect (Chi et al., 2018). These assumptions rely heavily on behavioral engagement with content and the products students create from these engagements. Combined, these components can be indicators of students' cognitive process changes (Chi et al., 2018).

The ICAP framework is broken into four levels of engagement: interactive, constructive, active, and passive (Menekse & Chi, 2019). These change processes lead to a deeper level of learning then would be possible for learners on their own (Chi et al., 2018). As predicted by the ICAP framework, studies have found that students' post-test scores increase from the passive through the interactive levels of engagement (Chi & Wylie, 2014; Menekse et al., 2013).

Passive. Passive engagement is the lowest level of engagement with course content. Students read content, listen to audio, or watch a lecture without performing any

other tasks (Chi & Wylie, 2014). When students engage at the passive level, they are receiving information and storing the content knowledge. Prior knowledge is not activated leading to a lack of deep level of cognitive-knowledge change (Chi et al., 2018).

Active. The next level of the ICAP framework is active engagement. At the active level, students manipulate the content they are learning by pointing, taking notes, making observations, or rewatching parts of a lecture for better understanding (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). At this level, students may activate their prior knowledge causing the new content knowledge to be stored and linked with their previous knowledge about the topic (Chi et al., 2018).

Constructive. The third mode of engagement is constructive. In this mode, . In this mode, students activate their prior knowledge to make inferences that are deeper than the initial content presented (Chi et al., 2018). For example, they may explain concepts to others, draw a diagram representing what they learned, draw conclusions, rewrite notes in their own words, and reflect upon their learning (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). They may create a product that showcases knowledge beyond the content provided (Chi et al., 2018). At this level, it is important to examine the student products to determine whether students actually reached the constructive level of engagement (Chi et al., 2018).

Interactive. Interactive engagement is the highest level of engagement and promotes the deepest learning. In this mode, students interact with peers using their constructed learning and make inferences based on their peers' constructed knowledge (Chi, 2009; Chi et al., 2018; Chi & Wylie, 2014). Joint dialogue is essential in this mode,

as students should be interacting and learning new perspectives and understandings (Chi & Wylie, 2014; Delahunty et al., 2014). At this level, students' cognitive change processes include storing new knowledge, activating prior knowledge, inferring from their own, and inferring from others (Chi et al., 2018).

Limitations of ICAP Framework. First, the intended mode of engagement of a learning activity and the actual engagement may differ (Chi et al., 2018; Chi & Wylie, 2014). For example, we may assume that students are taking notes or rewriting notes in their own words while engaging with the instructional materials each week (active), but that may not be the case. Instead, students could be reviewing the instructional materials while cooking or driving with little to no interaction (passive). Additionally, students only reach the constructive and interactive levels when knowledge is inferred from self and from others. This is then based on assumptions, unless student products are collected and analyzed for signs of inferred information above and beyond the instructional materials provided (Chi et al., 2018).

Second, engagements at the interactive level may be dominated by one student, rather than being a joint dialogue (Chi & Wylie, 2014). Students would not be interactively engaged, since they would not be inferring from others forming a deeper level of learning (Chi et al., 2018; Chi & Wylie, 2014). Finally, the ICAP framework is not meant to predict whether or not one active learning technique is better than another. Rather, its purpose is to state that the levels of learning build upon each other (Chi et al., 2018). For example, many studies have found that the constructive level of learning proved to lead to more cognitive-knowledge changes than active and passive. However, there have been few studies relating interactive to constructive modes of learning. The

few studies have not found a large difference in learning between interactive and constructive levels of engagement (Menekse et al., 2013; B. L. Wiggins et al., 2017). Due to these limitations, the ICAP Framework was adopted in this study as a model of reflection for faculty members, to assess their own types and amounts of engagement levels. Reflection allowed faculty to visualize areas where more active engagement was needed and areas where more constructive and/or interactive engagement would be beneficial.

Related Studies. Lee et al., (2020) studied 71 undergraduate students enrolled in a flipped classroom elective covering communication and critical thinking skills.They defined a flipped classroom as theory being presented in an online format to be completed prior to the face-to-face application portion of the course. In the online modality, the students accessed content, discussion forums, and quizzes to check for understanding. During the face-to-face application, students applied theory to examine case studies, debated prompts, and conducted peer reviews on projects and assignments. To encourage students to complete the online portion of the course prior to attending class, participation points were awarded for taking the online quizzes and participating in a brief review at the beginning of each class.

For data collection, students were surveyed based on their participation with the online modules in the course. Lee et al. found that 57% of students engaged at a passive level when they read articles. They did not take notes or discuss the readings with anyone. When watching videos, 45% of students engaged at a passive level and 34% of students engaged at an active and constructive level. These results suggest that if the goal is to encourage students to actively engage with the instructional materials, we must

provide guided note takers and/or templates for note taking. Due to these findings, when the *Active Learning Course Planning Map* indicated a course activity was passive, I often suggested including a guided note taker or reading quiz that required students to actively engage with the material rather than passively read or watch.

Lim et al. (2019) studied 108 medical students. Participants were asked to read instructional material (self-study) and/or attend a lecture prior to being divided up into four groups: *lecture and question, lecture and summary, self-study and question,* and *self-study and summary* (Lim et al., 2019). Participants in the question groups were asked to develop three questions based on the instructional material they studied while the summary groups were asked to summarize the material they encountered. Both groups then participated in small group discussions to discuss the questions developed by each participant (Lim et al., 2019). Researchers found that members that generated their own questions performed better overall (Lim et al., 2019). This study reiterates the importance of allowing students to individually construct their own knowledge based on the instructional materials. Due to the findings of Lim et al., (2019), in consultation meetings I encouraged faculty members to take a close look at their constructive activities to ensure that students were truly generating their own questions and learnings.

Research Question

The purpose of this study was to explore the faculty perspective during the course design and development process at UNC Charlotte through the implementation of an *Active Learning Course Planning Map* and working directly with an instructional designer. The research question explored was:

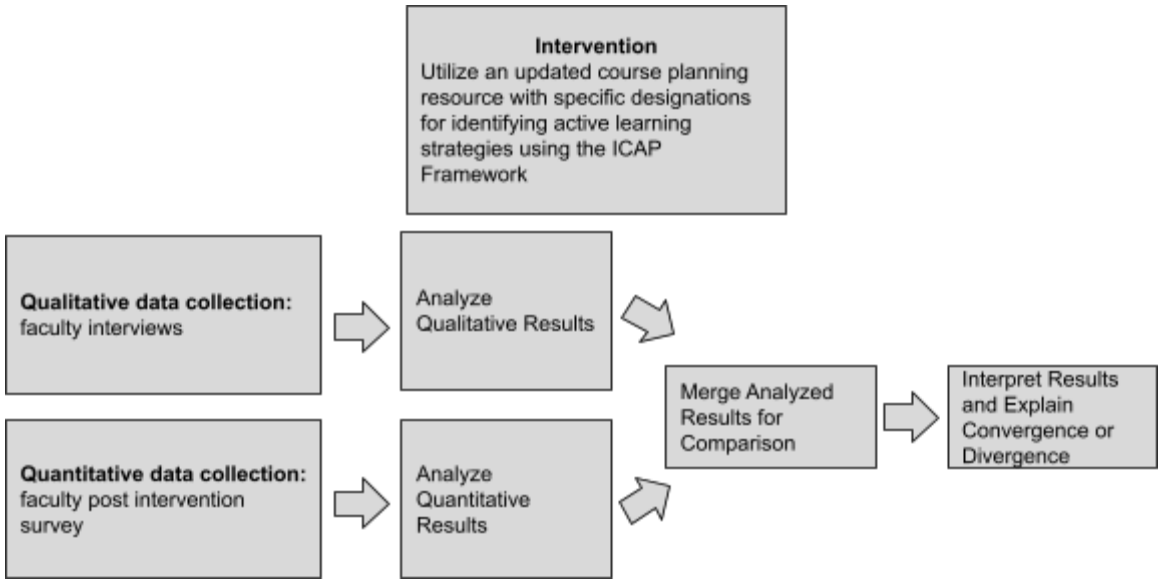
- How do faculty understand and implement ICAP principles and use the *Active Learning Course Planning Map* in the development of online courses?

Methods

Convergent parallel mixed methods design involves “quantitative and qualitative data to develop complete and valid conclusions" (Plano Clark & Creswell, 2014, p. 392). In this research design, quantitative and qualitative data are given equal priority and collected concurrently. However, both sets of data are analyzed separately and then merged to triangulate and interpret the findings (see Figure 7). In sum, convergent parallel mixed methods design draws on the advantages of both quantitative and qualitative data collection (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014, p. 392).

Figure 7

Convergent Parallel Mixed Methods Research Design



Note. Adapted from Figure 16.3 Creswell & Guetterman, 2019 and Figure 12.4 Plano Clark & Creswell, 2015.

Setting and Participants

This study took place during the Spring 2022 design and development cycle at UNC Charlotte, from January 10 to April 29, 2022. Nonprobability purposive sampling was used, or the selection of participants because they are convenient and "most appropriate for the study" (Plano Clark & Creswell, 2014). Faculty members working directly with me to develop courses were eligible for the study (n=6). At the beginning of the design and development process, these faculty members were provided with information about the planned research and had the opportunity to opt-out. All six faculty members consented to participate in the study.

Intervention

The goal of this study was to create a course planning map that encouraged faculty members to intentionally and mindfully implement active learning strategies using the different levels of the ICAP framework. Originally, the course planning map focused on breaking the content up into modules, creating module objectives, identifying which activities will be completed by students, and what instructional materials are needed to get students to meet the objectives. The original format did not encourage, explain, or provide places to identify the level of engagement students may have during the learning activities (see Figure 8).

Figure 8

Original UNC Charlotte Course Planning Map

Module 1:		
Module Overview		
Course Objective(s): • **Module Objectives:** •		
Module To-Do List		
Activity	**Instructional Materials (what is needed by the student to complete the activity)**	**Objective Alignment**

Prior to the Spring 2022 semester, I worked directly with my colleagues at UNC Charlotte to update the current course planning map to include definitions and descriptions of:

- course learning objectives.
- backwards design.
- active learning and ICAP Framework.

A column was added to each module to encourage faculty members to align each learning activity with a level of the ICAP framework (*interactive, constructive, active, and passive*).

Figure 9

Active Learning Course Planning Map

Module 1:			
Module Overview [The goal of this section is to grab the attention of your students. Motivate students to learn by creating curiosity, describing interesting aspects of the module, asking thought-provoking questions, or by including descriptive text that paints a mental picture that can bring the content to life. Stories, quotes, personal anecdotes, or videos that relate to the module's content are great strategies to engage learners online.]:			
Course Objective(s): ● CO #: ● CO #: **Module Objectives:** ● MO 1.1: ● MO 1.2:			
Module To-Do List			
Activity ● Provide the name of the assignment only. ● Use the linked document to provide detailed instructions for completing the assignment. ● Examples include: assignments, discussions, knowledge checks, quizzes, exams, projects, etc.	**Instructional Materials** ● Specify what is needed by the student to complete the activity. ● Write resources in the citation expected of your topic. ● Provide the link if it is an external resource. ● Examples include: readings, videos, podcasts, interviews, lectures, etc.	**Objective Alignment** ● Specify the Module objective and/or the course objective that aligns to each module activity.	**Engagement Level** ● Specify the level of engagement related to the assignment: passive, active, constructive, interactive.
Module 1: Assignment			

Timeline and Procedure

During the Spring 2022 online course production process, I conducted individual virtual meetings with the faculty members weekly. Each meeting had a specific agenda and flow to make the online course design and development process intentional and mindful. This study focused on the first ten weeks of the process, the course design and planning phase. I describe this phase as the “thinking” phase, as we are not building the

actual course quite yet. Instead, we are completing the *Active Learning Course Planning Map* and creating a detailed plan of the course.

Weeks 1-2. During weeks 1 and 2, faculty were enrolled in an online course production onboarding course. The goal of this course was to introduce faculty to the official course production process and begin the initial steps of course design. In Week 1, faculty were asked to introduce themselves to their peers and submit a possible modular outline of the specific topics covered in their course. An initial introduction email was sent to each faculty member I was working with to get to know one another and begin building the instructional designer/faculty member relationship. As faculty members submitted their proposed course outlines, I began filling out the *Active Learning Course Planning Map* with the information provided. In Week 2, the first consultation was conducted. This meeting lasted about 30-45 minutes and consisted of faculty members describing "a day in the life of a student in [their] course" and discussing any concerns or challenges they may face during the course production process. During this meeting, I introduced the *Active Learning Course Planning Map* and encouraged faculty to share content and/or courses that they had already created.

Weeks 3-10. These weeks were dedicated to filling out the *Active Learning Course Planning Map.* After our initial meeting and discussions, I trained the faculty members to use the *Active Learning Course Planning Map* by creating the first module with them in a virtual meeting. During this meeting, I defined the different components of the map:

- Module Topic: What is being taught?

- Module Overview: How does this topic and content relate to the bigger picture? How will they use this information and skills in future careers?
- Course Objectives: Which course objectives align to this module?
- Module Objectives: At what level of knowledge should students integrate the content into their own lives?
- Instructional Materials: What readings, videos, case studies, interactives, etc. do students need to engage with to learn the content?
- Learning Activities/Assessments: How will you have students practice the knowledge they have learned? Will students interact with the instructor or their peers? How will you know students have learned the materials you intended?
- Module Objective Alignment: A mental reflection and check to see if the content aligns with the goals of the module.
- Level of Engagement: At what level of the ICAP Framework is the student interacting with the proposed instructional material, learning activity, and assessment?

Depending on the number of modules to be developed, faculty were assigned three-to-five modules a week to complete on their own. Prior to our weekly meeting, I would review the *Active Learning Course Planning Map* and prepare discussion points on areas ensuring alignment between objective and content, brainstorm alternative ways to engage students, and/or discuss challenges that faculty had while working independently. These weekly meetings were a way to catch up with one another, plan the course completely, and ensure that there were various ways to engage students throughout the course.

Data Collection Instruments

Given the convergent parallel mixed methods approach, both quantitative and qualitative data were collected. The quantitative instrument included an adapted post-intervention survey created using a Google Form. The qualitative instrument was an interview conducted with the participating faculty at the end of the process (see Appendix A).

Post-intervention Survey. Attitudinal measures are meant to "measure participants' feelings towards topics" (Plano Clark & Creswell, 2014, p. 241) and often ask participants to "rate their level of agreement" with a statement (p. 241). The survey adapted for this study (Drysdale 2019) measured how the collaborative mapping model had "influenced the experience of faculty designing and developing learning experiences in partnership with an instructional designer" (p. 66). The survey consists of eight closed-ended, Likert-scaled questions ranging from *strongly disagree* (1) to *strongly agree* (6). These questions set out to measure faculty's experiences working with an instructional designer while using a course planning map. The survey was collaboratively created and field tested by instructional designers, faculty, and additional researchers to ensure validity of the survey (Drysdale, 2019). All participants (n=6) in this study were sent the survey at the end of the development process. See Appendix A for the specific measurement tool.

Faculty Interviews. Faculty interviews were conducted virtually over Zoom using the faculty interview protocol (see Appendix A). Each interview lasted about 15-to-30 minutes. Interviews were audio recorded with closed captions. The closed captions were then used as transcriptions and reviewed for accuracy.

Data Analysis

Post-intervention Survey. Four out of six faculty members completed the post-intervention survey, for a response rate of 66.7%. Survey data was downloaded and organized in SPSS. Descriptive statistics was calculated including mean, mode, and standard deviation.

Faculty Interviews. To analyze the faculty interview questions, I first downloaded the faculty interview audio files and transcripts to a Google Drive folder only accessible to me. Files were renamed with the labels of "Faculty #1, Faculty #2, Faculty #3, … Faculty #6" and the original Zoom files were removed. After this process, I conducted a preliminary exploratory analysis (Creswell & Guetterman, 2019; Plano Clark & Creswell, 2014) reviewing the audio files and updating transcripts to ensure accuracy and remove any references to people or places. After completing the initial review, I uploaded the interview transcripts into NVivo and organized the interview data into 10 cases containing each of the interview questions. I then added each participants' response to the respective interview questions. Two cycles of coding were completed. Due to the nature of the research question exploring how faculty understood and implemented a process, the first cycle of coding consisted of line-by-line coding analysis using *in vivo* codes. The main goal of utilizing in vivo codes was to "preserve the participants' meanings of their views and actions in the coding itself" (Saldaña, 2021, p. 141). Once the interview transcripts were coded, I reordered the codes alphabetically and began to look for relationships. *Focus coding*, reviewing common relationships among codes and grouping them into major themes and categories found throughout, was used as my second coding technique (Creswell & Guetterman, 2019; Plano Clark & Creswell,

2014; Saldaña, 2021). My last step was to interpret these themes using in vivo codes from the faculty interviews.

Results and Discussion

This study explored the question, "How do faculty understand and implement ICAP principles and use the *Active Learning Course Planning Map* in the development of online courses?" The participating faculty members were familiar with the tenets of active learning and already used a variety of active learning strategies in their courses. Guided by the *Active Learning Course Planning Map,* the ICAP framework helped the participants categorize different types of active learning and reflect upon the proper alignment of ICAP, learning activity, and learning objective. Three major themes emerged from faculty interview: (a). thoughts about the Active Learning Course Planning Map, (b). Active Learning and the ICAP framework, and (c). impact on course design. See Appendix B for aligned direct quotes from each theme.

Thoughts About the Active Learning Course Planning Map

Among the surveyed faculty participants (*n=4*), responses indicated agreement (5.13 with a *SD* of .32) about the usefulness of the *Active Learning Course Planning Map* (see Table 6).

Table 6

Faculty Survey Results for Active Learning Course Planning Map Questions

	N	Min	Max	Mean	Std. Deviation
[The Active Learning Course Planning Map was useful for evaluating the design and structure of my course.]	4	5	6	5.50	.577
[Collaborating on a course map made teaching my course more seamless]	4	4	5	4.75	.500
[The collaborative mapping model improved the quality of my course design work as a faculty member.]	4	5	5	5.00	.000
[The Active Learning Course Planning Map helped me evaluate my course in ways I had not previously considered.]	4	4	6	5.25	.957
Average	4	4.75	5.50	5.1250	.32275
Valid N (listwise)	4				

Faculty interviews aligned with this conclusion. Participants reported finding the planning map to be a useful, reflective, flexible tool. One faculty member called the tool "very beneficial" and said it helped the participants "push themselves to think about all the resources that are needed." The tool also helped faculty to stay organized and structured, and to think about all of the pieces throughout the course including the alignment between what students needed to know (objectives), how students learn it (activities) and how students show their knowledge (assessments). Participants were able to return to the map throughout the process to see the details of the course. They were also able to "jump around" and "know that it wasn't restrictive and allowed for some flexibility." Once faculty participants finished designing the course, they often returned to the map to review and edit each piece while keeping the big picture in mind with ease.

Thoughts About Active Learning and ICAP Framework

The ICAP Framework was new to faculty, while the idea and implementation of active learning was not. The ICAP Framework allowed faculty to reflect and be challenged "to make the things that students are actually doing with the instructional materials and working on in order to meet the objectives in the course as active and as deeply engaged as possible." Furthermore, the framework and examples provided helped the faculty, specifically with little to no experience with online teaching, integrate active learning strategies that they had not known were possible in the past.

Impact on Course Design

Among the surveyed faculty ($n = 4$), responses indicated that there was agreement (5.31 with a *SD* of .34) about the benefits of directly working with an instructional designer to create an online course (see Table 7).

Table 7

Faculty Survey Results for Working with Instructional Designer Questions

	n	Min	Max	Mean	Std. Deviation
[The quality of my course improved from working with an instructional designer.]	4	6	6	6.00	.000
[I plan to collaborate with an instructional designer on a course map again in the future.]	4	5	6	5.25	.500
[Creating a course map made me more open to developing the course (writing assignments, etc.) with an instructional designer.]	4	4	6	5.00	.816
[Collaborating with an instructional designer on a course map saved me time designing my course.]	4	5	5	5.00	.000
Average	4	5.00	5.50	5.3125	.23936
Valid *n* (listwise)	4				

Faculty interview responses were aligned with faculty survey results.

Collaboration between the faculty, instructional designer, and instructional media designer helped create alternative opportunities for learning. Faculty reflected that this process of using the *Active Learning Course Planning Map* helped make their course "more clearly identified" and will allow students to "come away with a much better experience." An example of a course change is including interactive lectures using Articulate Rise, scaffolding a course into smaller chunks of information.

Further Considerations and Next Steps

The data results make it apparent that participating faculty members appreciated the scaffolded, collaborative approaches to the UNC Charlotte course design and development process. However, further studies are needed to determine whether the integration of the ICAP framework increases active learning in online course development. Most of the faculty in the study were already familiar with active learning and integrated it into their course. They also had familiarity with creating learning objectives and aligning assessments. These could have been factors in the *Active Learning Course Planning Map* success. Given the positive experiences faculty had while collaborating with an instructional designer, additional studies could also be conducted exploring this relationship. Comparing how different instructional designers collaborate with faculty members using the *Active Learning Course Planning Map* could also help determine whether the tool or the ID has a greater impact on the overall course design. However, in this initial study, we can conclude that the *Active Learning Course Planning Map*, along with the collaborative work with an instructional designer was an asset that helped in the planning and execution of the final online courses for the Spring 2022 cohort at UNC Charlotte.

CHAPTER 5

A BRIEF DISCUSSION OF CONTRIBUTION TO THE ONLINE LEARNING FIELD

As an online learning thought leader and advocate for student success, my goal is to share my own experiences of working with subject matter experts (SME) as we develop online courses. This action research study focused on the problem of practice surrounding the transition of face-to-face courses into the online modality while promoting the use of active learning strategies. From this work, I have:

- proposed the Collaborative Active Learning Instructional Design Model (CAL-ID) to help guide instructional designers in their work of creating online courses.
- explored the intentional integration of active learning while investigating the relationship between IDs and SMEs during a course development process.
- created an instructional design podcast to grow and share within the online learning field.

In addition to summarizing below, I also conducted a final conclusion Podcast discussion episode on *Be an Instructional Design Rockstar* podcast.

Proposed Instructional Design Model and Application

With the support of my colleagues at UNC Charlotte, I created the *Active Learning Course Planning Map.* In past online course design and development cohorts, curriculum maps were used as a way for the faculty member to create a brief outline of planned for modular topics, instructional materials, and learning activities. The original format tended to encourage low-level thinking, resulting in a checklist of resources. While this made the course planning phase short, the lack of detail made it difficult to

start building the course in the learning management system. Weekly meetings were also more of a check-in with conversations surrounding challenges they are facing with meeting deadlines and/or how to make a specific learning activity in the online modality.

With the introduction of the *Active Learning Course Planning Map*, faculty were encouraged to reflect more, identifying the levels of engagement for each planned learning activity. They become more intentional and detailed with their chosen learning activities. Because of this, I could make my feedback and questions more specific and our weekly meetings much more productive. The creation of the course within the Learning Management System became much easier because I had a greater understanding of the overall picture of the course.

While the *Active Learning Course Planning Map* made the design phase much smoother between the faculty member and myself as the instructional designer, there were limitations. First, the amount and types of active learning did not increase with the use of the *Active Learning Course Planning Map.* However, it did make faculty more reflective and intentional with the types of learning activities that they chose to integrate into the course. Second, the use of the Collaborative Active Learning Instructional Design (CAL-ID) model requires weekly progress towards the course design. If the course progress falls behind, it is difficult to truly reflect at the level needed to use the *Active Learning Course Planning Map.* Finally, courses cannot be built in the learning management system while simultaneously filling out the *Active Learning Course Planning Map.* There must be a distinct planning and development phase in the process for the *Active Learning Course Planning Map* to be beneficial for the course design. Even with these limitations, the *Active Learning Course Planning Map* improved the

overall online course design and development process for myself as the instructional designer.

Contributions to the Online Learning Field

Since starting the dissertation process, my goal has gravitated towards becoming a thought leader and innovator within the online learning field. As a result, I created a podcast called *Be an Instructional Design Rockstar* that became a tool for reflecting upon the day-to-day work that I do as an instructional designer. This podcast has allowed me to share my own experiences and reflections as an instructional designer. With an average of 29 listeners per episode, I have begun opening the door for an instructional designer community to share perspectives, backgrounds, challenges, and improve online learning for all students. I truly look forward to seeing how this podcast transforms after this dissertation process.

Next Steps

As an instructional designer, it is often difficult to see the impact of our work on student success and learning. We work directly with SMEs to create online courses that students will then enroll in and complete. Feedback from students is indirectly given from faculty through an unofficial and volunteer basis. As described in Chapter 2, earlier cycles in this action research dissertation study were focused on attempting to bridge that gap. Unfortunately, due to unforeseen circumstances with the chosen course, data were unable to be collected from students to see the direct impact of an official instructional design cycle on student success and learning. With the creation of the Collaborative Active Learning Instructional Design Model (CAL-ID), my goal is to continue utilizing

this model with faculty and begin integrating data collection techniques that showcase the impact of instructional design on students.

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APPENDIX A

RESEARCH STUDY INSTRUMENTS

Cycle 0 Research Protocols

Student Questions

1. How do you define interaction? How would you define interaction in online courses? How and where do interactions take place?
2. Tell me about a time when you were part of an interaction that took place online.
3. How did the online interaction differ from a face-to-face interaction you have had?
4. How has learning through peer interactions impacted you?
5. Tell me about a time when you learned through a peer interaction?
6. What are your thoughts in regard to peer interaction online?
7. How has participating in interactions between peers affected your communication skills? …your interpersonal skills? ….your abilities to work with others?

Faculty/Instructional Designer Questions

1. How do you define interaction? How would you define interaction in online courses? How and where do interactions take place?
2. What are your thoughts of online interactions?
3. Do you ask your students to engage in online interactions? If so, why and what type? If not, why not?
4. From your perspective, what do you expect students to learn from interactions in online courses?
5. If you had to compare face-to-face interactions to online interactions, how are they similar? How are they different?
6. What skills might students develop because they participate in interactions in online courses?

Cycle 1 Research Protocols

Pre and Post Student Survey

1. Last 4 digits of phone number
2. Middle initial

Demographics Questions (Required)

1. Gender: How do you identify?
    a. Male
    b. Female
    c. Non-Binary
    d. Prefer not to answer

    e. Prefer to self-describe, below:
2. Which category includes your age?
    a. 18-20
    b. 21-29
    c. 30-39
    d. 40-49
    e. 50-59
    f. 60 or older
    g. Prefer not to answer
3. Which of the following best describes you?
    a. Asian or Pacific Islander
    b. Black or African American
    c. Hispanic or Latino
    d. Native American or Alaskan Native
    e. White or Caucasian
    f. Multiracial or Biracial
    g. A race/ethnicity not listed here (please specify)
    h. Prefer not to answer

Active Learning (in Post-Survey ONLY)

Construct #1: Classroom Climate

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. My class experiences have made STEM seem more interesting to me.
2. My class experiences have stimulated my enthusiasm for STEM.
3. My class experiences have made the STEM field seem more attainable.
4. My class experiences have made me feel more enthusiastic about learning STEM.
5. My class experiences have increased my confidence in my ability to do STEM.
6. My class experiences have made the idea of taking advanced STEM classes seem more possible.

7. My class experiences have helped me see that there are other students like me in STEM courses.
8. My class experiences have given me an opportunity to work with other students who like STEM.
9. My class experiences gave me the opportunity to discuss scientific ideas with classmates.
10. My class experiences gave me the opportunity to discuss possible explanations with classmates.

Construct #2: Recognition as a Scientist in the Classroom

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. My assignments in the class allowed me to demonstrate my ability to analyze and evaluate evidence.
2. My assignments in the class provided opportunities to demonstrate my reasoning skills to my professor.
3. My professor recognized my intellectual contributions to class discussions.
4. My assignments in the class provided opportunities to demonstrate my reasoning skills to my classmates.
5. My classmates recognized my intellectual contributions to class discussions.

STEM Identity

Construct #1: STEM Identity

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. I intend to complete a degree in the STEM field.
2. I am confident in my ability to succeed in my university STEM courses.
3. I have a strong sense of belonging to the STEM community.
4. It is my choice to study in the STEM field.
5. I have come to think of myself as being associated with the STEM field.
6. Being labeled a "STEM person" is an important reflection of who I am.
7. I feel like I belong in the STEM field.
8. I am a "STEM person".
9. I am like other STEM students.
10. I am representative of what it means to be a STEM student.
11. My personality and values are similar to most STEM students.
12. I feel like I belong with other STEM students.

Construct #2: STEM Career Aspirations

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. I would enjoy a career in STEM.
2. I have good feelings about a career in STEM.
3. Having a STEM career would be interesting.
4. I would like to have a career in STEM.

Construct #3: STEM Motivation

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. I am confident in my ability to do well in STEM courses.

2. I am confident in my understanding of the material in my STEM courses.
3. I am successful in my STEM courses.
4. My STEM courses are valuable to me.
5. My STEM courses are important to me.

Student Reflection Questions

1. Prior to the feedback session with my peers, what knowledge did I bring? What was I still struggling with?
2. After participating in the feedback session with my peers, what new knowledge did I take away? Are there any areas that are still unclear?
3. Did this activity change your view of yourself as a "STEM person"? Why or why not?
4. On a scale of 1 (not engaged) - 5 (highly engaged), how would you rate your level of engagement with the assignment? Why?

Cycle 2 Research Protocols

Faculty Survey

The construct questions will be answered with the following scale:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Somewhat Disagree
- 4 = Somewhat Agree
- 5 = Agree
- 6 = Strongly Agree

1. The quality of my course improved from working with an instructional designer.
2. I plan to collaborate with an instructional designer on a course map again in the future.
3. Creating a course map made me more open to developing the course (writing assignments, etc.) with an instructional designer.
4. Collaborating with an instructional designer on a course map saved me time designing my course.
5. The *Active Learning Course Planning Map* was useful for evaluating the design and structure of my course.
6. Collaborating on a course map made teaching my course more seamless
7. The collaborative mapping model improved the quality of my course design work as a faculty member.
8. The *Active Learning Course Planning Map* helped me evaluate my course in ways I had not previously considered.

Open-Ended Question: How has collaborating with an instructional designer in this model of course design helped you most as a faculty member?

Faculty Interview Protocol

1. What words or feelings come to mind when you think about the online course design and development process you just experienced?
2. What was your overall experience in working with an instructional designer?
3. Had you gone through a course design and development process with UNC Charlotte before?
    a. If yes, interviewer will go to question #4.
    b. If no, interviewer will go to question #5.
4. How would you compare the use of the *Active Learning Course Planning Map* with your previous experiences?
5. How would you rate the amount of active learning you have in this developed course compared to previous courses you have developed?
6. After going through the process, what was your overall experience in working with the *Active Learning Course Planning Map*?
7. What was your greatest takeaway from the design and development process?
8. What lesson(s) from this experience will you take with you to your future courses?
9. On a scale of 1-10, with 1 being the lowest and 10 being the highest, how would you rate:
    a. The variety of active learning strategies in your course?
    b. The amount of active learning strategies in your course?
10. Anything you would like to add about the process?

APPENDIX B

PRESENTATION OF DATA

Theme (Second Coding Cycle)	**InVivo Code (First Coding Cycle)**	**Researcher's Interpretation**
Active Learning Course Planning Map	"one of the things that I think of that goes right along with that structure and organization that I also like really appreciate is that kind of backwards design piece. So just like with this course planning map, having the opportunity to think through. How do all the different pieces of alignment kind of work together? And how is each piece that I'm working on contributing to the ultimate goals that I have for the course" "But I found the tool itself to be very beneficial. To organize the materials you need thinking about the objectives and how they align. And then it really pushed me to to think about all the resources that are needed. When I teach each of those modules." "but I think it serves a purpose to tie in everything that we're doing. So the students did understand. Oh, this isn't just random activities I'm engaging in. But they actually do you know coalesce to achieve this this bigger purpose." "I mean it was an incredibly like key organizational structure in the process right like being able to come back to it like I mean build it out, but then be able to come back to it. I mean just as recently as the past couple of days and link things, and it became sort of like a one-stop shop" "I started with module one, but I	Participants found the course planning map to be a useful, reflective, flexible tool. The tool helped faculty stay organized, structured and think about all of the pieces throughout the course including the alignment between what students needed to know (objectives), how students learn it (activities) and how students show their knowledge (assessments). Faculty were able to return to the map throughout the process to see the details of the course. Once faculty finished designing the course, they often returned to the map to review and edit each piece while keeping the big picture in mind with ease.

	think I jumped. I jumped around and I think that's okay it allows for a person who's working on it to you know it's not restrictive. I would say right. if that makes sense. it allows for some flexibility" "So most of us were never taught how to teach and it's sort of starts pulling together the Why, and you know, I ask myself, often is is a student going to take away from this what i'm hoping they do how be honest, it's really exciting when they tell you they did I mean so? Yeah, get into the purposeful meaningful reason why we do what we do." "It helped organize the thoughts" "You know I came from a world that if you want to know what was on an exam, it was like. Well, it could have been anything in the last 10 chapters, you know. Thanks that that narrowed it down. But what was I really supposed to be taking away from that? So this process it forces. It forces all of us faculty to look at this from a very, a very honest approach point. Why am I asking a student to do this assignment Because if there's not a real a real answer to the why? Other than Hey it's cool or Oh, I did it I had to go through it, which that's i'm sorry that's not really a valid response." "one of the things I loved about It was it kept me attending to course objectives module objectives" "I am all about increasing engagement for students, and so and	

	doing that in a meaningful way, right like not doing it superficial"	
Active Learning and the ICAP Framework	"The ICAP framework was new to me, and so that was something that I appreciated. You explaining and giving us like concrete examples before we worked through it. But yeah, I mean, I overall really like positive experience. I appreciate it being sort of like a home base, so to speak. For the process." "And when we started moving more into learning about even the the early days of active learning, opened up a door for me. This world from me that I had never pondered. You know I thought about this from even a student person who, going Wow! The this would have made, they would have made college courses more meaningful." "Because I do think you know, especially with online modules that students have to do. They do want something different than a Powerpoint right? like some some different type of presentation. Medium. and so I asks how I think each of our strengths have come through right, and been able to just coalesce and to to produce a soon to be finished." "But I feel like the engagement level remains I mean the same. We just didn't have like a name or a framework for it." "But so okay, connection had never more been made. So this really clarified the the active learning that I am having students engage in. So I	The ICAP Framework was new to faculty, while the idea and implementation of active learning was not. The ICAP Framework allowed faculty to reflect and be challenged "to make the things that students are actually doing with the instructional materials and working on in order to meet the objectives in the course as active and as deeply engaged as possible. Furthermore, the framework and examples provided helped the faculty, specifically with little to no experience with online teaching, integrate active learning strategies that they had not known were possible in the past.

	thought it was pretty awesome” “but some of what I was having students previously do in other classes. I had not really identified it as active learning, you know, to me a quiz. I had never thought about that as being active. it was just a quiz” “But what I thought about was like as we did go through each activity and reflect on the level. I was like, Oh, wow! right like we are engaging them in, you know. I mean the hope, and the goal is always to engage them in active learning, right. But to actually think about it, and see it in relation to the examples you gave and into relate in relation to the framework. That was actually really exciting.” “I had never thought about active learning before this semester.” “I think one you gave me a framework smart with 2. You gave me ideas. So then, like process and work and work with and work on, and 3, you gave me ways in which to think about how to make things seamless. Make things a little more clear. make things a little more interactive” “My background is in in an inquiry-based science, right student standard instruction. I love teaching right. I love pedagogy in It is my job to teach my teachers as to model for my teachers how to engage young learners right. And so in my courses, it is my goal right to to be interactive, right and be engaging with with the	

	students. And so a lot of what? a lot of the base for this course You will also see right in my in my face-to-face. Courses, I will say, for asynchronous course. Right for asynchronous course I don't know i've never done a asynchronous science methods. Course, all right, so I can't compare with it to happening, correct, The interactiveness of this schools designed would have been more than out of reduce it. But it is at its course to closely up like before you you know i'm saying, if that makes sense the things that I still say is that interacting this and engagement was added to right and and upped because of the different methods of It's not a powerpoint it's something else for the students to move through right like, and I don't know that's called but that that other click-through right piece that that you show me. And we think about the interactive lesson plan right piece that that that you put together and also like that lab, that lab safety right interactive. Those are added pieces that I think make thing have have upped the interactive game in this. In this class that I did not. I did not have the the knowledge, or know how or right like in that is what I think. You as an instructional design coach we're able to again your strength, lifted it. Elevated right? What? what? This interactive, course. had it as its base right to make it even more interactive if that makes sense. Yes, I think we we increased in the interactive space which is saying a lot for a teacher who already considers himself an engaging in interactive Professor”	

	“The constructive components, all of those pieces completely active in this online format. And I really appreciate that. I think this process supported us to do that as well.” “to be honest with you I think it's something that I've always been kind of mindful of student engagement, and maybe that's the the elementary teacher in in myself before coming to higher ed” “what I loved was How you and [the IMD] came in and said Okay, how can we make the this interaction with the assessments and the case. Study right be more active, and also provide students and opportunity and this is something that [the other faculty] and I talked about long before.” “I'm allowed to think outside the box.” “The difference was, so we had the activity piece we had the instructional materials piece, and we had the objective alignment piece on. We didn't have was the engagement level piece so this was also the first time working with icap framework for me. I think that this piece is particularly helpful, similar to the ways that [the other faculty] described. But one of the things that I think is helpful about this piece is because, even like, even if we're not using these words or haven't been using some of these words to talk about the different engagement levels in the past like the passive, active, constructive, interactive I think in [our] conversations together about	

	what we do in class, both in in-person and in online formats. We're always asking ourselves, Well, we know what our goals are for what students learn. But what are they gonna do right? And so thinking about Well, how are we engaging students in the content? In the most active ways possible, so really aiming for. Certainly there are some elements right where students may passively engage in some resources, but I think we work really hard to make sure that we are having students meaningfully engage in all of the resources as much as we can in those active constructive and interactive spaces the cause. And so I think it's really helpful to just have that mapped out and really clear, so that we can also challenge ourselves to make the things that students are actually doing with the instructional materials and working on in order to meet the objectives in the course as active and as deeply engaged as possible."	
Impact on Course	"But I think one of the things that may that some of like i'm thinking about the videos and how [the IMD] made those more approachable or accessible to students I, My hope is that, and my hope is that they engage with those right and those become part of the learning as well." "I think students will we'll come away from this with a much better experience than what I have been able to provide up to this point." "it's probably about the same it's just more clearly identified." "And I think, actually make this	Collaboration between the faculty, instructional designer, and instructional media designer helped create alternative opportunities for learning. Faculty reflected that this process of using the Active Learning Course Planning Map helped make their course "more clearly identified" and will allow students to "come away with a much better

	course even better for the next group of students.”	experience.” An example of a course change is including interactive lectures using Articulate Rise, scaffolding a course into smaller chunks of information,