THE EXPERIENCES OF BIOLOGY INSTRUCTORS AT A COMMUNITY

COLLEGE WITH THE INVERTED CLASSROOM:

A PHENOMENOLOGY STUDY

by

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DEDICATION

This project is dedicated to my wife, Beverly. I am the luckiest man alive to have you as my life partner. Beverly, I love you!

My mother and father would have been very proud of this moment. There would have been a big "*fiesta*" in Corpus Christi, Santana-Villarreal style!

project. Thank you. Thank you, Dr. Jovita Ross-Gordon. Your work in adult learning has been inspirational as I worked on this project. I was present at a recent lecture you facilitated; I am delighted that you continue to inspire other doctoral students by your continued work in our discipline.

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LIST OF ABBREVIATIONS

Abbreviation	Description
CIT	Critical Incident Technique
CoP	Community of Practice
IBE	Inference to Best Explanation
IBIC	Introductory Biology Inverted Classroom
LEH	Lecture Equivalent Hour

ABSTRACT

This dissertation research reports on the experiences of a team of community college educators who develop, implement, and teach an introductory biology course on the inverted classroom platform. Research questions addressed include: (1) What have been the motivations and professional influences of the instructors for transitioning to the inverted classroom for the introductory biology course? (2) In what ways have the participants' teaching practices changed (if any) as a result of the transition to the inverted classroom? (3)What were the benefits and challenges in teaching the inverted classroom? (4) How do educators perceive adult learning and teaching now that they have designed and implemented an inverted classroom? The study was qualitative by design and used interviews and a critical incident technique (CIT) focused group to obtain the narratives of the lived experiences of the participants who worked and taught the IBIC. Interpretive phenomenology was used to analyze the data to understand the aggregate voices of the participants.

Study participants reported their previous understanding of and experience with inverted classrooms to be none to minimal. Their motivations to transition to the inverted classroom included the opportunities to work with colleagues on a team effort as a way to create the best product, and a desire to improve student learning. Participants made revelations about themselves and their own teaching, as well as how to better support adults in learning. As a result of their new experience teaching an inverted classroom, participants reported their teaching practices now reflected the importance of student

engagement, student advocacy, and flexibility in the classroom. Participants identified the benefits of designing, developing, and implementing an inverted introductory biology classroom to include the colleague support and relationships that developed as a result of following a team approach, and the way the inverted classroom supported student learning by emphasizing student engagement, providing multiple ways for students to learn, and enabling student recognition of their responsibility, while creating confidence in their ability, for their own learning. Challenges reported were the amount of work and stress involved, technical difficulties, lack of support from administrators, and power dynamics of the team.

Participants unanimously agreed the transition to the inverted classroom was worth the work, time, and stress that went into it, concluding that the inverted classroom was more successful than the traditionally taught introductory biology course for the community college students that it served, while providing their reasoning from their teaching experience. This paper also presents advice and recommendations for other educators interested in exploring or adding to their experience with the inverted classroom, and it represents an unique addition to the inverted classroom literature by documenting the experiences of a *team effort* of educators building and teaching an inverted classroom with no prior experience in doing so.

1. INTRODUCTION

Community colleges serve a diverse population of students because they are more affordable than four-year universities, have convenient campuses, and maintain an inclusive admissions policy (Bailey et al., 2015; Pfahl et al., 2010; Wang et al., 2019). The two major groups of community college students are young students just out of high school who need to continue to develop academically and often require remedial courses prior to pursuing college courses, and older students that are attempting to obtain additional training and skills because they have been displaced from their former employment position or have decided to pursue another career (Pusser & Levin, 2009).

Because of the constantly changing employment market, the need for the acquisition of new skills, knowledge, abilities, and perspectives continues to grow (Bahr et al., 2017; Jacobs & Hundley, 2010). Consequently, the students at community colleges are primarily adult learners who seek training in order to be relevant to the job market, and who have competing demands on their time, such as jobs and family. Increasingly, colleges and universities are responding to the needs of higher education students for flexibility and accessibility by offering more course content online (Lehman & Conceicao, 2014; White, 2019). Today it is common for at least part of a course curriculum to be accessed online, even if the course is taught in a traditional classroom. This change reflects preferences of students in how they receive information, but it also forces those students who are not technology literate to learn these skills to be successful in their coursework, and ultimately in jobs.

Research suggests that instructors struggle with ways to engage their students to actively learn course content, especially when the students in the classroom represent a

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wide range of backgrounds and academic preparedness (McGuire & McGuire, 2015; Roehl et al., 2013). At the community college level, education is constantly changing and adapting to meet the needs of students. As students' learning habits change with their interests in new technologies, education must adapt to match those learning habits. The focus of education needs to be on the students, with a more personalized system of learning to help the students develop and use the skills needed for success in a global economy (Berry, 2011; Cevikbas & Kaiser, 2020).

With this focus, the emphasis is now more on the paradigm shift to constructivist approaches of teaching that are student-centered and away from behaviorist approaches that tend to be instructor-centered (Barnes, 2013). Fosnot and Perry (2005) offer a definition of constructivism, suggesting it is a theory that creates learning as an interpretive, recursive, nonlinear building process by active learners interacting with their physical and social learning environments. A constructivist learning environment is a place where learners may work together and support each other as they use a variety of tools, information, and resources in their guided pursuit of learning goals and problem-solving activities (Wilson, 1996).

To address this shift, community colleges are trying to create curricula that are learning- and student-centered (Seyedmonir et al., 2014; Zainuddin & Halili, 2016). Bergmann and Sams (2012) advocate for the paradigm shift from "teaching" to "learning," ushering in a new era of student-centered and self-directed learning. In the traditional paradigm, colleges existed to provide instruction in a lecture; in the new paradigm, colleges exist to produce learning through critical thinking and problem analysis (Lage et al., 2000).

Although traditional face-to-face teaching remains the mainstay of undergraduate education, technological developments allow instructors to use a combination of online and classroom instruction—referred to as blended learning (Strayer, 2012). A type of blended learning design called the "inverted classroom," and alternatively the "flipped classroom," or "reverse instruction" among other terms, switches what is traditionally done in class with what is traditionally done for homework (Brackin, 2012). The term "inverted" is adopted in this document to refer to this model.

The process of inverting a classroom begins with delivering the lecture content as homework, most conveniently accessed online. With lectures no longer given during class time, as occurs in the traditional classroom, the online lecture content is instead provided in a variety of formats to be viewed and assimilated by the students prior to coming to class. The students engage the course content through videos, slide presentation, or modules as homework (Bergmann & Sams, 2012). The course content may include the introduction to terms, theories, and concepts about the topics of interest (Herreid et al., 2014). Subsequently, in-class time is dedicated to practice, experimentation, and application of new content knowledge. The structure and strategies available from the inverted classroom model empower instructors to fully transform their classes to learner-centered environments; that is, a place where the students control their learning (Wright, 2011). The accessibility of course content online redefines how instructors need to evolve to help students learn the necessary course material (Barkley, 2010). The instructor is a facilitator for the students and works with them when they need assistance (Fulton, 2014).

One of the principal goals for transforming the classroom to an inverted classroom experience is to place more of the responsibility on the learners to control their own learning by engaging in activities that facilitate their understanding of the course content. Teaching the course on an inverted platform so that a portion of the course is an online homework module allows students greater flexibility to control more of the pace, time, and place of their learning process (Fulton, 2014; Seigel, 2013). The inverted classroom makes it easier to provide content in a variety of ways to accommodate differences in learning styles so that learners can engage the course materials in a way that is most comfortable to them. For community college students, the inverted classroom is a teaching method that has great potential to accommodate the needs they have as adult learners and help them achieve their education goals.

Purpose

The purpose of this study is to learn more about the teaching-learning process of the higher education instructors of a redesigned introductory biology course in a central Texas community college who shifted to inverted classroom teaching in order to share with others in the field the lessons learned and the experiences of implementing an inverted classroom.

The instructors participating in the study (a) all worked together at the same community college and (b) all taught the same science course. Some of the study's participants were part of the team that first developed and implemented the redesigned science course at the community college, while other instructors participating in the study were only involved in the teaching aspect.

I thought it useful to the broader educational community to capture an in-depth exploration of the teaching-learning experience created by the unique situation of the start-to-finish conversion of one traditionally taught science course into an inverted classroom. By studying instructors that shared in the experience of the inverted classroom project from concept phase to delivering instruction, and by not introducing variables of different disciplines and institutions, I expect their perspectives and meaning-making to provide a more comprehensive reflection and cohesive examination of the process than if they did not share the same exclusive experience.

The Evolution of the Classroom to an Inverted Platform

Lage et al. (2000) introduced the idea of using technology to "invert" a traditional classroom environment as a way to address their students' varied learning styles and infuse active learning into the classroom, resulting in a potentially more meaningful learning experience. Recognizing that multimedia was a technological advancement that was well utilized by students, and desiring to increase the effectiveness of the learning environment, they capitalized on its popularity and ubiquitousness amongst their introductory economics university students to present new material as homework via video lectures, PowerPoint presentations with voice over, and printable PowerPoint slides. The face-to-face classroom time was spent on activities designed to build understanding and reinforce concepts of the materials students viewed before coming to class.

In 2007, two high school instructors, Bergmann and Sams, discovered software to record their lectures for students that missed class. Students who had not missed class began requesting the recordings to augment their study time outside of class. Within a

year, the instructors hit upon the idea of giving up the lecture and prerecording all their lectures for students to view as online videos before coming to class, a method they called "pre-broadcasting" (Bergmann & Sams, 2012; Noonoo, 2012). In-class time was reserved for engaging students in activities related to the content they had reviewed as online videos. Eventually, the term "flipped classroom" was used to describe their process, and Bergmann and Sams consider themselves pioneers of the movement because of their active promotion of it, especially for K-12. While they acknowledge Lage et al. (2000) originated the inverted classroom concept earlier, they believe the method did not gain traction at that time because the paper publication predated YouTube (Noonoo, 2012). Thus, it appears that instructors were independently evolving the inverted classroom concept to creatively solve common problems that instructors face. Fulton (2014) indicates the inverted classroom concept continues to spread in popularity as educators learn about the advantages of the platform.

Adapting Inverted Classrooms to Bioscience Curricula for Adult Learners

Adult learners make up a large portion of college students, especially in community college (Schwehm, 2017; Stokes, 2007). Too often, many adult students enter community college with only the minimal skills needed to begin college-level work. In my experience, I have found that those aiming for employment in the biosciences and related healthcare professions can struggle to succeed in their math and science classes if they have not developed higher-level thinking and study skills. Students who come to their courses lacking higher level thinking and study skills are especially dependent upon the skill of the instructor to successfully deliver concepts of scientific mechanisms in an understandable way (Bahr et al., 2017; Jarvis et al., 2003). Because effective science

education requires an instructor to balance presentation of factual content with its explanation (Rissing, 2013), and because this balance is not always achieved in practice, students would certainly benefit from the development of higher-level skills, which can be accomplished by instructors offering learning activities that encourage analysis, evaluation, and creation of material that support learning of course content (Bloom, 1956).

Additionally, Alfaro-LeFevre (2006) identified the lack of higher-level cognitive skills as contributing to the lower-than-desired success rates of adult learners attempting healthcare profession coursework. Higher-level cognition skills provide students with an ability to think critically about problems that may arise in academia or in a professional setting (Kasworm et al., 2002). These skills help make students most successful as professional healthcare workers (Alfaro-LeFevre, 2006).

Many science courses have an active learning component known as the laboratory, which is used as a hands-on approach to learning through application of the concepts addressed in the lecture portion. The study of biological mechanisms using this activity-based curriculum may lead to the students' deeper understanding of the biological concepts and theories as learners advance through their prerequisite courses and their professional program (Dahle et al., 2002).

But while the laboratory practical approach supports active learning, the theory portion of the course continues to be delivered commonly in a traditional lecture format, which is worth more credit hours, delivers the bulk of the information from which students will be tested, and does not play to the strengths of adult learners. Many adult students bring to the classroom strengths in setting and achieving goals, life experiences,

and good problem-solving skills (Mackeracher, 2004; Lieb, 1991; Nurhayati & Bandung, 2019), yet many biology classes still rely on skills of memorization and do not use the previously mentioned strengths of adult learners in delivering instruction (Dunlosky, 2013). Activity-based curriculum, as used in the inverted classroom format, can be designed to incorporate the use of these strengths while providing enhanced learning by using face-to-face classroom time for students to learn with and from each other while the instructor facilitates (Barkley, 2010).

Added to the above challenges presented by traditional learning for adult learners is the fact that a large component of the student body in community colleges is demographically under-represented in education and has had difficulty being successful in traditional higher education settings (Castellanos & Jones, 2003). Most of the students in this demographic have full-time jobs and family responsibilities and therefore need to have flexibility to take a course when their schedule allows. These adult students must attend college during the weekends or in the evening when they can get some time away from their other responsibilities (Kasworm et al., 2002). While it is not uncommon for colleges and universities to cater to busy adult learners by offering class sections in the evening for convenience, it is still rare for classes to be offered on weekends, especially for science, technology, and engineering curriculums. As a result, adult learners wishing to pursue coursework in these subjects when they have time on weekends, do not have any courses available for them to take. By making extensive use of technology and adult learning methods to replace traditional modes of instruction, which increases learning flexibility and builds learning community, the inverted classroom platform overcomes the access barriers many of these students face and offers a way for them to succeed under

their unique time constraints (Fulton, 2014). The integration of all the above approaches to address the various challenging aspects adult students encounter while pursuing a health sciences profession curriculum resulted in the redesign of a traditional course into a high-tech inverted classroom at one central Texas community college. Here, I offer the context of that instructional re-design.

An Introductory Biology Class Redesigned on an Inverted Class Platform

The pass rates for two prerequisite biology courses, acquired from the Office of Institutional Effectiveness and Accountability (OIEA) at a central Texas community college, revealed a 47% pass rate for *Introduction to Anatomy and Physiology* and a 67% pass rate for *Human Anatomy* for the three-year period of 2005-2008. Additionally, 33% of all students intending to take the anatomy courses failed the assessment test to show readiness for these courses. These data showed an educational need for the development of a course to improve student readiness for successful completion of required courses for the health sciences. The community college biology department responded by creating an introductory biology course using traditional instruction methods. Assessment tests showed student readiness increased for students preparing to take the anatomy courses, which are nursing prerequisite courses (OIEA). Although the new course increased pass rates for these nursing prerequisites (OIEA), program instructors at the community college remained interested in further boosting success rates.

The approach taken by biology department staff to accomplish this aim was to redesign the introductory biology course to provide better vertical integration of the curriculum while more completely addressing the learning barriers of adult students.

Vertical integration of curriculum occurs when courses are designed to build on the knowledge gained from the prior course.

An objective of the redesigned biology course was to strengthen the students' understanding of the introductory biological concepts that tend to be difficult for them to understand. Students in a new learning territory are often afraid to ask questions because they do not want to appear unprepared or "stupid" to their peers in the classroom. Wheatley (2009) tells us that we need to empower our students to be fearless. Designing a program to build community and provide a safe and flexible learning environment allows for the students to grow and thrive in that setting, as documented by Kasworm et al. (2002). The course was designed to promote this type of learning atmosphere as well.

The change to an inverted classroom was not an easy task for the instructors. Besides the logistical challenges of developing the course content that could be accessed online and at any time during the day, the instructors had to buy into the entire paradigmatic change in their teaching styles. When employing an inverted classroom, the instructors have to be willing to let go of most of the control of the class and allow the students to become responsible for their own learning (Adams & Gringas, 2017; Wright, 2011).

The change in paradigms from a traditional-lecture platform to an inverted-classroom format is necessary for many different reasons. Primarily, as the students become savvier with technology, they favor the courses that have incorporated technology. Many students also are requiring more flexibility in their access to courses as they juggle their different responsibilities to families and employers. The inverted classroom addresses the changing needs and preferences of students while providing a

learning environment where students can feel safe as they engage in active learning. The inverted classroom provides a transition from the high school learning environment to college, where the traditional lecture format may be failing the needs of the students (Barkley, 2010; Bergmann & Sams, 2013; Chen et al., 2014; Kim et al., 2014; Lasry et al., 2014).

It is important to understand the phenomenon of experiences of instructors who have made the instructional paradigmatic shift to learn about the obstacles, successes, and the best practices they have discovered during the overhaul process. By understanding these phenomena, other instructors interested in implementing an inverted classroom in science or other disciplines may be aided to make better decisions to improve the delivery of their courses and thus course content comprehension by their students.

Study Proposal

The focus of this study is to examine the experiences of instructors at a central Texas community college who left a traditional-classroom instructional approach to design, implement, and/or teach an introductory biology course as an inverted- classroom teaching model.

By incorporating innovative uses of technology to aid curriculum delivery and tailoring the curriculum to work with the skills and goal-oriented focus of our adult students, the objectives of the redesign were to improve preparedness for higher-level biology courses and help the students see themselves as healthcare professionals. It is hoped that the findings of this study will assist in understanding the complexities and nuances of instructor development and aid other faculty members, programs, and higher education administrators to support instructional transformations toward more active

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learning and learner-centered approaches in science, technology, engineering, and mathematics (STEM) fields.

Research Questions

This study seeks to address the following research question: What has been the experience of college instructors who have adopted the inverted classroom model for their introductory biology course? There are several sub-questions that are also to be addressed by the research:

- What have been the motivations and professional influences of the instructors for transitioning to the inverted classroom for the introductory biology course?

- In what ways have the participants' teaching practices changed (if any) as a result of the transition to the inverted classroom?

- What were the benefits and challenges in teaching the inverted classroom?

- How do educators perceive adult learning and teaching now that they have designed and implemented an inverted classroom?

While the questions used in this study are similar to those posed in Brown's (2012) study on the inverted classroom, her study participants were not confined to the same curriculum or institution; her participants taught different disciplines and were located at a variety of institutions, including public and private universities and technical and community colleges. This study proposes to document and analyze the experiences of introductory biology instructors at the same central Texas community college, confining the scope to the experiences of a group of instructors all working within the same course. By taking a more focused approach, the study will provide a unique

opportunity to capture the perspective and knowledge of instructors as they engaged in the same shared experience. It will be interesting to discover how the instructors' perspectives of this study might add to our understanding of the utility of the inverted classroom.

Theoretical Framework

The framework of this study is teaching by learning and sharing, as I am interested in the experiences of the instructors involved with the inverted biology classroom and hope to aid other instructors who are interested in learning about the processes, benefits, and challenges of using an inverted classroom as a teaching model.

This study is rooted in interpretive phenomenology. Phenomenology is defined as a human science because the focus of the research is the structure of meaning from the lived experiences of the human world (van Manen, 1990). My questions began to form as I worked with my colleagues to develop activities for an introductory biology course, newly redesigned on an inverted class platform. My inquisitiveness is consistent with van Manen's (2014) work that asserts phenomenological questions may arise any time we have a certain experience that causes us to pause and reflect.

van Manen's (1990) approach to interpretive phenomenology is best suited to analyze the data in this study because the analysis process requires the interpretive role of the researcher. Because I have been on the team of educators who designed, implemented, and taught the introductory biology course on the inverted platform, I bring a unique perspective to this study of "having been there and done that." My multi-year experiences in teaching and course design highly qualify me to research the phenomenon under study. My role in this study is solely as a researcher and not a participant. This type

of role has been described in the literature as an instructor who is interested in examining his own teaching practice with the goal of improving the education he is providing to his students (Kincheloe, 2003).

In recent times, van Manen (2014) has described this method of interpretive phenomenology as epoche-reduction. This concept has been formerly referred to as bracketing and means to find the real meaning in the experiences of people's everyday life tasks (van Manen, 2014). This approach is typically accomplished by someone who has knowledge of the environment or discipline where the phenomena are occurring, yet requires the researcher "to voluntarily sustain the awakening force of astonishment so that conceptual cognition can be carried throughout intentional analysis, thus bringing the 'knowing' of astonishment into our everyday experience" (Cogan, n.d., para. 2).

The selection of a phenomenological methodology enables the in-depth examination of several instances of the study's subject in order to distill shared elements of the experience and present the themes common to all informants (Smith et al., 2013). Using a phenomenological approach, I will endeavor to provide descriptive accounts of events from which both practitioners and researchers in the field can benefit.

Significance of Study

There have been several research studies published that have studied the use of the inverted classroom in higher education (Beumer, 2018; Brown, 2012; Hava, 2021; Kim et al., 2016; Matawali et al., 2019; McCallum et al., 2015; Picciano & Dziuban, 2007; Telford & Senior, 2017; Tomas et al., 2019), but fewer studies exist for the use of the inverted classroom in the biology discipline in particular (Malto et al., 2017; Wolf, 2020). I investigated a group of biology instructor colleagues employed by a central

Texas community college and document their unique experiences with some or all facets of the redesign, implementation, and instruction of the biology course in the inverted classroom platform. My study has the potential to offer important insight into professional development needed to support the process instructors undergo to move from traditional instructional approaches to inverted classroom methodologies.

By adding to the collection of research literature existing on the use of inverted classrooms in higher education, other individuals, who would like to transform their teaching and courses to an inverted classroom learning environment, may become better informed. While this study is focused on the experiences of instructors who are teaching biology at a community college, the data gathered from this study could be used to inform others who have a desire to implement an inverted classroom in STEM or other disciplines.

2. INVERTED CLASSROOM RELEVANT LITERATURE

The purpose of the present study is to explore the experiences of higher education instructors who used a student-centered, inverted classroom platform to design and implement an introductory biology course. Because traditional teaching models often fail to enable student mastery of course content and fall short in the facilitation of student success (Bergmann & Sams, 2012), the knowledge and best practices elucidated by this study can be shared with other instructors who might desire to adopt an inverted-classroom instructional model. This study also represents a rare opportunity to gain this type of information, as there are few documented higher education studies on the topic of transitioning to the inverted classroom, especially for science courses.

The Challenge of Adult Education

Vygotsky (1978) made the claim that children learn best when a more knowledgeable individual, such as a parent, teacher, or peer, assists them in learning. The more knowledgeable individual would provide support for students to learn through such practices as demonstration, questioning, encouraging, and correction. He introduced the concept of the zone of proximal development, which is "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). According to this concept, the optimal learning experience for the students would fall within this zone and consist of activities they are able to accomplish first with assistance, and later with practice, independently.

Several studies support this concept of optimal learning through guided and collaborative experience for adult education as well (Armstrong, 2015; Karlstrom & Lundin, 2013; Nurhayati & Bandung, 2020; Oyelana et al., 2018; Page & Margolis, 2017; Wass & Golding, 2014). Literature reviews have reported the problem of student miscomprehension of course content and propose this occurrence may be due to teaching method (Vlassi & Karaliota, 2013). Current teaching methodologies, in which instructors make the decision of how course content is delivered, is often a mismatch for the learning styles of the students. Several studies have reported that this asynchronicity between instructional approach and learning styles can lead students to be less interested in school, thus learning less (Cavinato et al., 2021; Lacey, 2021; Lage et al., 2000; Zimmer, 2021).

Adult learners are the focus at a community college because they compose a significant demographic in those institutions (Bailey et al., 2015; Pfahl et al., 2010). In adult education, the curriculum is centered on the needs and interests of the students (Knowles et al., 2011). Knowles & Associates (1984) stated that adult learners are self-directing, internally motivated, derive benefits from experience, possess a great readiness to learn, and voluntarily enter higher education with a life-centered, task-centered, or problem-centered orientation to learning. Adult students in higher education are challenging the traditional education venues by devising their learning experiences. The adult learners are developing new ways of understanding course content by using social networking, technology-based methods of communications, and self-designed learning groups (Kasworm et al., 2010).

Kolb (1984) states that experiential learning involves participating in learning of a topic so that the learner can then reflect on their life experience to make meaning of the

new content. The adult learners want to know why a topic is important, and they want to engage in discussions to help them understand the important content presented in their learning process (Knowles et al., 2011). Life experiences are important in the learning process of the adult learner because individuals construct knowledge by using their experiences to understand the course content. Adult learners are very motivated to learn and tend to ask more questions that stem from their life experiences.

Knowles et al. (2011) suggest that faculty should change their instruction strategies to adapt to adult learners because it is known that these learners bring more experience to the classroom, participate more, and are more likely to challenge the instructor. Klein-Collins (2011) agrees that instructors need to be assessing their course and changing to incorporate the experiences of the adult learners to better serve them. The problem is that it is difficult to deliver instructionally sound experiential learning (Beckem & Watkins, 2012).

It is clear that nurturing critical thinkers and independent learners in higher education is a more serious challenge today, when the United States of America's overall international academic standing has declined, and the student population has undergone extreme demographic change (Ahn & Class, 2011; Bailey et al., 2015; Organization for Economic Cooperation and Development [OECD], 2012). The students in higher education are more diverse than at any other point in history (Ahn & Class, 2011). The current state of teaching does not appear to be working for the many types of student learners that enroll in classes at colleges and universities (Polson, 1993). Ahn and Class (2011) assert students in higher education must be empowered as individuals in charge of

their own learning, which can be accomplished within a higher education teaching model that places students at the center of their own learning.

Teacher-Centered Instruction Versus Student-Centered Learning

The traditional learning environment, where the instructor presents course content, usually by lecture, is referred to as teacher-centered (Minter, 2011). The student is relegated to the role of passive recipient of teacher-provided instruction, engaging in learning by listening, reading, and completing homework assignments of the teacher's choosing, that is, without student input, and which are usually completed individually and not in partnership with others (Minter, 2011). Although students may be encouraged to ask questions, the answers are from the instructor who functions as the primary source of information, without sharing this role with students for a more collaborative learning experience. Teacher-centered learning and its associated didactic lecture as an instructional method are often judged to be less effective than student-centered approaches in which teachers act as facilitators or coaches (Cousin, 2010).

In the teacher-centered approach, the teacher imparts knowledge to students by instruction, example, or demonstration (Blumberg, 2014; Talbert, 2017) and is the controller of the learning environment. Power and responsibility of the learning process are held by the instructor who decides on the course content, how the lectures will be presented, and how a student will be evaluated on the mastery of the course material (Davis & Arend, 2013; Jarvis et al., 2003).

By comparison, in student-centered learning, the focus of activity shifts to the student. Students take responsibility for their learning by actively participating in the learning process rather than only passively receiving information from a lecture

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(Hanewicz et al., 2017; Njoku, 2019; Slunt & Giancarlo, 2004). Types of instructional strategies used in student-centered learning can include active learning, where students engage in discussion, problem solving, or debating; cooperative learning, where students participate in partnerships or teams with other students to work on projects and assignments; and inductive teaching and learning, where students demonstrate learning of the course content in an exercise that solves a question or problem (Barkley, 2010).

Student-centered learning has been referred to as an inquiry-based constructivist approach by Thormann and Zimmerman (2012) because material presented in the classroom can be co-constructed by the instructor and the students through dialogue. This active learning strategy allows students to develop a better understanding of a topic because they are able to discuss the concepts as they collectively understand them (Vella, 2001). As students and the instructor engage in discussion, they add to the overall understanding and learning of the concepts by everyone in the classroom. Also referred to as dialogue education, questions are welcomed from both the instructor and students so together they can make sense of the course content (Vella, 2007). Brookfield and Preskill (2005) view dialogue as a way to nurture growth through collaboration and cooperation with other individuals that allows the students to be exposed to new perspectives.

While students are often comfortable using online tools to engage learning of the course content, they prefer to have access to the content in a manner that fosters social presence (Leafman et al., 2013). Indeed, students would prefer to be engaged with other students in learning instead of engaging the learning modules in isolation. Cooperative learning is an instructional method in which students in small groups work together to find the best solution to their problem (Davis & Arend, 2013). As a student-centered

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learning strategy, cooperative learning works well in higher education to foster the students' learning of course content and it benefits all students (Chen &Wang, 2013).

Many authors have concluded that to be successful in education, the student needs to be the focal point of course designs (Barkley, 2010; Barnes, 2013; Bergmann & Sams, 2012; Davis & Arend, 2013; Fink, 2013; Fulton, 2014; Mackeracher, 2004). McCombs (2003) stated that students are central to educational excellence as well as the would-be beneficiaries of reform; yet, in many schools the students have been almost entirely overlooked.

Emerging Trends: Blended Learning Facilitates Student-Centered Learning

In higher education learning environments, student-centered learning is often juxtaposed with teacher-centered learning, as if practices could only be one or the other (Blumberg, 2014). In the last 15 years, however, higher education has seen an increase in the use of a mixture of face-to-face classroom experience with online learning experiences, which is termed blended learning (Deeley, 2018; Gupta et al., 2021; Strayer, 2012). The availability of technology is driving this change and revolutionizing the way course content is being presented to students (Jenkins, 2003). Online learning has gained in popularity because it is easy to access and allows students greater flexibility to learn at their own pace and time (Hu & Johnston, 2012; Vaughn, 2007). Because of the role the internet has played in allowing for easy access to information, it is expanding the application of the student-centered learning teaching method. Taylor (2013) has stated that student-centered learning is a way to engage students online through social media in order to meet the students' needs.

This trend has become a forced opportunity due to the COVID19 pandemic. In 2020, educators were forced to teach online for over a year as the pandemic spread through the world's population. Prior to the pandemic, Talbert (2017) mentioned the potential use of the inverted classroom for online teaching modalities. The suitability of the inverted classroom for online learning needs to be fully evaluated as another tool to facilitate remote learning for students.

Many learners enrolled in higher education courses have grown up accustomed to using hand-held technology, "googling" information, and communicating by texting (Thormann & Zimmerman, 2012). These "technologically savvy" students are demanding their instructors present course content in more innovative ways (Dede, 2010). Because they grew up with technology in their hands, these students are unique in feeling they are connected to the entire world (Strom & Strom, 2011). As a result, higher education institutions have updated their computing infrastructure and incorporated emerging technologies to accommodate online courses and students (de la Varre et al., 2010; Sharma et al., 2020). Some instructors have updated their instructional strategies, or are beginning to evolve by expanding the scope of the traditional lecture courses, offering online course content as a distance learning course or as a blended course (Makarem, 2015).

Numerous definitions and variations exist of blended learning models when they are used in the education field (Horn, 2010; Ozadowicz, 2020). However, blended learning is commonly understood to mean classroom learning combined with online learning, in which students control the time, pace, and place of their efforts to learn the course content (Thormann & Zimmerman, 2012). Asynchronous learning, which

describes the situation when students learn the same course content at different times and places, is often a natural by-product of blended learning. In the context of online learning, it also means the students and the teacher are not engaged in the learning activity at the same time (Cherney et al., 2018; Thormann & Zimmerman, 2012).

Student-centered learning instruction, therefore, readily incorporates blended and asynchronous learning to support and accomplish its objectives (Hanewicz et al., 2017; Njoku, 2019). By students controlling their own learning, Bergmann and Sams (2013) envision a student-centered classroom where the students learn at their own pace and master the course content before they move on to new material.

Why the Traditional Model of Teaching Fails Adult Learners

Although educational studies over the past 50 years suggest there are viable alternative methods for students to learn course content, the educational profession continues to rely on the traditional lecture course model, where students listen to an instructor give a lecture and the students are led through a series of facts to be mastered (Talbert, 2017; Thomas & Brown, 2011). During a lecture, the course content is covered by assigned text readings, and the face-to-face class time is spent reviewing the content presented in the text (Bergtrom, 2011; Chen & Wang, 2013). The traditional models have operated on the assumption that higher education institutions' primary purpose is to expose students to a pre-defined body of knowledge. This thinking has led many students to regard their courses as just another "hoop" through which they have to jump in order to earn their degrees (Clegorne & Mitchell, 2013). Adult learners of today want to know why the material is important; they do not want to listen solely to facts presented by the instructor (Beckem & Watkins, 2012).

When the traditional lecture is delivered as a monologue often straight out of a text, only exceptional lecturers are capable of holding the attention of the class for an entire lecture period. The students who are not able to think critically, or reflect on the learning, spend time developing strategies to memorize or otherwise remember the material for the assessment (Maehl, 2000). The fact that the course lecture is presented in front of a passive student audience only compounds the problem of students not mastering the course content (Mazur, 1997).

For these reasons, traditional instruction is not the most effective method for students who are trying to understand and learn the required content for a course. Vygotsky (1978) states that students learn under the guidance of an instructor by collaborating with peers and by engaging in problem solving techniques to arrive at an answer to a posed question. Vygotsky (1978) was describing student-centered learning methods.

Traditional Instruction of Introductory Science Classes

Gateway science courses provide the necessary background to allow for entry into a field of study. These courses are an aggregate of rich knowledge content that students must successfully acquire in order to proceed into their chosen fields of study. Scientific jargon, details, and concepts of the science must be learned by the students before they can make meaning and understand their own experience of the scientific course content (Bergtrom, 2011).

The two most common ways to teach science courses are discipline centered and instructor centered. In discipline-centered teaching, the course is designed by a separate authority, such as an academic department, and the instructor transmits the information to

the students. In instructor-centered teaching, the instructor is the authoritative expert, the main source of knowledge and the focal point of all activity (NRC, 1997). In both these instances, the students are passive recipients of the course content from the instructor, which makes it teacher-centered and not student-centered learning.

The Promise of the Inverted Classroom Model as a Student-Centered Approach

In recent years, the student-centered approach to teaching has been gaining in popularity. One of the more promising student-centered alternatives to the traditional-instructional model is the inverted classroom model. The inverted classroom model reverses, or inverts, the traditional format of a classroom-based course. Also known as the flipped classroom, the inverted classroom lecture material is posted online with the intention of using class time for active learning and practice (Palloff & Pratt, 2013; Strayer, 2012).

The inverted classroom platform is set up so that lectures do not take place in a classroom. Instead, the course content usually presented in a lecture is engaged by the students on their own time as online homework. The students, thereby, may review the course content as much as they might need at a time that is convenient for them (Velegol et al., 2015). It is imperative that the students engage this material so that classroom time then can be used to participate in interactive activities that are used to reinforce the already studied course content (Lage et al., 2000). In this manner, the instructor is a facilitator to the learners—someone they may ask questions to master the course content, and the students take on the responsibility of being in charge of their own learning of the course content. The inverted classroom works by transforming the roles and responsibilities of the students and the instructor, allowing for mastery of the course

content by active participation in the learning process (Baker, 2000; Barnes, 2013; Lage et al., 2000).

Thus, the inverted classroom model makes use of blended and asynchronous learning through the two distinct elements of the design, the online component and the in-class requirement. When a course is delivered as an inverted classroom in an asynchronous manner, the online component is completed prior to attending the face-to-face component. Usually, the lecture assignment is accessed online by students outside of class time, thus freeing class time for building on that lesson with discussions, activities, or projects during class time (Fulton, 2014). Depending upon the inverted classroom model, students enrolled in the same course may then attend any of the interactive classes that are available during a given week, providing even greater flexibility for adult learners with scheduling conflicts and time constraints.

Instead of reviewing the course content as in a traditional teaching model, the inverted classroom uses the face-to-face time to focus on the development of critical thinking skills, study skills, and basic skills to prepare students to be successful in the course. Therefore, classroom hours are used mainly for active student work (e.g., problem solving and group discussions) with limited introductory and closing remarks from the instructor. Maximum time is allowed to address questions and to help students synthesize information and recognize connections among topics (Bergmann & Sams, 2012). Student interactions and dialogue play a major role in the overall student's learning. Isaacs (1999) asserts that generative dialogue creates new possibilities and new levels of interactions between students. The dialogue that is generated by the students in

an inverted classroom provides rich interaction that is intended to facilitate student learning and understanding of the course material.

An important and significant aspect of engaging in dialogue is the development of class community. Little time in higher education is spent on building the capabilities of the students in group interactions, negotiation of shared meaning, or in the co-construction of problem solutions (Dede, 2010; Kasworm, 2018). The development of class community allows the students to engage in very frank and constructive discussions concerning their learning and readings. To build community in the classroom, it is important that the students feel they have a safe environment to engage in discussion and learning (Vella, 2002). The members of the learning environment must be respectful of all perspectives when disagreement is communicated through discussions, as it is healthy for the students to have multiple thoughts and feelings on certain topics (Wheatley, 2009). Even though the students may disagree with some thoughts, each student needs to respect the position and perspective of others on the topic. Through disagreement and discussions, the students build trust amongst themselves and develop a very healthy manner to learn about each other in a safe learning community (Galbraith, 2004; Vella, 2002).

During 2020, the COVID19 pandemic forced educators to reinvent teaching as courses were moved to an online environment. Instructors embraced technology to teach their courses online as all citizens were asked to stay at home to minimize the spread of the COVID19 virus. The inverted classroom may have application for online courses as it facilitates community building and student engagement.

Inverted Classroom Model and the Needs of Community College Learners

Tremendous energy exists around the use of student-centered learning in the community college, which may be because community colleges have been recognized as the facet of education that will continue to grow when compared to four-year universities (Business-Higher Education Forum & Emtect Solutions [BHEF], 2010; Settersten & Ray, 2010). Community colleges are accessible to individuals who want to improve their opportunity to obtain more stable and higher-earning careers (Cummins, 2015). Many community colleges feed some of the fastest growing industries that struggle to employ enough skilled labor to stay competitive in their lucrative fields (BHEF, 2010; Pfahl et al., 2010).

The majority of adult learners in higher education attend community college (Wlodkowski, 2008). Students who attend community college often have life responsibilities that take precedence over college. Other numerous factors such as the socio-economic background of learners, lack of resources, poor teacher pedagogical content knowledge, lack of professional collaborative practices, and poor instructional leadership also contribute to the lack of student success (Selingo, 2013).

Efforts to increase the success of adult learners in community college have focused on their educational needs: academic advising, tutoring, and remediation (Knowles et al., 2020; Wlodkowski, 2008). Kasworm et al. (2010) advise that instructors also need to be responsive to the broader, changing needs and interests of adult learners in higher education. These authors indicate the need to incorporate the use of technology and student-centered courses in colleges and universities to increase access to adult learners.

An inverted classroom capitalizes on the online learning trend because it allows students to engage the learning module as many times as necessary to understand the material and at times of their own choosing. For community college students, the flexibility gained by the inverted classroom provides a solution to many of their challenges to learning. Horn (2010) believes in the inverted classroom's potential to not just change the medium of learning, but to change the way schools operate—from a monolithic, factory-model system to a student-centered model.

The Structure of an Inverted Classroom

The inverted-classroom model provides structure and strategies that enable instructors to fully transform their classes from an instructor-centered environment to a student-centered environment (Smyth, 2011; Talbert, 2017). This environment, in which adult learning strategies and dialogue are key aspects, has structural components that help students achieve success. According to Bergmann and Sams (2012), the components of a successful inverted classroom are: (a) clear learning objectives, (b) online modules for course content, (c) face-to-face learning activities to reinforce course content and, (d) effective assessments to monitor the mastery of the students' understanding of the course content.

As the first component, educational learning objectives provide clear statements of the anticipated results to be achieved by the learners through the educational program (Caffarella, 2002). The learning objectives will guide the program designers in developing or revising the different facets of the inverted classroom. In addition, the learning objectives provide an outline for how the program staff will improve the quality

and quantity of program resources and other basic operation aspects of the inverted classroom (Caffarella, 2002).

The online component presents the course content in modules in various types of presentations and modalities (Lehman & Conceicao, 2014). Opportunities to interact with peers, tutors, and instructors are built into the online portion of the inverted course through monitored discussions, web meetings, and so forth. The online component may include: (a) lectures on each topic with integrated video and diverse interactive elements, (b) interactive learning activities to augment lectures, (c) peer interactions (via discussion forums; participation may be monitored for grades) and, (d) formative assessments. Online assessment scores are tracked and used diagnostically to determine weak areas that are addressed during contact sessions.

The face-to-face component is then used to solidify the students' understanding of the course content presented in the online modules. Students engage in the following during the face-to-face classroom: (a) hands-on activities to help master topics, (b) collaborative peer learning activities, (c) direct interaction with instructors to address learning issues identified previously in online assessments, and (d) final module tests and other assessments for the course.

In the face-to-face component, the room is designed to facilitate an inverted classroom. The room design physically situates the students at the center of the classroom and places all other equipment towards the walls of the classroom (Bergmann & Sams, 2012). This design allows for all students to feel part of a participatory learning process.

Effective assessments are a crucial component of the inverted classroom and are addressed in both the online component and the face-to-face component discourse above.

Many types of assessments, for example, worksheets or discussions, can be used that will allow for the students to appreciate their understanding of the course content while being interactive with their classmates.

The design of the two facets of the course, online lectures and in-class supplemental activities foster a student-centered approach to teaching. The online facet of the inverted classroom provides the students access to the modules when their schedules allow for them to engage in learning. The simultaneous access to multiple resources and modalities in the online environment benefits the students' learning and understanding of difficult topics (Talbert, 2017; Thormann & Zimmerman, 2012). The online modules, often including digital lecture presentations, are completed independently, and the instructor predetermines the content and method of access. The advantage of the online component is that students can work at their own pace based on their skills, interest, and available time (Fulton, 2014; Telford & Senior, 2017) and access course materials anytime, anywhere. This approach moves most of the information dissemination out of the classroom so that class time can be spent on instructor-student interactions or various forms of active learning activities (Blumberg, 2014; Hava, 2021). Structured in this way, the inverted classroom incorporates both individual learning through the online assignments and cooperative learning with peers in the classroom. The mixture of learning leads to positive impacts on learning and on achievement by students.

Roles of Teacher and Learner in the Inverted Classroom

Often it can be difficult for both students and teachers to make the shift to a student-centered model, such as the inverted classroom. The success of an inverted classroom lies in the willingness of both teachers and students to follow through on their

respective responsibilities. The responsibility for the faculty is to redesign and conduct

the course in a way that requires students to uphold their end of the educational contract

(Wright, 2011). For example, the faculty must build an inclusive learning environment

that encourages the student to construct knowledge of the course content by actively

participating and cooperating in making sense of the material (Angelic et al., 2014; Hava,

2021). The instructors are also responsible for monitoring and assessing the integration of

new information within the cognitive framework (Bergtrom, 2011; Telford & Senior,

2017). Students are responsible for understanding new course content by participating in

activities that reinforce course content, such as engaging in topic discussions and helping

each other with problem solving assignments.

From a constructivist approach, the teacher is not the primary focus in the

inverted classroom, but functions as the planner, learning designer and facilitator (Smyth,

2011). The teacher facilitates learning as a coach who carefully observes the students

during in-class activities, identifies their learning needs, and guides them to higher levels

of learning (Goodwin & Miller, 2013; Navarro Morales & Londono, 2019). The

instructor serves as an additional resource to answer students' questions or bounce ideas

off, enabling the students to better understand the course content (Barnes, 2013; Lasry et

al., 2014) and create knowledge by organizing new information within a framework of

existing knowledge and experience (Chen et al., 2014; Cheng et al., 2019; Fosnot &

Perry, 2005; Talan & Gulsecen, 2019).

Because the students are the focus of the model, practice is necessarily learner

focused with an implicit requirement that "learning how to learn" is scaffolded within the

learning design (Smyth, 2011). Scaffolding is a concept first described by Vygotsky

(1978) and means that the students will be given the support necessary to help build their

skills in analyzing information and thinking critically about course content, much like

scaffolding would provide a support for workers at a construction site (Barkley, 2010). In

scaffolding, the resources are introduced to students to help them understand concepts.

The scaffolding is removed once it is no longer needed by the students because they have

developed their own learning process, just as the scaffolding is removed when it is not

needed at the construction site (Dunlap & Grabinger, 1996).

When the role of the learners in education is examined, the potential of the

student-centered learning model becomes clear in not only engaging the student to

participate actively in his or her own learning, but also in enhancing the depth of his or

her overall understanding of the course content.

Criticisms of Student-Centered Learning and the Inverted Classroom

The growing interest in student-centered learning in higher education is based on

the belief that this type of learning will lead to greater success for students (Wright,

2011). However, the student-centered learning instructional model is not without its

critics. These critics are mainly instructors and teachers who feel unprepared to use the

model, believe they will become detached from the learning environment, or see the

model as too time consuming (Anderson et al., 2014; Cevikbas & Kaiser, 2020;

Hutchings & Quinney, 2015; Lo, 2018; Long et al., 2017; Roe et al., 2018; Rohani et al.,

2020). Some critics believe that the future of universities will be different because the

course content will be organized around student-centered principles (Taylor, 2013),

leading some instructors to feel their roles will be less prominent in the classroom

(Fulton, 2014). The critics believe the students' needs will be placed above other needs such as content or administrative (Taylor, 2013).

Contrary to what some critics forecasted, the reduction in face-to-face classroom time has not resulted in higher failure rates or dropout rates. Vaughn (2007) reported that studies of course dropout rates for the inverted classroom are lower than fully online courses. When compared to traditional courses, the inverted classroom model can result in higher grades and improved learning outcomes (Babb et al., 2010; D Souza & Rodrigues, 2015; Xiao et al., 2021). However, Aycock et al. (2002) indicate some students have challenges with succeeding in the blended learning environment because they struggle with the expectation that fewer class meetings mean less work.

Research on the Inverted Classroom in K-12

The idea of an inverted classroom design has been around for decades in K-12, as teachers have long required students to read course materials before class to engage the concepts at a deeper level during class (Strayer, 2012). But instructors have built upon the concept to develop it even further beyond the belief that education is an accumulation of knowledge and skills. Apps (1996) believes that "education is a series of relationships: learners relating to their own intellectual, emotional, physical, and spiritual selves; teachers relating to learners; learners relating to each other; learners relating to knowledge; and teachers and learners relating to contexts and communities." This quote is helpful in describing the series of events that inspired the development of an inverted classroom in a high school chemistry class in 2007. Bergmann and Sams (2012) were high school chemistry teachers who began a collaboration of planning and recording their lectures to make them accessible to students outside of the classroom. The recorded

lectures were intended to help students who had missed class keep pace with the students who had attended the class. The students responded so positively to the model that the teachers continued to develop the idea and committed to the model for the entire 2008 school year (Bergmann & Sams, 2012).

Of the several books written on the inverted classroom in K-12 settings, the book by Bergmann and Sams (2012) detailed their experience as the first to use the inverted classroom model and to promote the model as reproducible, scalable, customizable, and easy for teachers to adopt. Whether or not Bergmann and Sams were the first to use an inverted classroom in K-12 is probably unknowable, but they are among the largest proponents of using the model (Finkel, 2012). Since their 2008 implementation, there has been an increased emphasis on the integration of technology in K-12 education in order to engage students in active learning (An & Reigeluth, 2011). This movement has led to some of the current variations of blended learning in K-12, which includes the use of videos, surveys, discussion forums, or topic presentations to deliver course content (Barkley, 2010; Bennett, 2013). Thus, many forms of blended learning and the inverted classroom already exist in K-12 education and, with increasing monies from funding sources, it is expected that more variations of these models will emerge in the future (Horn, 2010).

Although the inverted classroom has been well received by some teachers in K-12 education (de la Varre et al., 2010), it has not met with the success that many thought would occur. Yet, its use in high school systems has continued to gain ground (Thormann & Zimmerman, 2012). One of the variables contributing to the confounding of data on the effectiveness of the inverted classroom is the diversity of the definitions and

interpretations associated with the student-centered learning model (Abeysekera &
Dawson, 2015; Chen et al., 2014; Taylor, 2013). Another variable was identified by
McCombs (2003), who evaluated the parameters associated with a student-centered
learning model in diverse educational settings and found that the implementation of the
model was not consistent across educational settings and from school to school. This
result indicates implementation of, and the experience with, the model is different in
response to the needs of the learners in each setting, so there is not a "one size fits all"
scenario for the inverted classroom (McCombs, 2003).

Engel and Randall (2009) questioned the frequency of students asking questions
or engaging in exploratory behavior in traditional classroom settings and found that
students who are curious and ask questions about the learning materials are engaged in
learning. Furthermore, students are more likely to ask questions to clarify their
understanding of the course material when they feel comfortable in the learning space
(Barkley, 2010). Student-centered teachers in K-12 education, therefore, have an
especially important responsibility to foster their students' emotional and social growth
as well as their intellectual growth by creating a supportive and positive learning
environment (An & Reigeluth, 2011; Kayler & Sullivan, 2011).

As a foundation to solving the issues seen in schools today, McCombs (2003)
suggests listening to students and forming meaningful partnerships. These partnerships
are not only necessary in K-12 schools; they are also essential in higher education
venues. Thus, the use of the inverted classroom model has potential to be transformative
for both the learners and the teachers in higher education (Barkley, 2010; Thormann &
Zimmerman, 2012).

It has been argued that most research on courses with an online component has been performed mainly in higher education, so data to support online course use in K-12 education have not been substantiated (An & Reigeluth, 2011; de la Varre et al., 2010). But, there are authors who have published studies showing successes with the inverted classroom model in K-12 (NRC, 2000). Although the inverted classroom model was first documented in K-12 (Bergmann & Sams, 2012), the interest in using it as an effective teaching model in higher education is growing. Several researchers (Barkley, 2010; Fink, 2013) document approaches to integrating the inverted classroom in higher education.

Research on the Inverted Classroom in Higher Education

Student centeredness has been a significant strategy for the early years of higher education, as faculty strive to support and advance student learning in the years of transition from high school to college (Taylor, 2013). One of the earliest documented higher education classrooms using aspects of an inverted class model was by Mazur (1997). Mazur first began to work on a student-centered learning approach to teach physics at Harvard by introducing peer instruction, which he termed 'peerology.' Mazur encouraged an atmosphere of cooperation in his course, where the students' focus was moved away from the details found in a textbook to working on small presentations delivering key points and enjoining fellow students in problem-solving activities. Data has emerged recently (Beumer, 2018; Crawford, 2015; Floro, 2014; Matawali et al., 2019; Yemma, 2015)that documents the efforts of others with the inverted classroom or semblance thereof.

The popularity of using the inverted platform in college courses, at a time when higher education grapples with how to address the changing demographics which now

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includes adult learners and savvy millennials (Kasworm, 2018; Therrell & Dunneback, 2015), has prompted evaluation on different aspects of the inverted classroom model. Some of this research sought to determine whether the inverted classroom improved student success over traditionally taught courses (Overmyer, 2014; Renfro, 2014), others looked at the experiences of the teachers (Yemma, 2015), one looked at the experiences of the students (Floro, 2014), another looked at how students succeed in an inverted math classroom (Sun, 2015), and finally another assessed whether the inverted classroom increased the use of technology (Crawford, 2015). Research in science courses is developing, and mathematics research dominates much of it (Overmyer, 2014; Renfro 2014; Sun, 2015). However, several studies have used an undergraduate biology course taught as an inverted classroom to examine the experiences of the students (Beumer, 2018; Floro, 2014; Matawali et al., 2019).

The inverted or flipped classroom has been a hot buzzword in higher education for some time now (Renfro, 2014). In his study, Renfro used mixed methods to evaluate the use of an inverted classroom in a calculus course. Specifically, Renfro evaluated student achievement, mathematical thinking, attitudes, and teacher perceptions associated with the inverted classroom. The quantitative portion of the study used a questionnaire and a one-way ANOVA to look at the effectiveness of the inverted classroom versus traditionally instructed courses. Renfro used a case study method and interview to understand the potential use of the inverted classroom. Renfro found that most students benefited from the inverted classroom while a minority did better in a traditional course.

Overmyer (2014) used a quantitative study to explore the outcome differences of the traditional teaching method and the inverted classroom method in college algebra. A

group of 210 students in traditional instruction was compared with a group of 175

inverted classroom students on pre/post algebra readiness exams and final exams.

Overmyer used regression and ANOVA analyses methods to study exam data,

instructional method, gender, and ACT test scores as independent variables. The study

did not show a significant difference in the use of the two methods; however, the students

in the inverted classroom scored slightly better on exams than the students in the

traditional classroom.

Sun (2015) used structural equation modeling (SEM) to study the relationship

among self-regulatory constructs and achievement in the inverted math classroom. The

study adopted the Winne and Hadwin's self-regulated learning theory (Winne & Hadwin,

1998) as the theoretical framework to examine how students succeeded in this classroom.

A group of 151 students in a public Midwest university participated in the study by

completing two online surveys during the spring 2015 semester. The study found that

prior math knowledge and help-seeking each had a positive effect on math achievement.

The study also showed that the students most likely to succeed in the inverted math

classes are those who hold a high level of confidence in learning math, apt to use the

internet to learn math, seek help from others, and are prepared to use collaborative

learning (Sun, 2015).

Brown (2012) used a qualitative phenomenological method to study the

experiences of instructors using the inverted classroom for the first time. The participants

varied in teaching experience, discipline, and institutional setting. The researcher used

interviews and examined course materials as part of her data. The study found that the

instructors had to relearn how to teach through discovery. The teaching choices were

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directed by the experiences of their students in the classroom. The instructors appreciated the autonomy of the teaching model as they were allowed to respond to the needs of their students.

Yemma (2015) also used a phenomenological study to explore the experiences of faculty using the inverted classroom learning approach. Yemma selected ten participants and used the internet to conduct interviews. The participants were geographically dispersed and in different disciplines of study. The results of the study showed that there were some distinct cyclic phases associated with the use of the inverted classroom: motivation to change teaching styles, preparations for the course, curricular and student notification, pedagogy and practice changes to learning environments, and reflecting on the benefits and challenges of adopting the inverted classroom teaching model (Yemma, 2015).

Crawford (2015) evaluated whether the use of technology was increased in both health science courses taught as inverted classrooms and in faculty development on the inverted classroom. Crawford used mixed methods for his study. His 14 participants taught in either one of two healthcare programs at the same university. The quantitative portion of his study consisted of collecting data using questionnaires and then reporting descriptive statistics. Interviews were used to collect data for the qualitative portion of his study. Crawford reported that use of the inverted classroom did increase the use of technology in the target courses, but stated that faculty workload and lack of institutional support served as barriers to more of the faculty adopting the inverted classroom. A significant time commitment is required on the part of the instructor to implement and use the inverted classroom. Without support from the learning institution or other

instructors, the process appears daunting, and many instructors choose not to use the inverted instruction platform (Crawford, 2015).

Beumer (2018) evaluated team-based learning (small group, peer-led learning in the inverted classroom; Michaelsen et al., 2004) for an introductory biology course at a two-year, open access college. The team-based learning resulted in increased retention of the students, and higher passing rates and overall average exam score.

Floro (2014) investigated the use of the inverted classroom in an undergraduate introductory biology course. This study focused on using a matched pairs t-test to compare the students' surveyed attitudes towards science with both the inverted classroom and the traditional instructional method. Floro's study also used an exam and problem solving exercise to evaluate the effectiveness of the two methods in students' learning achievement. The study indicated that attitudes towards science and science learning may play a role in student achievement. However, the study did not show a significant difference in the effectiveness of the inverted classroom over the traditional instruction method based on the collected data.

Matawali et al. (2019) examined the inverted classroom compared to a traditional learning environment for a biology course. The parameter measured was examination: a pretest and posttest. The pretest was administered prior to the students being placed in either the inverted classroom or the traditional classroom. The study compared test scores from 75 biology students and revealed a significant improvement for the students in the inverted classroom.

This literature review reports two qualitative studies using phenomenology to investigate the benefits and challenges that the participants experienced. These studies

used data collected from participants in different teaching disciplines at different learning institutions. Quantitative studies in mathematics have been the focus of most of the recent research investigating the inverted classroom as a teaching model. Three of these studies reviewed were focused on the performance of an inverted classroom compared to the traditional instruction method in an undergraduate biology course (Beumer, 2018; Floro, 2014; Matawali et al., 2019). None of the studies reviewed in this study focused on the experiences of instructors involved in the design, implementation, or teaching of an introductory biology course at a community college. This research proposes to examine this specific situation in order to add to the body of knowledge available to the field and to help lessen the gap that exists in our understanding of the potential challenges and benefits to using the inverted classroom as a teaching model.

Connecting College Science Education With Adult Learning Principles in the

Inverted Classroom

Instructional design of a course is a systematic decision-making process that allows educators to identify the most important elements of the learning process and make decisions about what will be the most effective approach to implement as a learning methodology for the learners (Dean, 2002). Knowles et al. (2011) identified several attributes of adult learners, including that they are typically self-directed, possess a reservoir of experience, are problem-centered as opposed to subject-centered learners, have internal motivation, and need to know why they are learning what they are learning. It is important to make these adult learning attributes the focus of course design in order to capitalize on the adult student's strengths and help the student be successful (Pfahl et al., 2010).

Adult learners, who make up the majority of college students, especially in community college (Bailey et al., 2015; Snyder et al., 2019; Stokes, 2007), too often enter college with only the minimal skills needed to begin college-level work (Barnes & Slate, 2013; Tierney & Sablan, 2014). Those aiming for employment in the biosciences and related health professions often struggle to succeed in their math and science classes because these courses require higher-level knowledge and study skills (Alfaro-LeFevre, 2006; Giddens et al., 2015; Herrera & Blair, 2015). Although some adult students bring to the classroom strengths in setting and achieving goals, applicable life experiences, and good problem-solving skills (Kasworm, 2018; Knowles et al., 2020; Lieb, 1991), many biology classes still rely on the childhood skills of memorization and do not utilize the strengths of adult learners in delivering instruction (Klymkowsky, 2010; Momsen et al., 2010). This deficiency contributes to lower success rates of adult learners (Tierney & Sablan, 2014).

Knowles et al. (2011) have stated that adults often define themselves by their experiences, and researchers acknowledge the role that experience plays in adult education (Baumgartner, 2011; Lawrence, 2012). Students need to be taught to reflect on what they are learning when engaging the learning module. Techniques of critical reflection assist students to recognize and understand complex course content for themselves (Smith, 2011). Simao and Flores (2010) reported that students stated they learned to think critically because reflection was a key focus in their learning activities and in their increasing awareness of the learning process. Nomme and Birol (2014) have identified the need for critical thought and reflection in biology and science.

Humans come into this world as embodied beings, which means that their understanding and learning is connected to all of the senses of the body (Lawrence, 2012). Embodied learning is an essential component of adult and holistic learning. Learning for adults encompasses the body, mind, heart, and spirit and requires whole-person engagement (Lawrence, 2012). It is important to consider the ways that adults learn in order to make the learning process more conducive to their learning preferences. The learning needs of adults are internally or externally identified as the gaps between the ideal and their current understanding of the material, while motivation is the process of directing energy to accomplish a goal (Wlodkowski, 2008). Motivation is what makes adult learners behave as they do and participate in learning in order to close that gap of knowledge (Dean, 2002). If students are allowed to become stakeholders in their learning, they will respond by taking the responsibility for their own learning (Seigel, 2013).

Most programs involved in practical and academic training for adult student learners are centered on delivering teacher-presented lectures and making assessments based on the course content presented in the lecture (Adams & Gringas, 2017; Hockings, 2009; Lea et al., 2003; Talbert, 2017). These programs do not promote enriching and solidifying transferable skills, such as listening and setting goals that adult learners have developed and take with them wherever they go. These skills allow the learners to be successful in dealing and engaging in dialogue with their peers and learning from their peers. Mulholland and Turnock (2013) agree that adult learners learn more effectively to master the course content by developing transferable skills by working with people in groups. This tendency is especially true for those disciplines that require professionals to

work as a team, but it also has implications for professionals who are individual contributors to their fields.

In higher education, with the focus on the students' mastery of course content, the central idea behind mastery learning is that the student must complete all work to a certain standard before moving on to the next topic and receiving credit for his or her work (Seigel, 2013). The inverted classroom takes the principles of mastery learning and marries them with modern technology to produce a sustainable, reproducible, and manageable environment for learning (Azeta, et al., 2018; Bergmann & Sams, 2012; Christopher, 2018; Roe et al., 2019; Rohani et al., 2020; Telford & Senior, 2017). In an inverted classroom, there is asynchronous activity as the students would be working on different activities at different times in order to master the course content they most need to understand. Students who want to work ahead really appreciate the asynchronous facet of the inverted class model, and it puts less pressure on the students that need more time to master the course content (Prindle, 2013).

Because of the responsibilities and time constraints of the adult learner, the inverted classroom provides a more inclusive course delivery model (Lage et al., 2000). Proponents of the inverted classroom posit that the model can greatly increase the teacher's ability to provide differentiated instruction, given that students work at their own pace in the classroom, and teachers can provide more challenging work for those students who master the course material quickly (Finkel, 2012). By inverting the classroom and making it student-centered, it is easier for the teacher to accommodate the student who needs more one-on-one time with the teacher (Adams & Gringas, 2017; Mazur, 1997; Prindle, 2013). This student-centered approach focuses primarily on the

learning process and the characteristics of the adult learner and, secondarily, on the teaching and characteristics of those who help the adult to learn (Long et al., 2017; Mackeracher, 2004).

The inverted classroom, therefore, provides a student-centered learning environment where the learners are actively involved in not only their learning, but also in the decisions about how that learning should occur. This learning model fits the needs of adult learners better than a traditional lecture model because it allows for the student to have autonomy in deciding what would better serve their learning needs (Hansman & Mott, 2010). A number of researchers (Carter & Rukholm, 2008; McDonough, 2012; Randles et al., 2007; Sandmann, 2010) provide evidence to support the synergy of students as partners in learning with the teachers.

Professional Development Associated With the Implementation of an Inverted Classroom

Instructor professional development is viewed as a key ingredient in improving student performance in higher education; however, current professional development programs for practicing instructors often miss the mark in creating lasting, meaningful learning experiences that support the instructors' ability to effectively work with students (Blumberg, 2014).

When thinking about innovative ways to deliver professional development, one needs to consider what works and does not work in the existing educational model (Daniels, 2013). This awareness is especially true for the training necessary in the design, implementation, and support of an inverted classroom (Fink, 2013).

Besides the large amount of experiential learning and personal development that is associated with the use of a student-centered model, there is evidence in the literature for increased career satisfaction for teachers who use student-centered models of teaching (Wright, 2011). Unfortunately, instructors who change their instructional approaches do not always have professional development support and are left to develop the course on their own (Blumberg, 2014; Palsole & Brunk-Chavez, 2011). As a result, even though faculty members believe in the concept of a student-centered learning model, they may not actually put the model into practice (An & Reigeluth, 2011; Donmez et al., 2017; Long et al., 2020; Zawilinski, 2020).

Instructors must be critical of their own teaching practice and find concrete examples that serve as points of initiation for discussions with students concerning the course content. Instructors should also design activities and projects to help the students engage the course content in a way that increases their understanding of it (Clegorne & Mitchell, 2013). As well, instructors need to learn how to design activities that demonstrate the relationship between theory and practice, allowing the student to understand the use and importance of the course content beyond the simple transfer of knowledge from teacher to student (Clegorne & Mitchell, 2013). In her study, McCombs (2003) found that the two most important areas, in terms of impacting student motivation and achievement of student-centered classroom practices, are the students' perceptions that 1) teachers encourage positive interpersonal relationships, and 2) the voice of the student is honored.

Bennett (2013) reported the biggest barrier to implementing an inverted classroom was preconceived notions of what good teaching is. According to Bennett, good teaching

involves reflection so that the instructor is constantly evolving to meet the needs of their students. Changes need to be implemented in the way content is delivered, technology is used, and relationships are built with students so they are willing to collaborate in learning.

The differences in students' learning styles and the assessment tools used to determine learning styles need to be discussed at teachers' professional development conferences and in-house training. When instructors are able to ascertain the styles of learning their students prefer, they can adapt their instruction to complement the learning styles of their students (Felder & Silverman, 1988). In their publication, Mulholland and Turnock (2013) explain the differences in the learning styles of students for instructors in health and social care settings. Moreover, they present an instruction tool which provides direction and advice to teachers on ways to assess the students for their preferred learning style so that the teachers know how to engage the students.

However, the importance of teaching to student learning styles is a debatable topic in adult education, with some studies showing no demonstrable impact on student learning when learning styles are accommodated in the classroom (Coffield et al., 2004). Yet, Chen and Chiou (2012) found hybrid learning instruction to have a positive relationship between undergraduates' learning styles and learning effectiveness. In their study, Chen and Chiou reported that students who learned in a hybrid classroom had significantly higher learning scores and satisfaction than did students in the traditional classroom setting. When students' learning styles are a mismatch with the way an instructor conducts a course or with how the course is structured, the students feel

frustrated if they cannot adjust their learning style to the instructor's teaching preference (Carter & Kravits, 2015).

The inverted classroom may be a way to remove this barrier from a student's ability to learn because it appeals to a broad range of learning styles without placing undue constraints on an instructor to accommodate each student's learning style (Lage et al., 2000). The use of a wide variety of learning activities that students engage while in class coupled with the online component ensures "something for everyone," especially if those planning the activities are aware of different learning styles. Thus instruction using the inverted classroom facilitates many different learning preferences (Bishop & Verleger, 2013). Learning to design instruction for student engagement is important knowledge for teachers to be better facilitators in a student-centered classroom. The inverted classroom has led to academic growth and success, as well as individual growth of the participating students (Al-Samarraie et al., 2019; Hew et al., 2021; Limaymanta et al., 2021; Long et al., 2017; Onodipe et al., 2020).

Learning styles were described as five different styles by Felder and Silverman (1988). Their five learning styles are: 1) perceptive, 2) input, 3) organizational, 4) processing, and 5) understanding. Perceptive learners use their senses and intuition in order to grasp concepts. Students who ascribe to input learning need to use visual or auditory prompts to be successful. Organizational learners prefer to analyze data in order to make sense of concepts. Students who are process learners do better by actively interacting with their environment and reflecting on ideas in order to understand concepts. Finally, those students who learn by understanding take in information sequentially or globally in large sections at a time.

While the field of education is facing many changes, the educational system has stagnated; technological innovations are changing what we know about education (Daniels, 2013). Many of today's college students, often called digital natives or the "Net Generation," have grown up with technology. Most of these students have never known life without the internet (An & Reigeluth, 2011). Because of this reality, many teachers have tried to incorporate technology into their courses. In some cases, however, instructors simply put online what they are doing in a face-to-face classroom and then call it a blended, student-centered model. This practice usually does not work because it lacks the scaffolding necessary to support the effectiveness of the learning model (Daniels, 2013). An adequate amount of detail in the materials placed online is what allows the students to understand the course content. Then as is consistent with the model, there needs to be some additional materials available to the students that allow for reinforcing and reflection of the intended learning with the course content (Strayer, 2012).

Ironically, one of the great strengths of the inverted classroom model is also one of the most difficult barriers to teachers implementing the model: the technology component. It may be that some teachers lack the sufficient skills necessary to implement facets of a course that would require technology (Schachter, 2012). In professional development courses, the teachers many times learn about new and innovative software or instruction techniques but then have difficulty implementing their use for student learning (An & Reigeluth, 2011). It is difficult to develop pedagogical and technological expertise simultaneously as teachers are integrating technology into the classroom (Kayler & Sullivan, 2011). Increasingly, the growth in online learning is less and less a

distance learning phenomenon, and more and more a blended, student-centered approach (Horn, 2010). Professional development that deals specifically with addressing the skills necessary for using technology in an online environment, and the use of activities that reinforce the materials in the online learning modules, must be developed and included as training in order to support the instructors (Herman, 2012). The teachers need to be able to apply their professional development to their course content so that the new ideas are used in a student-centered format and are relevant to both the teachers and the students.

There are many ways of delivering online course content to the student (Azeta, et al., 2018; Christopher, 2018; Roe et al., 2019; Rohani et al., 2020; Telford & Senior, 2017). One of the easiest is to use narrated or non-narrated presentations (Selwyn et al., 2006). Other ways to capitalize on new technologies to deliver course content include many information and communication technologies (ICTs), such as videos, interactive modules, and short narrated presentations, which can easily be supported by the higher education institution's technology support staff (Selwyn et al., 2006).

Because teaching practices are continuously shaped by the values, beliefs, and experiences of the educators, researchers have recommended that educators build communities of practice (CoP), social networks, or best practices groups in order to share ideas and explore new ones to help the instructors enhance their practices (Addis et al., 2013; An & Reigeluth, 2011; Boschman et al., 2021; Daniels, 2013; King, 2011; Poole et al., 2019; Seyedmonir et al., 2014; Thomson & Barrie, 2021; Thomson & Trigwell, 2018). These skill-enhancing avenues should be part of teachers' professional development activities. This recommendation could be easily accomplished by internal or external periodic meetings of teachers to share their ideas and successes with each other.

King (2011) has even indicated that professional development communities for teachers could be set up online as a means for teachers to share ideas and learning from each other. Daniels (2013) also recommends that teachers who want to implement an inverted classroom work together as a team in order to support and learn from each other during the implementation process.

Another facet of adult learning that is usually not addressed in professional development seminars for teachers is critical reflection (Brett-MacLean & Cave, 2014). Evidence exists to show that reflective techniques such as critical portfolios and reflective journals can help instructors to consolidate and assess their learning and understanding of a discipline and its practices (Smith, 2011). Reflection is a process that has been associated with a wide range of learning outcomes, including improved thinking, learning, and assessment of self, especially during a period of professional growth and development.

Critical reflection can support professional development through assessment of decisions and actions, and it can lead to improvements in content delivery and student experiences in many professions, including teaching (Smith, 2011). Instructors need to be reminded of their role in modelling and reflecting on their teaching practices in such a way that they themselves are good examples of the kind of teaching they are trying to promote (Simao & Flores, 2010). This aspect should be a focus of professional development.

All of the ideas mentioned in this section support the need for professional development courses or training sessions that focus on strengthening the links between technology use, pedagogy, and course content. Even if teachers have a student-centered

philosophy, they can struggle to implement effective practices in the classroom that will support the students' understanding of the course content. The teachers need training that will introduce strategies to properly instruct their students in a student-centered environment.

Summary and Direction of the Study

Many sources of information exist concerning the inverted classroom. Some of these sources explore the effectiveness of the inverted classroom, the student learning outcomes, and a comparison of the student-centered versus teacher-centered teaching model. But research on inverted classrooms in higher education is still emerging (Beumer, 2018; Crawford, 2015; Floro, 2014; Matawali et al., 2019; Yemma, 2015). The adoption of computer-based technologies in education has outpaced the ability of researchers to provide empirical and theory-based data to support the efficacy of the learning models (de la Varre et al., 2010). With regard to the discipline of science, Bergmann and Sams (2012) state that the inverted classroom is a perfect model for sciences because it invites the use of inquiry learning as a powerful tool to help students create conceptual understanding without direct instruction.

One of the identified research gaps is documenting, chronicling, and studying the experiences of faculty learning to develop and implement an introductory biology inverted classroom at a community college. Brown's (2012) study, which investigated the experiences of interdisciplinary instructors who adopted the inverted classroom to instruct their courses, focused on undergraduate faculty at an assortment of higher education institutions, and used the internet and publically accessible listservs to identity her educator participants. By focusing on the experiences of community college

instructors who worked as a team to design, implement and/or teach an inverted

introductory biology course, it is hoped this study will generate additional perspectives

and experiences to add to the emerging body of knowledge on this topic as well as inform

the field of education about the challenges and the best practices associated with the

implementation of a teaching model of this nature.

3. METHODS

Background

Many higher education students who enter health sciences curriculum lack the necessary science background to successfully complete professional health sciences programs (Bahr et al., 2017; Reddick et al., 2012). To combat the problem of low pass rates in prerequisite science courses at a central Texas community college, an introductory biology course was redesigned as an inverted classroom to engage the students in active learning, with the hopes of preparing students better for success.

To implement an inverted classroom, an instructor must make a dramatic shift in their teaching practice, moving the presentation of course material out of a traditional lecture-based classroom to the asynchronous online classroom environment to make time for a more activity-oriented in-class experience. This shift in teaching practice changes the instruction delivery from a teacher-centered approach to a student-centered approach (Bergmann & Sams, 2012).

Although research is still emerging addressing the success of an inverted classroom at the college level, there are data that show the success of the inverted classroom in high school settings (Fulton, 2014). So while the concept of an inverted classroom is not new, the application of the method in higher education has only recently begun to be more prevalent. The effect and impact on educators faced with the transition from a traditional classroom to an inverted classroom has not been extensively studied (Matawali et.al., 2019; Picciano & Dziuban, 2007; Wolf, 2020).

To add to what is known in the literature regarding the use of the inverted classroom in the higher education setting, I investigated the experiences of the educators

involved in the design, implementation and/or teaching of an inverted classroom in the community college environment to understand more deeply the processes that educators experience during the transition to an inverted classroom. In this way, I hoped to inform professional development for those who might be interested in using an inverted classroom to facilitate student-centered learning courses at their higher education institutions.

My Professional Perspective

As an educator with 20 years' experience teaching at a community college, I have personally observed students struggle in a traditional teaching environment. In a lecture-based, face-to-face learning environment, students tend to listen passively to an instructor and then are assessed based on what they have heard or read. This type of learning environment has been an obstacle for many students who do not memorize information well or are not adequately stimulated by a teacher-centered (passive) learning experiences to retain information.

Because the student-centered educational concept of an inverted classroom was seen as a possible solution to help community college learners become successful active learners, and thereby ultimately perform better in the prerequisite science courses, an inverted classroom for an introductory biology course was designed and implemented at the institution in which I work. The novelty and success of this type of classroom in more completely addressing barriers to adult learning at the community college was lauded as an example for other courses at the institution, and now several other courses are being taught as inverted classrooms.

My Role as a Researcher

Instructors are subjective insiders involved in classroom instruction as they go about their daily routines (Kincheloe, 2003). And, educational researchers often pose questions and conduct research within educational settings as objective, outside observers of classroom interaction (MacLean & Mohr, 1999). My role in this study was as a researcher, but because of my history of developing and teaching the course I am studying, I interpreted data as an insider while bracketing my own biases to ensure I represented the participants' data and did not allow my own experiences to skew the results. Bracketing is a process in which the researcher interprets data without allowing their own experiences to bias or influence the findings associated with the data (van Manen, 2014).

The role of instructors changes when they become researchers because they ask questions about what they think and observe regarding their teaching and their students' learning (MacLean & Mohr, 1999). As a researcher, I am what Merriam (2009) calls a human instrument and filter of the information acquired from the study. I can make important decisions concerning what should be included, while collecting and analyzing data for the study. I endeavored to be reflective and careful while analyzing the data, adjusting the project as necessary in order to adequately enhance participant engagement and to document the process.

While the topic being studied is seen as connected with and deriving meaning from the respective physical and cultural environment, the individual perspectives of the informants contribute additional meanings (van Manen, 2014). A perspective I brought to the study is rooted in both an **instructor** and **researcher** worldview informed by social

constructivism. Crotty (1989) describes social constructivism as learning by participating in the world and making sense of the experience. Social constructivism in education is the process where learners are encouraged to interact and participate with each other in learning to construct, transfer, and share knowledge effectively (Thinley et al., 2014). In this way, social constructivism is learning that is all encompassing. This perspective applies directly to the knowledge gained and shared from the results of the research study and its value to the education field.

Chavez (2008) provides some guidance for insiders conducting research in their fields. First, an insider must be able to verify or falsify his or her assumed interpretations of data based on his or her practical knowledge of the field. I addressed this concern by reflecting on the data and bracketing my personal experience from the data interpretations. Chavez (2008) further warns researchers to use their observational skills to be sure they are able to differentiate what they know from what the data detail. I employed member checks to be sure I was representing the voice and data of the participants and not confounding my personal knowledge into the meaning making of the findings.

As a researcher in the study, my 20 years of teaching experience in biology at a central Texas community college, where I also have been on the team of instructors who designed, implemented, and taught the introductory biology course in the inverted platform, made me uniquely qualified for this role. I employed a pragmatic worldview perspective and did not see data as absolute. This perspective lent itself to the use of multiple sources of data and allowed flexibility of the research design to address the

needs of investigating the research problem. I also recognized the potential for multiple layers of context to encompass any issue under study.

Phenomenology as a Framework for the Study

Phenomenology is the study of how the world is experienced by individuals (Slattery, 2006) and focuses on describing what all the participants have in common as they experience an event (van Manen, 2014). The phenomenological method is appropriate when studying a set of individuals who have all experienced a specific phenomenon closely connected to their setting and context (Smith et al., 2013).

This study's theoretical framework was interpretive phenomenology as I sought not only to describe the experiences of the instructors who were involved in teaching biology in an inverted classroom platform, but also to understand what the instructors' experiences meant to them. The choice of this methodology allowed me to make an in-depth examination of multiple renderings of the same phenomenon, with the goal to distill shared elements of the experience and present the themes common to all informants (Smith et al., 2013). The advantage of a phenomenological approach, therefore, is its usefulness to encapsulate and depict the shared learning derived from an event from which others, both researchers and practitioners in the field, can benefit.

I specifically employed hermeneutical phenomenology to analyze the experiences of educators who were responsible for some or all of the redesign, implementation, or instruction of the biology course in the inverted classroom platform. Hermeneutical phenomenology was first applied by van Manen (1990) and is described by Smith et al. (2013) as a method to investigate the everyday practice and understanding of humans within their daily life activities. In teaching, hermeneutics is concerned with the

ambiguous dimensions of classroom experiences (van Manen, 2014). The changing

moods, emotions, behaviors, and choices of individuals create unique experiences in the

classroom which can be studied from the perspectives of the instructors (Slattery et al.,

2007). While being careful not to overlay my own preconceived understandings of the

phenomenon, van Manen's approach allowed me to call upon my own instructor

background to help me make sense of the experiences of the instructors who were the

participants of the study. Thus, van Manen's (1990) approach to interpretive

phenomenology was best suited to analyze the data in this study because it requires the

interpretive role of the researcher.

Selecting phenomenology as the framework for this study necessitated a

qualitative approach to investigate and describe the experiences of the instructors in an

effort to understand the motivations, benefits, and challenges of this instructional

approach transformation. Qualitative research emphasizes the context within which

events take place, situating both the event and the researcher in external circumstances

(Merriam, 2009). When following a qualitative research method, the researcher can be

seen as a human instrument (Merriam, 2009) collecting data from a variety of sources in

a multifaceted and detailed way. As such, the researcher's perspective and biases must be

acknowledged and taken into consideration. To ensure my own biases did not skew the

interpretation of participants' data, I bracketed my personal biases from the data.

In order to make sure my personal insights of the inverted classroom did not

confound the analysis of participants' data, I constantly returned to the data to be sure

that I represented the data as intended by the participants. I kept notes in my researcher

log throughout the data collection of this study to document my personal feelings, ideas,

and beliefs concerning the data so that I was self-aware of my biases and did not add them into analysis of the research data.

Research Setting

The study took place at a community college campus that serves a large minority population located in a central Texas major metropolitan area. The community college was willing to be a partner with me in this study. The campus is large, with multiple buildings that house academic and support services. The campus is also the major hub for the college's health sciences and medical programs. The large classroom in which my participants taught was fully equipped with all the materials necessary to teach biology: microscopes, cellular models, computers, projectors, and a Smartboard. There were enough student seats to accommodate 32 students comfortably. The teaching classroom was used as the location to conduct the interviews with my participants because the presence of the teaching materials may have helped the participating instructors with describing their experiences and forming responses to the questions posed by me as the interviews were conducted.

Study Participants

The participants targeted for this study were instructors employed by the community college involved with some or all of the redesign, implementation, and instruction of the biology course in the inverted classroom platform. van Manen (2014) states that phenomenological studies should have enough participants in order to understand life as it is lived. Dukes (1984) recommends between three and ten participants. The study included six instructors who had at least two years teaching experience at a community college. The age group of the study's participants was

between 25 and 70 years of age. The participants were women because most of the instructors who had been involved in the introductory biology class redesign were women.

The participants had experience with some or all of the redesign, implementation, and instruction of the biology course in the inverted classroom platform. The reason for the inclusion of all of these participants was to gather a wide spectrum of experiences. For example, some of the participants had been involved with the redesigned course since its inception, while other instructors had come to the redesigned course as an instructor only. Upon IRB approval, the targeted instructors were invited to volunteer for this study by email or letter. If the invitees were interested in participating in the study, they contacted me by responding to the invitations. The identity of the participants was protected by pseudonyms on transcriptions and the final report. Any electronic records of the data were protected by passwords. My dissertation chair and I were the only individuals who knew the participants' identities.

Purposeful sampling as described by Patton (2002) was used to select participants from the pool of interested volunteers. This type of sampling allowed me to choose, in a deliberate manner, a set of six instructors, who could provide the rich and meaningful data required in qualitative research. The sampling was also one of convenience because the participants were selected based on their affiliation with the design, implementation and/or teaching of the inverted introductory biology course.

Data Collection Procedures

Fosnot and Perry (2005) state that social constructivism is (a) based on the understanding that knowledge is created through social interaction, (b) acknowledged by

the choice of qualitative research method, and (c) incorporated through the collaborative nature of the phenomenological research process. Patton (2002) and Merriam (2009) explain that qualitative data can be acquired by many different methods such as observations, interviews, artifacts, and other documents. I selected interviews, focus group, and research notes to collect my data.

Interviews

An interview was the qualitative method of collecting data from my study participants that focused on the entire experience-sharing of the group. The data represent the experiences, beliefs, and language of the participants (Merriam, 2009). In the interviews, I immersed myself in the environment that I was studying so that I could describe the culture and social interaction of the specific sample (Merriam, 2009). For this study, I was interested in examining the experiences of the participants who were involved with some or all of the redesign, implementation, and instruction of the introductory biology course in the inverted classroom platform. By utilizing ethnographical interviews as a primary means of data collection, I gathered data that allowed me to interpret and describe their interactions and experiences.

Merriam (2009) suggested that the questions asked during the interviews are essential in collecting meaningful data from the participants. The researcher must ask good questions that are open-ended to allow for detailed responses. Interviews, as described by Merriam, allow the researcher, through a purposeful conversation, an opportunity for an in-depth exploration of a particular topic or experience from the perspective of those who have had the experience. The aim was to support the participants to verbally express their experience and constructed knowledge.

Each participant had a semi-structured, open-ended interview that lasted anywhere from 60-90 minutes in the biology classroom. Participants were asked whether I could contact them if I needed to ask follow-up questions when I was writing up the findings. The semi-structured format described by Merriam (2009) is a flexible form of interviewing in that, while the researcher knows the questions needing exploration, the interview is more like a conversation where question order and wording are not exact. When going into the interview, I had a specific set of questions to ask each participant (see Appendix A); however, when asking the questions, I urged the participants to speak freely about their experiences and only redirected the participants' interviews if they got off the focus of the study. As I conducted interviews, I explored statements by asking questions that were not preplanned, yet were pertinent to the study's purpose, probing the participants to further explore the phenomenon through their perspectives and beliefs (Merriam, 2009). The interviews were recorded. Additionally, I took notes during the interviews to document my observations of specific events, interactions, places, and so forth (Merriam, 2009), and these notes were part of my researcher's log.

After the interview, I analyzed the data multiple times to ensure that I understood the essence of each participant's responses. If additional clarification was needed, I developed follow-up questions for the participant to assist in my understanding of the data. To aid the development of follow-up interview questions, I used my notes for additional insights. I followed up with five participants in person, by telephone or by a personal email.

Additionally, a focus group was conducted where a critical incident for the participants was discussed (see below for details of the focus group data collection). Once

the individual and focus group interviews had been transcribed, coded for themes, and analyzed, the need for further examination of topics or themes might require additional interviews, conducted in person or by telephone. Because there was a need to have additional clarifications after the focus group, I contacted four of the focus group participants in person, by telephone or by email. Prior to contacting the participants, I reviewed the follow-up questions with my dissertation chair to ensure the questions adhered to the scope and purpose of the study.

The researcher's log contained notes that were taken during the interviews that provided insight into the meaning of the narratives expressed by the participants. The focus group and researcher's log applicability to the ethnographic interviews was noted here to facilitate the reader's understanding of how they were used to enhance the ethnographic interview process.

Focus Group

A focus group is an interview of the study participants together at the same time on a topic about which the group has knowledge. Because the data obtained by the focus group were socially constructed by the interaction of the group, a constructivist perspective underlies the data collection procedure (Merriam, 2009). The goal of the focus group was to extend and establish support for the data collected from the individual interviews, by validation from data derived from the focus group. One of the ways to validate the interview data is to have a second source of data that indicates a consensus of the data collected from the interviews. This validation of data is referred to as triangulation (Merriam, 2009). Four of the six study participants were available to participate in the focus group.

Following the individual interviews, I conducted the focus group to explore a critical incident that the interviewees experienced during either the design, implementation, or teaching of the introductory biology course. A critical incident can be defined as an event that has significance to an individual (Tripp, 2012). Critical incident technique (CIT) is a method of data collection that is collaborative where the participants make decisions about what is important in their experiences (Tripp, 2012). CIT is a guided, semi-structured interview and data analysis technique which employs a flexible set of principles to gather detailed information about how experts in a certain domain approach a procedure or significant situation and the meanings they attach to this situation (Hosie et al., 2014). CIT is useful for reflecting on professional practice and has the advantage of allowing for brief interviews. CIT is an effective means to explore teaching experiences and events that may have a lingering effect on the instructors and their practice (Keating, 2002). The participants were instructed to come to the meeting ready to discuss their thoughts concerning a critical incident of their own chosing. The instructions for the CIT focus group were written and delivered to the participants by email two weeks prior to the focus group meeting. I asked the participants to send me an acknowledgement that they received the instructions.

Although there are no rules about how many participants to include in a focus group, Merriam (2009) suggests between six and ten participants. Four of the study participants participated in the focus group; the remaining two participants were not available at the time of the CIT focus group meeting.

The focus group for this study was conducted in a neutral setting on the community college property and lasted for approximately 90 minutes. I followed the CIT

approach and asked the participants to describe the most influential experience in each participant's growth in teaching while being part of the team that developed, implemented, and/or taught the introductory biology course on the inverted classroom platform. Each participant was directed to come to the focus group prepared to tell the story of their critical incident. Group members then were asked to reflect on each participant's critical incident regarding their own learning, teaching challenges, and further insights.

Finally, the focus group was conducted in a nondirective style of interviewing to encourage a variety of viewpoints on the experiences of developing and teaching the introductory biology course. I introduced the topics for discussion and facilitated the interchange. The role of the facilitator is not to get to a consensus about, or develop solutions to, the topic of focus, but to create a permissive environment for the expression of personal and conflicting viewpoints of the participants' experiences (Brinkmann & Kvale, 2015). The goal of the collective interaction of the participants is to bring forth more spontaneous expressive and emotional points of view than an individual cognitive interview would (Brinkmann & Kvale, 2015). The focus group was digitally recorded in order to preserve the atmosphere and emotions exhibited by the participants.

The focus group protocol was modeled from other studies that used the CIT to explore the experiences of individuals in qualitative research (see, e.g., Coleman, 2006; Quigley et al., 2015). The critical incident protocol is located in Appendix B of this document.

Data Analysis Process

Phenomenological methodology is appropriate when studying a set of individuals who have all experienced a specific phenomenon closely connected to their setting and context. The ultimate goal of a phenomenological study is to describe the essence of the phenomenon. Following a review of the literature on phenomenological research, I found that van Manen's (2014) approach to the analysis methodology was the best fit for this study. van Manen's approach to research is "in-ness." It is a method of how we find-ourselves-in the world. van Manen advocates the interpretive role of the researcher. In this way, a researcher allows the perspectives of the participants to lead the analysis process, but the perspective of the researcher is also important in the interpretation of what the data mean.

I used a researcher's log to stay engaged and focused throughout the research time period and to record the research audit trail. The researcher's log, according to Merriam (2009), is used to record ideas, reflections, hunches, and notes about patterns that seem to be emerging through the researcher's reflection. In the researcher's log, I began to analyze and reflect on the participants' experiences. I made notes in my log of what I observed during the interview concerning the participant's feelings, body language, and facial expressions. It also kept me focused on how to best incorporate what I was hearing from the participants' interviews, in order to gain a deeper understanding of the respondents' experiences. The researcher's log was an effective tool during the analysis phase, as I reviewed what I understood from my experience about the interviewees' responses. My notes helped me in analyzing the data, and the log helped me stay focused on the themes that developed within the participants' interview question responses.

Data collected from the individual and focus group interviews were digitally recorded and transcribed. Transcriptions and research notes were then analyzed beginning with my initial coding. Coding is a crucial first step of data analysis in interpretive phenomenology using van Manen's (2014) approach. Coding is the identification of words and/or phrases in the data that assign a descriptive attribute for a portion of language-based or visual data. Coding was an ongoing process throughout this project, as the data were constantly being reviewed and analyzed as they came in, which Merriam (2009) describes as ideal in qualitative research because this process allows for findings to be substantiated, revised, and reconfigured. The data coding and theme identification followed Merriam's (2009) method:

1. The interviews were transcribed and evaluated for any patterns.

2. The transcribed data from the interviews were then coded by the interview question they addressed.

3. A master list of all the coded data was generated in order to interpret the data set.

4. Once the master list was composed, overarching themes were generated.

5. It is from these themes that superordinate themes were derived by grouping similar themes and categorizing the themes at a higher value.

6. The thematic data was used to answer the research questions and articulate the essence of the phenomenon.

Using these guidelines, I transcribed the interviews while they were current in my thoughts and memory. Once all recorded interviews were converted into text, I began to code each interview transcript. From these codes, I built a matrix in order to compare all

the codes and data from each of the participants. Merriam (2009) advises the researcher

to review all the documents and begin grouping codes together that seem to align. I used

the codes matrix to look for like themes, creating grouped codes and categories from

similar ideas. From these grouped codes, I then created a new code that encompassed the

ideas represented by the multiple sub-codes, a process referred to as analytic coding

(Merriam, 2009). This final set of codes represented my "master list" from which I

derived the major themes of the study. See Appendix C for examples of coding to

determine emergent themes.

As I was coding, I constantly reviewed my research questions to ensure the data

being coded pertained to the questions I endeavored to answer. It was also important to

be aware of contradicting responses in the data. Taylor-Powell and Renner (2003)

describe these types of data as countervailing responses or responses that are opposing

what the majority of the data suggest. This awareness is necessary to understand and to

identify tensions in the data. I analyzed data that were opposing using an *inference to best*

explanation (IBE) approach. Bazeley (2013) indicates IBE is used when an explanation

for all facts in the data are plausible or simple enough to be accepted. IBE draws heavily

on the researcher's background and experiences when deciding amongst competing

hypotheses or responses (Bazeley, 2013).

Next, I analyzed the themes and began to construct my findings. Themes were

defined as main ideas or underlying meaning (Merriam, 2009). The grouping of codes led

to themes in the data, and the analysis of the themes led to superordinate themes in

identifying the structure of the phenomenon. Once the data had been coded and placed in

themes, the data were analyzed by interpretive phenomenology according to van Manen

(2014, p. 318-321) in the following manner:

1. Investigated the experience as it was lived rather than as it may have been
   conceptualized.

2. Reflected on the essential themes which characterized the phenomenon.

3. Described the phenomenon through the art of writing and rewriting.

4. Maintained a strong and oriented pedagogical relation to the phenomenon.

5. Balanced the research context by considering the parts of the whole.

In this iteration of my analysis, I went back to the research questions and

answered them, making sure that the attributes of phenomenology were at the center of

the themes. I used interpretive phenomenology so that I could present the experiences of

the instructors from their point of view. van Manen (2014) describes uses of interpretive

phenomenology in qualitative research as the gathering of data through the collection of

the participants' individual experiences and chronologically ordering the meaning of

those experiences. The instructors' course design participation and their responses during

the interview provided a wealth of data that depicted their journeys through engaging in

this study, demonstrating their apprehensions, overcoming barriers, building

relationships, and incorporating what they learned in creating an introductory biology

course using an inverted classroom.

van Manen (2014) describes interpretive phenomenology as a study of the ways

humans experience the world. In using interpretive phenomenology, I presented the

findings by using direct quotes from the participants' responses. I used the participants'

voices to present the findings, which Connelly and Clandinin (1999) emphasize add rigor to the research.

From the study results, I formulated adult education learning recommendations to help other instructors who might be interested in implementing a student-centered learning model using an inverted classroom. I was specifically interested in the use of the ideas that are learned from the experiences of the participants in this study to inform other instructors who are interested in helping their students be successful by using a student-centered inverted classroom.

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Trustworthiness, Credibility, and Ethics

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Building Trustworthiness and Credibility

I wanted to be sure that the data for the narratives of the participants were represented fairly. This intention begins with treating the participants with respect and patience (Merriam, 2009). The goal was to make the participants feel very comfortable when they were describing their experiences. This effort built a good rapport with the participants so that they were willing to share their stories with me. Secondly, I endeavored to be transparent with the findings by offering the voices of my participants throughout this study, so that reviewers of my study will be able to scrutinize the analyses and the conclusions generated from the data. I did not augment or delete any of the data in the report from the transcripts of the interview; the original data were presented, and I was conscious not to bring my biases into the examination of the data or into the conclusions derived from the data by bracketing the data from my own experiences.

Merriam (2009) discusses the importance of transferability of data and findings by other researchers. Transferability was created in this study by providing detailed

descriptions of the setting, the participants' responses, and the findings of the study (Merriam, 2009) so that readers can determine if their own contexts may be similar to that of this study's and whether the findings of this study may be relevant in their own work. These details offer researchers and readers the opportunity of transferring the findings of the study for use in their own research and practice, adding credibility to this study.

In order to further ensure credibility of the study findings, Merriam (2009) suggests triangulating the data in order to make certain that findings are more than just chance, and not an incorrect conclusion in the researcher's analysis of the data. Therefore, I corroborated findings by evaluating commonalities and differences in several data sources: individual interviews, focus group discussion, and research notes. I also employed member checks to ensure I was representing the data as the participants had intended that their responses be understood. Member checks are also referred to as respondent validation and is the process where feedback is solicited concerning the researcher's findings from the participants interviewed (Merriam, 2009). The participants had a voice in confirming my interpretation and analyses. When presenting study findings, Merriam explains that triangulation is necessary in order to support statements and ensure the correct interpretations are made. Four of the six study participants volunteer to review my findings. Two of the participants were not available for review of the findings. I received confirmation from the four participants that the analysis of the interviews and the focus group represented their voices and their communicated intentions, and they indicated no changes were necessary in the analysis section of this study.

Ethical Considerations

Ethical issues for this study were addressed proactively, prior to the study beginning. This study was approved by the Texas State University Institutional Review Board (IRB) to ensure the study adhered to the research policies of the university and protected the participants from undue harm. The research project also needed to be approved by the IRB of the community college. Once the study was approved by both IRBs, the study began.

The research was explained to the participants to be sure they understood their roles in the study and the scope and purpose of the study prior to any interview. The volunteer participants were asked to sign a consent form to participate. The consent form also informed the participants that their data will remain confidential and will be used in the dissertation and potentially in published reports or papers.

Each participant was given a pseudonym to maintain confidentiality. The real identity represented by the pseudonyms was only accessed by my dissertation chair and me. The pseudonyms and research data were maintained in a research matrix in an electronic format that was protected by password. It is important to maintain confidentiality of participant identity in any written research study. All necessary protocols were followed and should be adequate to protect the participants' identities.

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Summary

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This chapter provides a detailed description of the overall research study design for data collection and analysis to generate study findings. It provides the reader with a greater understanding of the project, the researcher, theoretical framework, setting, and participants. Methods I used to collect data are identified, and the steps that were taken to

analyze the data are laid out in order to prepare the reader for the information that will appear in subsequent chapters.

The next chapter provides a comprehensive description of the phenomenological experiences of educators who have had experience with some or all of the redesign, implementation, and instruction of the introductory biology course in the inverted classroom platform at a community college. It is hoped that findings from this study will assist instructors who want to implement an inverted classroom in making decisions regarding processes necessary to design, implement, and teach the course. This study will also allow instructors to learn about the challenges and obstacles that were experienced during those processes. Readers will then be able to make decisions on what to transfer into their own curriculum and practice so that it is meaningful to their own professional development as well as for their students.

4. FINDINGS: PARTICIPANTS' EVOLUTION AND THE IDENTIFIED BENEFITS

This study was devised to address my research questions associated with the experiences of a team of 15 members (10 faculty instructors and five support staff) who developed and implemented an inverted classroom platform to teach an introductory biology course (IBIC) to higher education students. The instructor team members had little to no experience with the inverted classroom and, for all practical purposes, had never taught a class where the typical lecture class time was essentially spent as active learning time. Themes were developed from analysis of the data. I used interpretive phenomenology to represent the experiences of the instructors from their point of view (van Manen, 2014).

The development of an introductory biology course curriculum at a central Texas community college as an inverted classroom was a project that was grant-funded by the United States Department of Labor (DOL) and administered by a grant consortium. The project goal was to increase student success with introductory biology, but how to accomplish the goal was to be determined by the project participants. Ten biology instructors volunteered to work on the project. Of the six female instructor team members, who also volunteered to participate in this phenomenological exploration of transitioning to an inverted classroom platform, four (Rose, Tara, Andrea, and Carol) were part of the team prior to the first semester the IBIC was taught, and two (Beth and Sofia) joined the team after the first semester had been in session for some weeks.

Many of the responses to the interview questions require background information as context to understand statements made. The following information is provided as

context and as help with the chronology of events, and it is derived from my experience as the researcher who was also a member of the team that worked on the grant project and the implementation of the inverted classroom. The college administrator who was assigned the grant project met with Beth (then the department chair), Tara (a past department chair), and the department chair-elect about developing and writing the grant proposal. Tara was promised the job of grant director by the college administrator; she had prior grant experience and coveted the job, as she said, "I'm basically a born administrator. I *love* detail work." When the grant proposal was selected by the grant consortium during the spring semester, the job of assembling the team for the project fell to the department chair-elect. The team began meeting throughout the summer, except for Tara, who decided to wait for her position as grant director to be funded before meeting with the team in person. Although she communicated with the team by email, the members considered the department chair-elect to be the team leader (as did the department chair-elect), who recruited many of the members and convened and participated in the meetings in person. The fall semester had already begun by the time the funding for Tara's position was properly executed, at which time she began attending the meetings. However, much of the direction of the course had been decided and worked on by then. Team members were neither provided the grant proposal document nor briefed on its full content by those who had access to the document. As a result, they were unaware that the redesigned course was not the totality of the grant objectives; there were actually several more objectives involving other programs at the college, plus there was a schedule for deliverables that would be required over the course of the work as

proof of satisfactory progress toward completion of the grant, which would trigger release of funds by the grant consortium.

Tara attended meetings with the expectation that she would be recognized as the team leader because she was the grant director, but the ensuing power struggle between her and the department chair-elect resulted in the college administrator designating the department chair-elect as the team leader and Tara as the liaison between the grant consortium and the college. The power struggle also resulted in a tumultuous month or two of weekly meetings where team members were exposed to the added stress of leadership disagreements before Tara opted out of team meetings, choosing to participate in the inverted classroom project grant as an independent contributor. Tara was also at odds with the team's decision to pursue a uniform approach to teaching the curriculum, that is, the instructors teaching the five sections would each teach and use the same materials during the same week. Tara felt instructors should be free to move at their own pace and in their own way to cover the curriculum.

Because of the time lapse between the notification that the grant proposal had been selected by the grant consortium and its funding, the team got a late start on the course redesign. While the team spent the summer storyboarding the course objectives, the selection of the inverted classroom platform to deliver the curriculum was made just two weeks before the start of the fall semester. All of the interactive components to be used for the course had yet to be made. These components ran the gamut from the high-tech aspect of online modules for students to access prior to class to the low tech/no tech aspect of hands-on activities involving cut-out images, definition cards, Play-doh,

balloons, and so forth, for students to use during class time to reinforce the topic presented in the module for that class session.

The five sections of the course were taught on the same campus in the same room at different times. The way the room was arranged, that is, the placement of the desks and activities around the room, was part of the design that went into facilitating an active learning classroom. Weekly team meetings (Friday afternoons extending into the evening) were used to brainstorm the activities to use and then create them prior to the next week's classes; these meetings also were used to develop the questions to be used for assessments and tests.

The software selected for preparing and delivering the online modules required time-intensive training, and only two of the faculty team members became proficient with uploading content to the software. Prior to uploading into the module software, the course content was created in PowerPoint by team members, and then one team member "standardized" them for use by the software-trained members to upload into the modules. Other members worked on designing the hands-on activities, cutting and laminating multiple activity sets, and photocopying and collating objectives, guided notes (fill-in-the- blank written notes that students could fill in as they went through the learning modules), and assessments to be distributed to students in class.

The components developed for the course included objectives, outlines, guided notes, daily homework, interactive online modules, card-matching activities, in-class activities, topic quizzes, proficiency checks, in-class skits, and unit exams. The team often feverishly worked to complete enough of the components prior to the delivery of the first class for the week.

Participants' Previous Understandings Regarding Teaching and Learning Using

Inverted Classroom Approaches

Most of the participants were not knowledgeable about inverted classrooms, the

teaching and learning methods used, or the effectiveness of the practice prior to joining

the project. Rose had recently left employment at a research institution, so she was new

to teaching at the college. She described her knowledge of the inverted classroom as non-

existent, explaining,

> I didn't know what an inverted classroom was to be perfectly honest. So that was
>
> a whole new experience, and a whole new concept to me. It never occurred to me
>
> that there could ever be any other way of teaching than standing in front of a class
>
> and giving a lecture.

Other members of the project had read about the inverted classroom or had attended a

training session on the topic but were not experienced with the application of the method.

Andrea revealed, "The definition is about all I understood. I had no concept of what it

really was going to require to just do it—what was really going to be required to change

in instruction. I had no idea." Carol had attended a training session that introduced the

inverted classroom, and her understanding prior to the grant project was that

> …content was taught online, and then class time was used for activities. Class
>
> time was used for activities to reinforce whatever the students had learned online,
>
> so, my understanding was that it wasn't a time where you would come in and
>
> lecture. It was not a formal lecture time—that was expected outside of class.

Carol had an academic understanding of the inverted classroom but had never used it or

participated in its development.

Sofia had heard of the method because of her college teaching experiences. However, Sofia had not used the inverted classroom method in her teaching practice.

> I really didn't know too much. It was just a flipped concept, which to me wasn't really a foreign concept because I was used to being prepared before I go to class. That's a European style—so in other words, you wouldn't go to class unprepared without reading, so it wasn't foreign to me.

Sofia was used to the European method of teaching which was similar to the inverted classroom in that students were expected to come to class already having previewed the topic, but she had never been involved in the development of a course using the inverted classroom.

Like Andrea, Carol, and Sofia, Tara was aware of the method, but she had not used the inverted classroom as part of her teaching practice. However, "it was something that very much interested" her and it was a topic "that came up" in another course she was teaching. Tara was the only one on the team who had an advanced degree in education, and she was interested in adult learning and in keeping up with "pedagogy literature."

Beth joined the project team during the first semester of implementation. She was the only one of the six team members volunteering for this study to have had previous experience teaching on the inverted classroom platform. Beth adopted a version of the method in the mid-2000s for her own biology courses, at the suggestion of and coaching from other instructors, who were providing narrated PowerPoint presentations to their students and asking them to review the presentations and fill out lecture notes before class. Beth and her colleagues did not have a name for their teaching method when they

first started with this approach, but now it would be recognized as an inverted classroom. When Beth could not consistently conduct class in person one semester, the suggested version of an inverted classroom gave her the flexibility to be able to care for her terminally ill mother and still deliver course content.

> The first semester I did it was the semester my mom was terminally ill. And I could get a sub for one of my physiology classes, but not the other. And what I did was narrate PowerPoints, establish specific times I'd be sitting in front of the computer to answer any questions—and they had to do it in a group—active learning things, and they had to post [material] on the discussion board on Blackboard, so for the lecture time I missed, it was almost a hybrid course.

The success of the experience made Beth a solid convert, extolling the method as "very effective," and she had continued to use it. But she recognized that her effort prior to her involvement with the IBIC project lacked the goals inherent in the grant project. She explained, "I flipped my course years ago out of convenience for me. I didn't do it with pedagogical thought—how am I going to build it this way, what are the results, how will I develop it?" Beth found out through her participation with the grant project that the way she had been teaching her classes was what had become known and popularized as an inverted classroom, and that there was still much untapped potential in the concept that could be mined to enhance its effectiveness for adult learners.

The six participants varied in their understanding and application of the inverted classroom prior to joining the project. None had any experience with what was required to design, develop, and implement a course in the inverted classroom platform. Beth and Sofia were the only participants who had experienced the use of an inverted classroom as

a teaching tool. Beth used a type of inverted classroom without knowing the format had a name. Sofia had used some aspects of the inverted classroom as part of the approach that is used in education in Europe. The other four participants either had not heard of the inverted classroom or just knew the basic concept. The participants were dependent on other team members who had a greater understanding of the inverted classroom to coach them during team meetings and as the implementation progressed.

Motivations and Professional Influences That Prompted the Instructors to Join the Project to Create a New and Improved Introductory Biology Course

"Like a Community": Instructional Collegiality, Bonding, and Teamwork

When most of the study participants joined the IBIC project, the project had a goal but the actual method for accomplishing the goal had not been hashed out; that is, establishing the method would be the top priority for the team once the team convened its meetings. The goal to redesign an introductory biology class to increase student success rates had a lot of inherent merit by itself. And for faculty members, who are constantly evaluating different ways to make learning more applicable and to update their pedagogy, the project held the allure of gaining a cutting-edge educational experience. But beyond the intrigue of new pedagogy, the potential for working closely with other like-minded instructors was actually the highest motivating factor for some participants.

Carol had taught the introductory biology course before and was interested in the inverted classroom method, but even more than that, she was interested in the team aspect of the project. Carol smiled and laughed while remembering her initial reasoning for agreeing to join the team.

I just wanted to cooperate and, then as I started to learn more about the project, it

sounded like a really neat project. What also really enticed me about it...is I used

to teach, then I had a real-world job, and then I went back to teaching, and I

really, really enjoy working as a team. I think that teamwork is just, for me, so

effective, and I think it just really makes for quality work. So, I was interested in

working as a team—that was a real big component for me.

Sofia, an adjunct professor, was also drawn by not only the goal of the project to increase

student success, but also the team aspect to achieving that goal.

I like the idea of developing. To begin with, I like the idea of working as a team to

develop something—so we would share experiences, we would share what we

know. And also having something coherent developed that will apply to different

classes—to all the students—and not everybody teach whatever they think,

however they think they should teach.

Both Carol and Sofia felt a team effort would produce the best results, and therefore their

belief was a major motivation to want to be part of the team.

Rose, like Sofia, was also an adjunct professor. Both were new to the faculty at

the community college but not to teaching, and they wanted to be accepted and valued

professionally by their peers which might parlay into a full-time position as a biology

instructor at the college. Rose hoped that her participation with the project would give her

some exposure and an opportunity to show that she belonged by her ability to contribute.

Rose expressed her thoughts on her motivations.

I wanted to be part of something that was bigger than me, which I know sounds

really weird, but I was new to the college, I was looking for something to

participate in to become more of a member of the team, and I liked the people

who were involved and talked about it [the project] around me. And the whole

idea actually interested me.

Rose was drawn into the project team because she liked the people attached to the

project, and it piqued her interest. The collaborative nature of working on a team of

colleagues toward a common goal, plus the belief that a team effort would generate an

enhanced product were reasons that motivated Carol, Sofia, and Rose to join the project.

Helping Students Learn and Succeed: Motivated by the Challenge

In addition to the desire for collaboration and feeling like part of a team,

participants also responded that they were motivated by the challenge presented by the

project to help students learn and succeed. Andrea admittedly was "always looking for a

good challenge" and was inspired, in this case, because "one of the benefits of it [the

project]" was providing students with a better way of course delivery. Her motivation

came from her memory of being a graduate student some five years prior, and she

recounted the experience of sitting through "dry" lectures from professors who were "so

unengaged" that it took a lot of "discipline" just to show up for the lecture. She

empathized with students facing a similar circumstance, and it motivated her to find a

better way for students to learn.

Tara was motivated by the subject of adult education, but "particularly" by the

challenge of helping students "who have had such a rocky educational experience before

they come to us." She explained, "They're full of self-doubt, they're scared, they're

anxious, and to give them an environment that they feel safe enough to learn and use their

adult brains, that's a powerful thing to try to work on." From the literature, Tara knew the

potential of inverted classrooms to provide adult students with an ideal learning atmosphere and she had high hopes for how well it could work for the IBIC.

Beth disclosed that the goal of the project to increase student success rate for basic courses excited her "the most." Beth was very aware that many students were repeating the basic biology courses, some multiple times. She wanted to be part of the effort that helped change that outcome for the college and the student. Beth started teaching with the team several weeks into the first semester. Over a decade ago, her first experience using narrated PowerPoint presentations to deliver course content as homework and then coaching students by email or digital devices unexpectedly resulted in better exam performance compared to traditional class students, and her inverted class did it without "the important professor" standing in front of the class and instructing them. She recalled,

> …and it worked—and I *never* looked back. So that's why the idea of IBIC [is so good], the flipped classroom and all of that, of being able to redesign the courses so that the students had ownership of their own education. They had to buy in…

Beth's experience taught her that the students were more successful in the course when they were engaged with the course content; that is, they learned better when they prepared at home and were ready to participate when they attended class.

The participants who were motivated by the challenge to develop and implement an inverted classroom because of its potential to help students learn and succeed provided reasons for joining the team ranging from a desire to spare learners from a boring college class, to putting adult education theory into practice, to prior success with a version of the inverted classroom.

Teaching Insights the Instructors Developed During the Process of Developing and

Implementing an Inverted Classroom

The insights discussed by the participants centered on their desire to continue to improve their teaching practices and to maximize their students' opportunities for success in higher education.

Participants' Learning About Themselves and Their Teaching Practices

The participants adopted the inverted classroom concept to redesign the introductory biology course because they wanted to explore ways to engage students in their courses. What surprised them was that they would also learn a lot about learning and about their teaching practices. The participants had different ideas of what they needed to do in the classroom to make teaching more accessible and effective. One realization was that creating the inverted classroom for the introductory biology course helped them to see how incorporating important small changes in the classroom helped the students be more receptive to learning.

Beth's initial surprise by the success that her students had with the inverted classroom platform the first time she tried it years ago inspired her to continue using the inverted classroom platform. But her IBIC experience led her to another epiphany, this one about herself.

> I have to say that one of the things I recognize about myself is that I had gotten lazy—that I hadn't changed my notes much over the years. Now, no reason to reinvent the wheel, but you can tweak things and make them better. I had made changes trying to stay up with good case studies and things like that, but I didn't write them, I just went out and found them. So, what I learned about the way I had

been teaching, about myself, was you've been sitting on your laurels for a little bit there. And that even though I am getting close to retirement, there's no reason not to put your best out there, even for the last semester you teach. Besides, I'll stay an adjunct after I retire from full-time. No reason to not do your best as adjunct.

When Beth joined the team, the semester was underway and team members were busy teaching the redesigned introductory biology course on the inverted classroom platform. Beth sat in on a class Rose was teaching, and she found the student engagement fostered by the way the class was now taught to be remarkable. Enthusiastic about the quality of the learning she witnessed, Beth's experience with the team's development of the inverted classroom made her realize there was still more to learn about becoming a better educator. She soon started teaching an IBIC class. But her knowledge about biological concepts was rusty after teaching other science courses; she found that initially frustrating, but concluded "it was good for me," explaining, "I did have to adjust my own expectations of myself and say, 'if you're going to teach this well…you've got to sit down and think about it and imagine what questions they would have.'" She credited having to teach the IBIC "well" with making her a better teacher for other courses.

Rose was enamored of the students and their response to this new way of educating that, in turn, seemed to reinvigorate her own sense of commitment to her teaching profession. She credited her students with making a valuable contribution to her own education. Rose offered,

I like the students, I like their energy, I like their enthusiasm, I like it when they don't seem to be too enthusiastic and then all of a sudden, they get enthusiastic, they get excited. I've learned a ton from students. And I'm not talking about

academic stuff—I'm talking about people stuff, which I think is missing from

some teaching, and I think the IBIC platform has encouraged me to become a

much better educator.

The active learning classroom seemed to spark a different relationship between student

and teacher which Rose had not experienced before in her career and it was one she

relished.

Tara talked of how the IBIC had led her to understand the importance "to

reinforce, to reinforce, to reinforce." Even though she had employed guided notes in her

classes for years, it was the daily activities and assigned daily homework in the IBIC that

made her realize the extra reinforcement was key to student success. She also credited the

IBIC with a new perspective, "to think about things from not just content, but how do we

present the content, and how do we reinforce the content, and how do we design tests to

support that?" Similarly, Sofia learned the importance of better PowerPoint presentations

to reinforce content. She had always used PowerPoint presentations before in her

teaching, but now she made them "more like a story, and it helps the students follow."

Carol learned that "I really love to learn" and she felt fortunate for the experience

to be paid to learn "more and more" about subjects that she loves to teach. Carol also

found that there was a difference between her course delivery before the IBIC and the

more effective course delivery she learned from her IBIC involvement.

…in terms of my teaching philosophy, I think it just really made me aware of the

effectiveness of case studies, and the interactive [component]—I tried to do it

before, I would give assignments, but not truly as a flipped classroom, and I just

really think it [the IBIC] was effective.

Carol's personal insight into her experiences with teaching the inverted classroom led her to better understand how to make her course more effective by emphasizing certain activities, specifically case studies, that made the instruction of her course content more engaging to her students.

Andrea wanted to learn about the process of the inverted classroom platform method and was very motivated to become a productive part of the group. Initially, she spent a lot of time getting familiar with the software program used to develop the interactive content, lamenting, "I spent *hours* listening to those [training] recordings, but it was just not my thing…" Not to be deterred, Andrea quickly shifted to building story boards in PowerPoint for the composers of the interactive content, acknowledging, " I don't have that kind of creativity, like they could take my basic PowerPoint and turn it into this great, interactive, amazing thing that I didn't have in my mind's eye to do." She not only found other ways to contribute to the effort but realized she did not have to do it all—her colleagues' skills sets could do work she could not.

Andrea reported that how she taught and how she saw her career were completely transformed by the IBIC experience. Andrea had come from a research-oriented university background where it was "all about the details and the correctness and getting everything down to the minutiae and kind of drilling that into you." Although she acknowledged, "that's what knowledge is," she now believed that "teaching is a lot more than delivering material, and that knowledge is a lot more than being able to quote a fact." She surprised herself with how much she liked "getting the student into it" and how developing relationships and discovering individual strengths and weaknesses helped her to "mold" the material to play to her students' strengths. She now favored the "student

centric" approach, and she saw the shortcoming of traditional teaching as "there are a lot of students who have a lot of amazing potential that somebody delivering material *at* them is not going to get through to them." The IBIC experience for Andrea was a convincing and exciting one that taught her about how to reach students, and she adopted and embraced active learning for all her classes, "even non-flipped classes." Andrea volunteered that "it really changed the way I teach every class," especially noting key points she had discovered, "…how important active learning…and even active listening is, and when the students start shutting down, they're just not going to learn, they're just not."

The participants easily shared what they had learned about themselves while learning about a different way of teaching while working on the IBIC project. Their personal revelations about their own attitudes and habits with which they had approached their chosen craft demonstrated shifts of awareness that transformed how they showed up for themselves and the students in the classroom. The experience of teaching the IBIC also honed their understanding of the elements that contributed to the construction of an effective learning environment and, thus, they believed they became better instructors.

Supporting Adults in Higher Education

Tara's motivation for joining the project was to continue her work with adult education. Tara received her master's degree in teaching with a specialty in Science Education and devoted her career to helping the nontraditional student, whose previous educational experiences had not prepared them for college, to reach their goals of being successful in higher education. From her experience teaching the introductory biology course in an inverted classroom, Tara came to learn that the inverted classroom provided

the safe place that allowed adult students to work together and at their own pace. The introductory biology course was one of the first that students interested in STEM take for scaffolding into other science courses; that is, students learned content in the introductory biology course that they would then build upon to understand new science content. Tara observed that the course helped students develop confidence in their understanding of biology as they prepared to engage in more content-rich courses.

Tara related an experience she had while presenting on the IBIC at a conference when an audience member challenged her, saying the inverted classroom was a failed concept and questioning why she was doing it. The challenger did not like the emphasis the inverted classroom places on "pre-preparedness—that they're [the students are] supposed to know everything before they walk into the classroom…," because as this individual said, "students do not do the work beforehand." Tara explained to the audience that the inverted classroom as practiced in the IBIC is modified from the standard concept of the inverted classroom, and "it's *all* the ancillaries that is the important thing about the classroom." Tara's practice of the IBIC was less about the inverted part and more about the Open Educational Resource (OER) aspects and "on the personal attention and the reinforcement." Her perspective on educating adult students was that it takes a "different mindset," explaining there was a common misconception in education that "you educate somebody so that they can walk into a job the first day and do that job off the bat." Instead, Tara reasoned, "What you want to do is educate them so they can do that [job's] learning curve effectively, and they'll go on into their job and do it very quickly and effectively."

Tara's participation in the IBIC helped prompt her more in-depth thinking about how the adult brain learns, leading her to conclude that the IBIC is "better designed for how an adult learns," which she believed is what is "at the core of its success," adding that is what she emphasized when she was challenged.

The process of developing and teaching the inverted classroom had also made Andrea aware of the flaws of delivering a lecture to students who had not been trained in how to take notes or reflect on prior knowledge to connect with and build new knowledge. Participants highlighted that this was the challenge that higher education, especially the community college instructor, has with the population of students they serve. Andrea commented,

> …a lot of them have zero clue—*zero clue*—as to even what to do to be a successful student in any class. And so, you're trying to teach life skills while you're trying to teach somewhat difficult material…you're teaching the students more than you're teaching the material.

While Andrea voiced the reality that many of the students show up to community college lacking essential learning skills for college coursework, Rose had an additional insight developed from her experience with her students. She discovered this insight when questioning a student who was not filling out his guided notes.

> …it's not [that] they're not able to; I think they're afraid to. They are afraid to put something down that's going to make them look stupid…these are people who nobody has *ever* given any kind of encouragement to. Nobody's ever told them that they were smart. Nobody's ever told them that they were worth a damn…. And it takes them a little while before they believe [they are].

Rose had to inform this student that he was in danger of being dropped from her class because of his poor performance, telling him that he needed to come to her office to prevent that from happening. She found out during the office visit that "when he was in high school science, his high school science teacher told him he was an idiot. Well, he's not, he's just not." After confirming that he had watched the modules, she asked why he had not filled out his guided notes. He told her it was because he "didn't know what the right answer was." Rose had him sit at her desk and put down what he knew, "and he did it." Rose discovered what she thinks the issue is—"that these kiddos have been told they're not worth a ——— and they believe it. And so, they're not willing to take a risk of reinforcing that with yet another teacher."

Rose identified that by the time the students had made it to this educational level, many of them had a history of being told by someone, unfortunately even by teachers, that they did not have what it took to succeed. The challenge—and the reward—for these IBIC instructors were to provide opportunities and encouragement to help their adult learners overcome their past conditioning and build their confidence in their abilities so they could succeed.

Participants' Teaching Practices Changed as a Result of the Transition to the Inverted Classroom

The participants reported different ideas about how their teaching practices had changed as a result of their participation in the design, development, and implementation of an inverted course for introductory biology. The project fully captivated the participants and, as a result, they were inspired to try new approaches to teaching students. The new approaches included finding ways to engage students in active

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learning, taking on more of an advocate role, getting to know the student, and being flexible with delivery of the course content for the students' benefit.

Engagement of Students Is Key

During the development of the course, team members shared ideas on how to create a better learning experience. Participants emphasized their understandings that active engagement in learning was essential. Active engagement methods took the form of in-class activities, peer-to-peer teaching, and the instructor personally engaging with students.

Carol shared how she had used activities in other classes, specifically involving cards that were simple cut-outs with definitions, content concepts, descriptions, or images printed on them that demonstrated the ideas that Carol was trying to get the students to understand. The idea of the card activity became a central focus of the inverted classroom that the team developed. Carol described how she used the card activities in class to reinforce new material she presented, "I'd explain something and then I'd say, 'OK, show me that you know this.' I'd take out a card activity, and they're like, 'Oh, wow, now I got it, I put it together, I get it now.'" Carol's observation was that card activities were effective, but feedback from the students solidified that assessment. Carol continued, "…what I've heard from the students is that they, *they* feel it is effective. No matter what our method of assessment is, I do hear time after time, semester after semester, that the students like it [card activities]." By using an activity that challenged the students yet created a sense of achievement through demonstrating their learning to themselves, the cards were popular with the students while enabling them to be more engaged and successful in their course.

Andrea had now seen firsthand how the inverted classroom transformed her course to one in which students were fully engaged with learning and with each other. She believed students start to feel "the cohort feeling—the community of the classroom that you definitely don't get in other lecture style classes," and that when "the students are much more engaged with each other, [and] they're talking to each other, [that is when] they're much more likely to turn to each other and do student teaching." The students actively engaged with each other meant they were also actively teaching each other. Rose saw the advantage of peer-to-peer teaching also and she encouraged it. She elaborated on her thoughts of why students working in a group were helpful to their learning.

> I think to begin with, professors are intimidating. They're the authority figure in the classroom and everything they say is right, and they're not to be challenged…[but] for some reason, I could say something at the front of the class, and if someone sitting in a group said it to them, they get it. And I think that peer-to-peer exchange of information is what makes this particularly work so well. And if you know something, and you're really, really good at it, you have an opportunity to, quote unquote, teach it. And as I like to tell my students, if you can teach it, you understand it. And I think that gives them an opportunity to own it and to feel like they're a part of their learning. They're not being talked at, they're being talked with, and they're talking *with* their peers.

> Beth also recognized the benefit of students engaging with each other, especially when it came to overcoming the reluctance of some students to participate. By observing other students actively participating in a hands-on exercise and showing their excitement

for what they were learning while doing, the "one who is sitting there with the 'I don't care' attitude is leaning a little forward watching this, so the group work on the activities creates this. If you've got some that are enthusiastic, the enthusiasm is infectious." Beth also thought it helped during the first few weeks "to sit down and be a group member and model good cohort behavior—and model enthusiasm."

Similarly, Andrea reported that many times the students who were not engaging in the hands-on activity because they were more "reserved type A" or "don't take much joy out of the activity" could be redirected into peer teaching and engaged that way. The format of the IBIC allowed the instructors to promote student engagement however they could, and many took advantage of the opportunity to do so.

Another important aspect participants highlighted about student engagement for better learning is the opportunity it provides to assess where the student is in the learning process and whether learning is occurring. Beth found engaging the student to be fundamental to getting to the core of the problem for each student, that is, finding out where in the process they encounter their first obstacle and teaching to overcome it.

Sometimes they can't even read the question accurately. So, step one is to sit down and say "Tell me what this question is asking. Let's figure that out first," because a lot of time that's why they don't do well on tests. They don't read for comprehension as well as they need to at this level. So just having to build those skills from scratch….

The introductory biology course for too many students had been a "weeding out" course, unintentionally, because of the sad fact that so many adult students show up to college without adequate skills, such as reading comprehension. Team members reiterated over

and again that the student engagement that is possible through the inverted classroom helps a struggling student stay in college because they feel supported by their instructor in their learning.

Andrea emphasized the opportunity that engaging with students in real time provided for more effective teaching.

It's like there's just so much more to teaching…I mean, there just is. And not to say that lecturing doesn't have a place. For sure, they need to know facts, but the time that the flipped classroom gives [me] allows me to really make sure the core is there, the foundation is there.

Andrea and the other participants agreed that many of the students who register at the community college do not have the basic academic background to succeed at the college level. The instructors deal with the challenge of not only delivering course content but also having to help the students develop study and analytical skills to be able to continue with their academic goals. The participants in this study asserted that the inverted classroom allowed them to do both. Andrea contrasted the difference between the "old delivery system" with what her new experience with the inverted classroom had been.

I feel like a lot of the students don't have a foundation and then they just get material thrown at them and it doesn't have anywhere to go, so it just kinda goes in one ear and out the other….People do assessments, the daily quizzes and all that stuff to try to figure it [what the students haven't learned] out. But even if you have a student who fails a quiz every single day in a regular classroom, you're just going to get up and lecture, right? Like you know that they didn't get the foundation, but—unless they're coming to your office hours, [and] you are really

doing intensive individual tutoring—there's not much you can do about it. But

with IBIC and the flipped classroom you can see it really early, and you can say,

"Ok, like I can tell all of you are missing this. Let's get together and let's figure it

out."

Instead of lecturing and only capturing the students who are seeking coaching during

office hours, Andrea and the other IBIC instructors were able to assess content

comprehension while working with the students, which facilitated their ability to

intervene and help the student so the student would not drop the course due to not

mastering the content.

Rose's experience with the design of the inverted classroom impressed upon her

how the team approached curriculum development by elevating the students' need to be

engaged in learning, and thereby incorporating fun ways to accomplish that goal.

The student is everything. It was never—when we were talking about things and

how to do things—about what was going to be easy for the instructor, but what

made it accessible to the student. How do we make this easier for the student, how

do we—and that was always the question—how do we engage the students,

what's the best way to do this, what's the most *fun* way to do this?

Rose further reflected on her switch in teaching philosophy compared to how she

delivered content as a teaching assistant when she was a graduate student: "And you

know, I taught when I was a grad student, and you give the information and walk out

again, and that has changed forever as a result of being part of this group." Rose, like the

other participants, found that her approach to teaching has completely transformed

because of her experience with the inverted classroom and its emphasis on student

engagement. Each of the participants shared a different approach to engage students in their IBIC classes, demonstrating they were each learning about and adapting their teaching to the multifaceted learning opportunities provided by the inverted classroom.

Re-envisioning Teaching as Relationship and Advocacy: Personalized Education

The participants spoke about the changes in their relationships with their students since learning about and implementing the inverted classroom methodology. Several of the participants stated that they are much more likely to sit down at the work area with their students and engage them with discussions, whereas prior to being involved with the inverted classroom, the participants conveyed that their lectures were very impersonal, and they did not spend any time getting to know their students. Andrea illustrated her experiences by saying,

> They get to know you, they're much more comfortable coming to me to say, "I didn't get this," instead of, "well, I didn't wanna ask a question," "I didn't wanna feel stupid," and, you kinda get to show your personality and become more of [just] a person. But if you want to do that [get to know students], you absolutely can do that.

Andrea stated that these relationships with students continue when the students register for one of her courses that follow the introductory biology course.

> I have these students who have come to every single class that I've taught, knowing they weren't [there] just for the IBIC, but just because they felt like they kinda got to know me, and it's almost like a personal classroom. They get to know each other, they get to know you, you get to see again their strengths and

weaknesses and can help them build on their weaknesses, and I just feel like it's a little more personalized.

The students who already know Andrea and feel safe with her are more likely to engage in asking questions about course content. This classroom atmosphere makes other students who do not know Andrea feel more at ease and therefore more likely to ask questions and engage in classroom discussions. The students know they are in a safe zone and are not going to feel that they are asking "stupid" questions.

Some participants were cautious at first about opening up to their students, because in this new instructional model that encouraged engagement, relationships could veer into uncomfortable places. Andrea stated she had to allow herself to be "vulnerable" to the students and let her students "know" her as a person, but the end result was establishment of trust where the students were willing to form the important learning relationships. Andrea recalls, "You become invested, like you have to put yourself out to them. It's a lot more vulnerable as an instructor, but you have to be willing and have the energy and effort to connect with your students." Andrea acknowledged that this has led to some very challenging times when the students felt so close to her that they shared some personal information with her, "horrible stories" of tragedies of what her students were living through, calling it "frustrating…infuriating" while admitting the impulse to "want to hug them, and you want to save them and you want to shake 'em…" like they were "your own children in some ways." This sharing of personal information strengthened the relationships and the comfort level of engaging in learning. The connection led Andrea to seeing the person *and* the student. This way of teaching was very emotionally draining, and Andrea confided, "I have shed some tears over my

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students that I would have not ever done otherwise," but it led to a better learning environment than "if it was just a regular classroom." Andrea concluded, "That's part of making it the relationship of teaching, instead of 'they could just read a book if they want to learn a fact.'"

Andrea was a proponent for taking "the wall down" and being "exposed to them as much as they're exposed to you," but she acknowledged it is a hard thing to do for most instructors because they are uncomfortable with a more personal style of teaching. In Andrea's mind, the relationships are invaluable to the success of the students.

Beth had a number of similar stories she told regarding specific students and their dire situations that she was able to help turn around, and how "it's the people who have the time in the classroom to make these connections that are helping these students. So that's very rewarding." She spoke more broadly about the differences between the students in the introductory science courses versus the more advanced courses who had built problem solving skills by then, and how she had to learn to adjust her approach to teaching in the IBIC, because "they felt stupid and defeated" if they couldn't solve a problem she assigned "in the first minute" due to their undeveloped skills. She also believed it made a difference to students that *they* felt important to the instructor, adding, "that old saying—'if students can't feel that you care about them, they're not going to care about the subject matter'—I think that is so true." Beth was very proud of the effort that went into the IBIC development and of the way the IBIC helped students. She made sure the students understood this course existed for and because of them. She stated, "when I tell them that we developed this for them, they feel special. Makes them feel good." Beth took the time and made the effort to get to know students, especially those

who were struggling. Her approach to personalized education created successes for students who were on the verge of giving up.

Rose also learned the value of developing relationships with students. She was delighted to be part of a group of instructors who had developed teaching methodologies and activities that facilitated the engagement and relationships of students and instructors in the classroom. From the other participants, Rose learned to

…become more of a student advocate than I might have been, because I see how important this is to them and how important it is getting the information to them. And I honestly have to say that the people that I've worked with on the IBIC team had a lot to do with that, not just the student interactions that I've had, but their attitudes and their passion—not only for the topics that they teach, but for their students—and that was a very big eye opener for me.

Rose contrasted her IBIC experience with when she was a graduate student and had the "feeling that professors really don't give a rat's ass about the student," adding, "to see these people so dedicated to the goal and to the students…that has impacted the way that I teach."

Rose reflected the attitude of many of the participants. The depth of the commitment to their students' success with the IBIC mirrored the importance of helping set these students on a trajectory to be successful in their lives. By being accessible to the students and caring enough to build relationships of trust and advocacy, the participants enriched the educational experience of their students and of their own teaching experience.

Nimble Teaching—Inverted Classroom Offers Flexibility to Adjust for Learning as Needed

Another aspect of a teaching change that participants credited to the inverted classroom was the ability to "read" how students reacted and engaged and then to adjust lesson plans and activities in ways that would be effective for learning. Andrea referred to it as "the sense of the room, of talking to your students, and looking at their grades" and then "being willing" to be flexible to change up how the time was spent in the classroom to accommodate the needs of the learners. Because of the usual huge disparity in college preparedness found in the student community college population, Andrea was able to use the flexibility the IBIC format gave her to "swing that upper population down to help instead and give them something to do" when she was struck with the dilemma of "do you teach here to that population or do you teach to that population?"

Likewise, Sofia talked about her experiences with first using the inverted classroom and then realizing that not all things planned will work, but modifications to the plan makes learning possible for most students. The original concept was to "just do activities in class," but the students were not coming to class prepared enough to just do the activities. Sofia learned to use the results of the daily quizzes to follow up with reinforcement of the topics that the students were not understanding, applying "the activities in different ways to stress what I realize they don't have clear." Even though it was an inverted classroom concept, when she realized the students were not coming to class as prepared as they should, she started checking whether they had done the guided notes until they got into the habit of completing them. After she started intermittently

grading their guided notes, Sofia found that the students "became very meticulous" with filling out their guided notes since they did not know if she would be grading them or not.

Carol also reported how her expectation of the way the inverted classroom worked was different from the reality. Carol explained that even though the students studied the material before class, they needed additional opportunity to be guided through the material, referring to it as "a second walk through the material." She attributed the discrepancy to not having someone to answer questions that arose as "they were going through the [online] material," whereas, "in a traditional lecture…they can raise their hand at that point in time." Carol's expectation of the content being taught online to free class time for activities to reinforce whatever the students had learned online hit a snag when students required more explanation of the content before being able to engage in the in-class activities. But she came to recognize that for difficult concepts, some adjustments needed to be made, and the IBIC format allowed for that to happen.

Even though the participants' initial ideas and understanding of how the redesigned course would function under the inverted classroom platform changed in actual practice, the inverted classroom platform provided the flexibility to find what works best for them and their students. As instructors had more experience with the inverted classroom, their lesson plans changed to accommodate content delivery that would work for that day's teaching.

The Benefits of Designing, Developing, and Implementing the Inverted Classroom

Benefits of the Team Approach

Faculty Supporting Each Other: "We Can Do It. We Can Do It"

One of the most striking aspects of the project was that most of the team members were willing to do whatever seemed necessary to help the project be successful. The team members were so committed to each other and the success of the project that they synergized their strengths to make sure all facets of the project were well supported. To this end, it was common for instructors to help each other deliver the course content in the classroom. The instructors could then see how the course was facilitated and make necessary adjustments to ensure the course was improving from one class period to another. Andrea was all smiles when she described the first semester that classes were taught with the materials for the inverted classroom. She remembered the novelty of the moment and how important it was that she had support in the classroom from other instructors in teaching the new platform. She felt it "crucial" to have a "backup" instructor ready and willing to step in and assist her during the class, in case she needed a hand or forgot something, until she gained some experience with the new format. She explained, "It would not have gone nearly as well—the struggles would have been insurmountable at times. We had a lot of emotional support from each other—a lot of 'we can do it, we can do it.'"

The presence of more than one instructor in the room was not a team directive or project objective. This decision was made by individual instructors who made themselves available; they were willing to put in extra time to make sure the classes were successful.

Rose was one of the instructors who put in the time, and she was grateful for the additional help in the classroom she received in turn.

> I got support from everybody, I mean, if I needed materials, the materials were
> there; if I needed advice, the advice was there; if I needed a lecturer, it was there.
> The people that were a part of this team were very, very generous with their
> knowledge, with their experience, and their materials. I never had to start a class,
> a program, from scratch.

Rose was very aware of how valuable the team effort was to her and in helping her classes go well for the students.

Besides having the immediate help in the classroom setting, the instructors could discuss the progress of the course and decide what aspects of the content and activities worked best. Sofia credited the best practices shared by each of the instructors during the team meetings with improving her classes, including helping renew her interest in teaching, saying "just talking about the subject and different ways of presenting it, it would kind of bring back the enthusiasm, and it actually made my classes better."

As the participants gained insight into the use of the inverted classroom, they shared their insights with their colleagues at weekly meetings. By sharing their knowledge of the activities and techniques they used that worked and, conversely, what did not work, it increased the successful implementation of the prepared materials, which then increased the confidence of the participants with the process.

Like Sofia, Carol also was grateful for the time the instructors spent teaching and learning with each other, and she cited the experience as the most rewarding part of being on the team. Carol stated that she learned a lot about herself and about teaching from

others; she explained how useful it was for her own development to learn about the best practices of others in the program.

> That's what I loved about the whole project…I loved learning from others—I learned so much from others. And I felt like it personally helped me to be better at my teaching, that it helped me to be a better person, that it helped *me*. I just really admired our team. Everybody had something really strong to bring to the table, and that's not always the case when you work with a team.

Carol gave high marks to the team that was assembled. While acknowledging "we had our bumps along the way," she thought the team was "really functional" and "gung ho" and that team members stepped up because "we needed everybody to be doing different things…there were so many tasks that had to be done in such a quick amount of time…" Rose further characterized the experience as, "We were 15 people doing 15,000 different things and everybody was pitching in." Tara also recognized "we were able to really help each other a lot" and mentioned the fact that, for instance, team members would let the next instructor using the room know, "I've blown up all the balloons, they're over in the back so you can use them." She also valued the opportunity to confer with her IBIC colleagues, remembering, "you could bounce ideas off and you could say, 'hey this didn't work, would you try?'"

Beth cited an instance when a major problem was identified and needed to be corrected in order to finish the product for a looming deadline and "the core doers stepped up to the plate and got it done." Beth also pointed out that it was a huge benefit IBIC instructors "can step right in seamlessly" for another IBIC instructor when the need arose. Sofia echoed the observation of the benefit of having a team approach to teaching

the IBIC, but not just for the instructors. She found the students benefitted in a couple of ways by the instructors teaching and using the same material, including issuing the same tests, stating, "…they [the IBIC students] belong to a group—they felt that they belonged to a special community, and they felt that all the professors involved were giving their best, that they could go to any of the professors." Sofia continued her explanation, "And many times I'll have students of other IBIC professors that will come and ask me questions because they had the same material," whereas with "handouts from other professors, you look at that handout and say, 'I'm not sure what they want you to do here,' but [not with] IBIC handouts, [because] everybody had the same handouts." The advantage of using the same materials allowed instructors to easily assist other IBIC instructors and their students, so both the IBIC students and instructors were beneficiaries of the team approach to teaching the IBIC.

A number of benefits of the team approach were identified from the participants' responses:

- in-class assistance to the instructor teaching the class;

- emotional support and reassurance when it was needed;

- workload sharing;

- seamless substitute teaching for each other;

- facilitation of an IBIC study connection between students and the option for students to get help from other IBIC instructors; and

- best-practice exposure through team meetings and sitting in on each other's classes, especially the first time the content was being delivered.

This last aspect then allowed each instructor to make adjustments to their own delivery of the same content so that pitfalls were avoided, and the course was being constantly improved with each iteration to keep things flowing more smoothly in the next session. Additionally, participants reported that the team experience helped reignite a passion for teaching and fostered an esprit de corps amongst the members.

Bonding and Long-Lasting Professional Relationships: "It Really Helped Me Feel More Planted in the Department"

When the participants were asked to talk about their most rewarding experience with the inverted course process, several offered it was the relationships and the feeling of being "part of something." The participants knew each other on a professional level but became very close in the time they spent together developing course content and activities for active learning during the process of transforming the introductory biology course into an inverted classroom. The participants fondly remembered the time spent working with each other and stated that enduring relationships were formed through the process of working on the project. Sofia described this building of personal bonds and forming community:

> I think at the end, it created a bond. It created a bond between the people that worked on the [project]…being there every Friday [team meeting and workday], you get to know the people, and it became kind of like a community.

The inverted classroom project was beneficial for professional interaction and sharing of teaching ideas, but analysis indicated the experience was equally important for the development of lasting friendships among the participants. The strenuousness of meeting the project's goals and the combined effort needed to succeed promoted collegiality that

was not foreseen, despite the inevitable conflicts. Rose, who was tasked with managing

the team meetings, commented on the performance of the team and how it functioned

during meeting disagreements.

> I liked the fact that it was one big team. I liked the fact that we all worked
>
> together and that we could disagree. That was one of the things I found very, very
>
> interesting about this group, is that there were times when there were heated
>
> discussions and we all walked out of the room still liking each other and still
>
> being friends.

Rose was delighted she had the opportunity to be part of the project team, declaring,

"And so that whole part of being a team and being part of something bigger and being a

respected member of the team meant a hell of a lot to me. And I probably took that away

as the best part of that experience."

Appreciation and respect for each other were sentiments also used by several

other team members to describe their interactions with each other. For Andrea, "the

relationship with the other people" was her most rewarding experience with the team.

Andrea made connections with colleagues that she would normally not have any

interaction with during the academic year because they taught different courses on

campuses that were separated by forty miles. The inverted classroom project, however,

provided the opportunity for the participants to develop a professional bond and

friendship. Andrea explained,

> I loved that we became like a little family…We don't teach the same classes,
>
> we're on the other end [at different campuses], we would see each other passing
>
> in the hallway at the department meeting, and there would be no bond at all [prior

to the team experience]. And so, absolutely, the relationships by far [were the

most rewarding experience], and, I felt it really helped me feel more planted in the

department, actually. It really increased my loyalty to the college.

Andrea left her teaching job at a large university to teach at the community college, and

she had been at the college about three years when she was nominated by one of her

colleagues to take part in the project. Her team experience fostered feelings of being

"…part of the department instead of just [in] a job," which surprised her "more than

anything." Now, she looks "forward to going to department meetings" where she gets "to

see people, and before, it was definitely not that." Sofia also thought "overall, it was a

great experience, and it helped also for us to bond together. Even now, for example, when

we go to the [department] meetings, we still kinda felt it [the bond]." Prior to their

experience on the IBIC team, Andrea and Sofia felt there was little to no social aspect

and no personal connection with their colleagues. Now although they no longer see each

other regularly, they renew their bond with their team colleagues at college work

functions. The career aspect of their lives has been enriched by their experience of

engaging with each other through challenging times during their participation on the IBIC

team.

Carol credited the bonding of team members with holding the team together under

a difficult scenario. As one of the two faculty team members responsible for transferring

the content of PowerPoints composed by other members into the software program that

made the modules interactive, she felt a tremendous amount of pressure. The process was

laborious and extremely time consuming, and the other team members were counting on

her to get modules released by a certain day of the week, which was not always possible.

The modules were used by the students as their homework, and any delay in their release

meant students had less time to get their preclass work done.

> I think, honestly, it's been long enough to where I can look back lovingly on the
> project and, one of the aspects that I loved was the camaraderie that was
> developed with the team. I know at times it was stressful; we were all under such
> pressure and all of that. But I was really proud of our team for holding through
> and coming out as well as we did. Given the pressure and everything that went on,
> we could have ended up hating each other, just like blaming [each other], but the
> team never truly fell apart.

As Carol reflected on her experience, she remembered the pressure she and the team felt,

and she credited the relationships created in the process of developing the IBIC with

fostering a tolerant work experience that kept the team functioning. The participants

largely viewed this experience of working together as a team to produce the IBIC as

having a positive and profound impact on their work lives. For most, the experience

completely reoriented their perspective on their career and their sense of belonging at the

college, creating bonds amongst each other and to the college.

Benefits of the Inverted Class as a Teaching Method

Student Engagement: "There's None of This Perceived Wall Between Me and the
Students, and It's Fun"

The instructors found the inverted classroom to be liberating from their old ways

of teaching. No longer a slave to traditional lecturing, the instructors felt free to actively

engage with students during class time. Rose often talked about how this opportunity to

develop and teach the introductory biology course as an inverted classroom saved her

career. At the time, Rose was in the process of transitioning from a non-academic

position at another university and was not sure if she could find another position that she

would enjoy. She was working as an adjunct instructor at the college when the

opportunity to be part of the inverted classroom project became available. Rose jumped at

the opportunity, and it ended up helping her to find her place in academia. Working on

the inverted classroom project introduced her to a whole new way of teaching—

interactive teaching, which freshly inspired her motivation for the profession. With her

passion renewed, she threw herself into helping to create new ways to engage students.

Rose modified a DNA replication activity for use in the inverted classroom, which

became one of the most popular and effective activities for the students developed by the

team.

> I am able to engage with the students, I can actively interact with them, there's
>
> none of this perceived wall between me and the students, and it's *fun*. I mean it is
>
> a ton of fun. Where else can you make DNA and then eat it? And they get that,
>
> they get it. And I think the students like it, too. They come to class. I can tell you
>
> attendance [rates] in my [inverted classes] are much, much higher than they are in
>
> just the regular ones.

Rose enjoyed delivering the course content in a creative manner and the students showed

up for a more creative way of learning. She characterized the IBIC learning experience

featuring student engagement as, "it's not threatening, it's not intimidating, and it makes

it [learning] accessible."

Sofia was also excited about the changes she saw in the students, and she was

ready to use the inverted classroom in other courses because of the success she had in the

IBIC. She experienced her students' learning through their engagement with the material in class, and she became an advocate for implementing the inverted classroom in the other courses she taught. She asserted,

> [Students] benefit from that [inverted classroom], because they have gone over the material—they didn't come completely [to class] not knowing anything. So, I think that if we can develop, in many of our classes, the same style and maybe perfect it, it will be great.…I think the students and we benefited from the program.

The interaction possible through student engagement in the IBIC conjured up the idea of a living organism to Andrea, which energized her and her teaching.

> IBIC brings your classroom to life. It's interactive, it's alive, it's a living organism—instead of you standing there speaking to this really dull, kinda dead classroom. You can hear an IBIC classroom down the hall, but in a positive way—it's not because students are causing a ruckus—it's because they're learning. That's amazing, that's invigorating. I always leave the IBIC class, like, all excited, and adrenaline [fueled] and whoo-hoo, that was fun! It's like playing. It's a lot of work—it's a lot of emotional work—but it's so invigorating.

Even though Andrea acknowledged the amount of work involved by the level of engagement she had created in the IBIC, she found it profoundly rewarding and the effort self-perpetuating.

Beth credited the "highly interactive" classroom for allowing "the one-on-one or the one-on-four communication to talk about those things that we don't always get to in our other classes." Beth liked to connect the dots for the students between where they are

now and where they will end up in a health science career, as a way to make the information relevant to them and answer the question, "Why are we learning this unit?" She recognized the student engagement possible in the inverted classroom helped to "hook them and set them on a path that has built their confidence, that shows them a way to their future, that is realistic, clear, instead of this pie-in-the sky 'I'm going to be a nurse' with no understanding what that is going to require." She found it personally rewarding to see the IBIC students then show up in her other health science courses and do well, despite their own personal challenges of poverty and near homelessness, but now enthusiastic about what they were learning because of their IBIC experience.

Multiple Ways for Students to Learn and Reinforce Learning

Beth credited the effectiveness of the inverted classroom to it providing students multiple ways of learning and experiencing the course content. She provided the example of how she brings common household items into the learning "to illustrate concepts, often difficult-to-explain concepts." By using something already familiar, such as "something they see underneath their kitchen sink," coupled with the element of a "hands on" activity, it was an "invaluable" way to teach to "any student that is at all a kinesthetic learner." Beth elaborated that a hands-on activity is "irreplaceable, including it cannot be replaced by these wonderful 3D apps on our iPads. You've got to be able to put your hands on it. These [3D apps] are a great start, but then put your hands on it." Beth found great value in the familiar objects and low-tech activities for building confidence in students that learned best by using their hands, and she favored their use over the more high-tech applications available on iPads.

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Rose similarly believed the IBIC was popular with students because of the multiple ways of reinforcing the course content, and she provided a synopsis of ways she used activities that also challenged students.

>…the card activities; the other activities that we do, for example, all the water stuff we do, which is fun—how many drops of water can you get on a penny before it spills over?; the worksheets are supposed to help reinforce the material; the notes and the objectives which I tell them to treat as if they were essay questions and to answer them as though they were essay questions; my asking them questions about the material and having them answer….

Activities that are fun, interesting, and challenging engaged the students and reinforced the learning. The students had multiple ways to relate to the content, and it made an impression on the students. Reinforcement of the course content was highly valued by the students and a reason for the course's popularity. Carol talked about how she reinforced the material in class by:

>walking them through the [online] material again…they take notes again freehand style, and I have images on PowerPoint where I ask them a whole lot of questions, like "identify this, identify that"…then we take out the card activity or the case study and we spend that time.

Carol's experience was that the students asked for the reinforcement by saying—"'we didn't really get it on the module,' and just that explaining it second time around, I think part of that is the verbal [reinforcement]." Carol believed that the students needed to hear the material explained rather than just a visual or hands-on presentation.

Sofia's experience was that students were learning from each other even if they were not in the same IBIC class.

> …you could see them, for example, in the open labs how they would say, "Oh are you taking IBIC?" and they would all put their handouts together and get to know one another and study.

While students had multiple ways to learn the course materials, Sofia found her students favored the guided notes "because many of them do not know how to take notes." She asserted:

> And once they start doing it, they get used to it, and know how it works, and they liked the guided notes. In matter of fact, I hear again and again "what did you like about the IBIC?" "The guided notes." More than the modules.

Each of the participants presented course materials to students in multiple ways. Activities provided hands-on and fun, creative spins on exploring the concepts being taught; visual presentations were provided by the modules and PowerPoints; written exercises were represented by objectives, worksheets, and guided notes; and students learned from each other and other IBIC professors outside of class time. Participants observed students to have preferences for favorite ways to learn, and they seemed to be different for each participant's experience.

Students Are Responsible for Their Own Learning

Among the benefits recognized by participants was that their IBIC students became responsible for their own learning. Carol spoke on how students learning to be responsible for their own knowledge benefited them—not just now—but also in their future careers.

I think the advantage is that, first of all, it reinforces to students that they can learn material on their own for the types of classes that I teach where students are going into health care professions. That's really important, because rarely do they have a supervisor sitting there next to them explaining everything to them. So, I think realizing that you can learn information on your own is really important.

The study skills taught in the IBIC were fundamental to the students' ability to learn on their own and be successful in their higher-level courses, and Carol believed students realizing they could teach themselves once they acquired study skills was a really important realization for them to make. Beth also acknowledged, "This concept of the inverted classroom puts the responsibility of the learning on the student," a theme she reinforced while in class by informing the students, "You can lead a horse to water, but you can't make them drink. You can lead a student to knowledge, but you can't make them think." She let the students know, "That's your job. Now, if you don't know how to think, if you don't know how to problem solve, that's my job. But it's your responsibility to get it done." Sofia added that "they become more involved [in their learning]."

The students, knowing that class time would be devoted to their interaction with the material and each other, did a better job at coming prepared to engage in the hands-on activities during the day's lesson. Participants highlighted that the format of the IBIC prepared students to learn on their own by teaching study skills. Being responsible for their own learning was a concept introduced by their instructor and reinforced by teacher expectation that they come to class prepared to participate.

5. FINDINGS: CHALLENGES, EVALUATION, AND RECOMMENDATIONS

Challenges of the Inverted Classroom

With as complex a project as revamping a course and teaching it as an inverted classroom while meeting grant deliverables and deadlines, challenges were inevitable. The participants registered their perspectives on a number of issues that cropped up during the process. Although many of the participants reported the project was one of the best experiences of their professional careers as educators, during the interviews some of the challenges discussed evoked sorrow, wistfulness, and remorse over perceived mistakes made, and there was regret that the process was not better than it was for some aspects.

A Lot of Work for Everyone, and a Whole Lot of Stress for Some

Many of the participants spoke of the large amount of work necessary to develop the introductory biology course as an inverted class. Rose shared that the members were working many hours on the project in addition to all the other responsibilities of being an instructor at a community college. She estimated that the planning meetings took "probably about 12 hours a week at the beginning," later morphing into "15, 16, 17, 18 hours a week in addition to everything else we were doing" when the team started to physically produce materials for activities. Tara recalled spending "a minimum of 10 hours a week on just the IBIC stuff." She had other responsibilities as the grant director that also occupied her time.

Although Rose saw the IBIC work as "a break…from my other duties," and she did not experience "any conflict in preparing for either" IBIC or nonIBIC classes, other participants reported a different experience. The amount of work and stress began to take

its toll on many of the participants. Andrea lamented that the amount of time she was spending on the project affected her family life and her other classes. She estimated she was working an extra 12 to 15 hours a week on just creating the class material—all while pregnant with her first child. Her plan was to work really hard, let her leave time accrue, and then take leave later, after the baby came. With regard to how the time she spent on the project affected her family life, Andrea opened up about the ramifications:

> My husband gave me a hard time about it, but part of that was I kinda took my grad school mentality, which is work really hard now and have the benefit later. And so, especially during that fall—that was when we were really [working on the project] intensively—and, I delivered [a baby] in February, so I told myself, I was just going to work my tail off…And then, I would benefit later on in the summer of using that [LEH] (Lecture Equivalent Hour) time.

The project was not only taking time from Andrea's family, but the time constraint was putting pressures on other responsibilities she had. She did not work on improving the courses she was teaching, due to the time she was "focusing" on the inverted classroom project, admitting, "I would say the rest of my classes were on auto pilot during that time—there was not a lot of creativity and revision happening in the other classes." The participants were working long hours that went way beyond the time of the normal parameters of a college instructor's responsibilities. Andrea found the project dominated her life, at home and at work.

Similar to Andrea, Carol found the project consumed her life. Carol's principal role of transferring the storyboards into the software and making sure the content modules were interactive placed physical and mental stress on her:

It pretty much saturated my entire life….I had very few hours where I wasn't working on the project, and, it was really hard, honestly. It was really hard physically on my body, because we were all just sleep deprived. *I* was sleep deprived. What was most disappointing about that was, because I was sleep deprived, I didn't feel like I was as effective in the classroom as I would have liked to have been. When you're going on two, three hours of sleep and you come in and you're trying to do this—get students engaged—and with this type of a teaching style, you really have to get the students engaged in the activities. So that means constantly walking around and checking everything, and your energy level has to be really high. Well, being on a few hours [of sleep], of course I tried my very best, and I think based on the feedback I got from the students [I did well], but I knew it wasn't my personal best, and that's what was a little bit frustrating.

Carol's experience was shared by many of the participants who felt exhausted and burned out during the most intense portion of getting the project started and implemented. Never before attempting such a project, participants had no idea about the amount of work it would take to ensure the project's success.

Beth reflected on the loss of one of the original team members who resigned from the team because of the pressures placed on her and her family by the project, acknowledging, "There was so much burnout…I think we're still seeing a little of that….we may not see that kind of creativity for a few years from some people." The original team member was an adjunct professor who Beth doubted would ever teach in the department again, explaining, "We pushed her because of her medical background. She was terrific at coming up with case studies and things like that…it was a huge

amount of work for a woman who just really wants to be with her kid." Beth lamented the

loss of a talented teacher, "So, she got burnout and I haven't seen her name on the

[department teaching] list since..." Beth continued,

> …there was a lot of pressure, a lot of pressure. And some of it was self-imposed
>
> because we weren't willing to make a mediocre product. And that's the hallmark
>
> of our department, really. We don't do things in a mediocre way in this
>
> department which is why expectation of us is so high…

Beth's previous experience as department chair gave her a perspective of the reputation

of the department within the college, and she felt she identified with and was responsible

for it. And even though she herself did not suffer burnout from the IBIC, she knew

burnout had occurred with participants who were heavily involved in the development of

the course.

When asked whether the work on the IBIC interfered with her other classes, Sofia

responded, "Interfere, no, but it cut my time.…In other words, it would have been good

to have had extra time and not to have to teach and concentrate on developing." Sofia

would have preferred not simultaneously designing, developing, and teaching the IBIC

because of the demands on time that it caused.

Andrea discussed her experiences of trying to manage the expectations of the

inverted classroom project and all the other responsibilities the faculty had with teaching

courses. Andrea remembered a team member using the phrase "building the airplane

while you're flying it," which described the pressure she felt to deliver the content

because everyone was counting on her. On many occasions the content was being

developed the night before it was supposed to be used in the classroom the next morning. Andrea recalled,

> We were a day ahead, if that, like there were times where I remember going to [teach class], realizing, "oh my gosh, I need balloons in two hours," so on the way to school I stop…and bought balloons. I think that's what makes the first semester of teaching a class so stressful—it's that feeling, but this was a whole different deal because it was the detail—[IBIC] is in the details, right? The success of the class is in being prepared, it's in the details, it's having the ability to focus on the students while you're together and not having to worry about finding materials…you wanted to put your effort into the actual teaching part and the student part, but in the back of your mind you're still having to scramble, like "what was the password to log in to that?", so it's like juggling a dozen balls at once.

The responsibility of the success of each class period was keenly felt by her, both because of the dependence of the team on her coming through with content in time for class, and also her expectations of coming to class prepared to teach without forgetting some crucial element she needed.

The participants indicated they had no idea how much work they were getting into by taking on this project, but when they started to work on the project, they found themselves working overtime. The stress of the project was experienced differently by the individual participants, and it ranged from feeling like the extra assignment was a welcomed break from a routine to negatively impacting lives and causing burnout.

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The Selected Software and Lack of Technical Assistance to Build Course Content

One of the challenges discussed extensively by the participants was the complexity of the software selected to build the online modules for the course. The demonstration of the software program showed it had a lot of impressive features that could be used to build interactive course content for the introductory biology course. Unfortunately, after procuring the software, the participants discovered by experience the program was not easy to learn. Only two of the team members became proficient in using and navigating the software. This predicament led to a huge bottleneck in producing and getting the modules readied for use in the course. Rose expressed remorse over the software selection:

> I think the program we chose to build the lecture modules in was a huge impediment and continues to be a huge impediment….I don't think we did enough homework on the options that were out there, and because we were rushed and we didn't have the luxury of time, we picked the first thing that somebody understood and felt that they could work with, and we went with it.

Tara echoed Rose's criticism of the software selection, "I think, that it [the course modules] could have been done on a much easier platform," citing an inability to "update easily" when changes were made to the modules.

The team had a software expert who was impressed with the capabilities of the particular software and had made the recommendation of the software. The team simply followed his lead but had no idea of the level of complexity involved and the learning curve necessary to become proficient with the software. Tara suggested she knew of a different software that would have provided "a much easier platform, anybody could

have taught it, we could have hired a zillion people to help us do this, it would have been user friendly," but "those decisions were made. We live with them." The software selection was made prior to Tara officially joining the team and her attendance at meetings, and so she did not contribute to the decision to select the software.

Carol was one of the two faculty members of the project team that was proficient with the software and felt the issue was not so much a problem of selecting the wrong software as much as it was a failure in training and staffing to work with the software. She had wanted to hire more technology-savvy individuals to help with getting the course content into the software platform.

> I was really, really frustrated that we were not able to hire. I knew that we needed to hire two more technology people, or we needed to have two more people on our team step up to the plate and learn how to use the [software] program. And we got neither for like two and a half years. And so consequently, we paid the price with that.

Carol believed "the price" that was paid was inefficiency and delays in getting the modules completed, which exacerbated the stress for the team. Sofia also felt "the major obstacle was the fact that they [college administrators] did not hire a person to actually work that software."

Originally, there was one part-time person hired to help with the software, in addition to the two faculty team members who were proficient in its use. Eventually, another individual was hired part-time to work with the software, but he was not able to become proficient in its use. Carol was also frustrated that the team did not spend sufficient time in mentoring and training the part-time employees hired to help create the

modules using the software, and she believed this was one of the factors that hindered the process of completing modules to be used in the course. It was upsetting to her that the original part-time employee hired to work with the software was not "supervised in an appropriate manner." She explained, "Not because we didn't try, but because we were all so busy, and I felt really bad that we didn't get the mentoring [provided] that this person needed to succeed as an employee on this project." Personnel support was an important issue to Carol, and she felt that in the busyness of that time period, a person specifically hired to help with the software was failing because no one had time to sufficiently train and mentor. As a result, the employee was working very hard but the work product generated was flawed and needed to be heavily edited by one of the two proficient faculty team members.

Andrea recalled the initial excitement about using the software. The team thought the modules would be cutting edge and everyone would love them and want to deploy the modules in the classroom.

> I feel, especially at the beginning, we were trying really hard to be really, really, maybe too cutting edge, using technology too much…but sometimes the tried-and-true "paper and scissors" is the better way…. And I think that slowed us down a lot, at first. It would have been different if we walked in with all of these high-tech skills probably; it could have just naturally flowed. But we were really trying to force it in there. There's really cool technology out there that probably could and would benefit the classroom if we knew it.

Andrea's insight on the software summarized the feelings of other team members. As the project started, the biggest obstacle to its success was the difficulty with the software.

The software was inspirational in the applications that could be used for the modules, but the use of the software was arduous and not easy to navigate; hence, the difficulties that the team had to deal with in order to get the project completed.

The team was almost unanimous in the hindsight that the project would have been better off with a different, more user-friendly software for the modules. Only two team members became proficient with the software program, which placed a lot of pressure on them to get the course content created by the other team members uploaded into the software in time for its use in class. Because of this bottleneck in producing modules, modules sometimes were not ready in time for class, and instructors had to improvise with the presentation of the content, which invoked a tremendous amount of stress for the content developers, instructors, and students. After going through the additional stress created from selecting a software program that required a certain amount of technological acumen that most on the team did not possess or have the time to acquire, the experience left the participants better positioned to ask the important questions when making decisions about software in the future and not just be swayed by appearance.

Support From the Grant Leaders and College Administrators Was Lacking: "We Ended up Basically in a Fight for Our Lives to Get the Project Done"

One of the challenges that kept coming up in the interviews was the lack of support from the leadership of the college. Because the project was funded by a grant from the federal government, the college administrators were very cautious in their decisions about the grant monies and the project budget. This approach resulted in a slowing of the process to acquire supplies for the project in a timely manner. Tara remembered the constraints that were placed on the project because of the limited

experience the administrators had with handling grants, such as not knowing the pace at which the federal grant budget office worked. Because of her position as grant director, she was the liaison between the college grant budget office and the grant consortium that issued the grant.

> There are two things that have been the most frustrating. One of them has been the lack of leadership from the head of the [grant] consortium. The other thing was that the [college] grant budget office…was very, very, very slow [in releasing money]. They didn't understand that we had to have things ordered by the beginning of July in order to close the books on the first of August.

The process of getting money distributed was complicated by the fact the grant was written as part of a consortium, necessitating the college administrators to approve the monies and then the leaders of the consortium had to approve all expenses for the grant. The college administrators promised to get Tara permission to spend money, but Tara had to repeatedly ask for them to approve the money, which did not happen for over a year.

The delays in the release of funds led to many constraints on the ideas and activities the project team had begun to put in place for the new course. The delays in acquiring supplies and equipment necessary for the implementation of the course content meant, for one example, computer tablets were not available for the students to use to engage the course content, as the instructors had planned. Tara indicated this situation was tantamount to a living "nightmare" for her personally. She was very invested in the project being a success, and events were not conspiring to that end.

And so, we were way behind on our budget, on getting our resources in, with

computers and everything, and personnel. Oh, and that was just, that was a

nightmare. That was awful. This has not been one of my big successes.

Tara's position gave her behind-the-scenes knowledge of what was going on, which the

other team members did not have.

And I think that that *really* put us behind the eight ball. And then, of course, there

was complete chaos at the grant level, at the high level, you know, 'cause we were

part of a consortium of eight, and then at the overall grant group, it was under

total chaos. And so, we were getting zero direction on down.

Tara had a keen awareness of what the grant deliverables were and how the slow release

of funds was impacting the overall compliance with the grant specifications. The overall

chaos she witnessed contributed to the "nightmarish" situation. The fact the college was

not approving funds even though the money was written into the grant "was always an

issue."

Beth also commented on the sluggish money flow. It appeared that much of the

money was tied to specific purposes and the college administrators were having difficulty

getting the monies allocated to the team for purchases needed to support the

implementation of the course. By the time all the authorized signatures were acquired for

a purchase request, the bid was no longer good because it was "three months later." And

when she inquired about what happened to money in the budget for a certain purchase,

she was told by the college administrator there had been a "communication problem."

The purchase was finally made, but the delay impacted the ability to use expensive and

highly desired equipment that was instead languishing in the classrooms unused. Because

the process was frustrating for Beth, she took every opportunity to bring the money situation to the attention of the college administrators who verbally, at least, expressed their support for the project to her, because the project was "a huge feather in our [the college's] cap."

Another situation found inexplicable by Rose was the fact that many of the team members had not seen the grant proposal and what it specified, but were expected to make sure the grant goals were achieved. At the point of the interview some three years later, Rose had still not seen the grant proposal. She felt this situation was caused by a vacuum in leadership, where no one seemed to be in charge, and it contributed to a harried effort to meet grant specifications at the last minute, when a deadline would be dropped on the team.

Well…this is probably part of the dynamic leadership thing, that nobody bothered to look at the grant—I never saw the grant, and I asked a couple of times, and then I thought it wasn't my place to ask. Nobody seemed to be in charge of the benchmarks and making sure we were meeting each little thing that we had to meet, and in the end, we ended up basically in a fight for our lives to get the [grant objectives] done. And honestly, that was some of our best work. And that's the one thing that I really still have nightmares about—trying to get those…images done, trying to get things written, coming in over Christmas break, hauling ass trying to get stuff done. That could have been better handled.

Rose's disappointment did not take away her sense of accomplishment at rising to the challenge this situation created. The anxiety of not meeting the goals of the grant caused by the last minute deadlines and her frustration with the lack of direction could have been

avoided with better communication and organization from those in a position of authority regarding the grant. Still not knowing how the grant project originated, she questioned the process by which the grant was conceived and managed:

> No one even consulted the Biology department on the grant?...or did they just say, "Oh, by the way, we got this grant and you guys have to work on it"? And so why wasn't there somebody from whomever it was that wrote the grant…riding herd on it?

Rose expressed disappointment with the college leaders who had signed off on the grant because they never visited the team during the time when all the work was being accomplished. Rose would have liked to have been recognized by these leaders for all the time and effort being put into the project, but the team was never acknowledged by them. To her, it seemed there "was a constant struggle to get any recognition that this [project] was going on." The lack of a presence by the administrators gave her the impression that "the people at the college level, the people who wrote the grant… just said, 'here's the grant, do the work,' and then they completely forgot about it." She reiterated this view by voicing, "I don't think there was any support there at all, and it was a constant fight to get the LEH." Many of the participants were promised the LEH release time for the work they did for the project, but the administrators were slow to release those hours, and in a few cases, some of the participants were not given release time until the second year of the project.

Carol echoed the sentiments concerning lack of support from the people who were responsible for managing the grant deliverables.

I distinctly got the feeling that the higher-ups didn't realize what was going on in terms of the work. We were expected to work really hard to meet…the deliverables at the end, and I don't think they realized the number of hours that we were working on that—and we were expected to work.

She felt understanding of the team's efforts and hard work, given the constraints the team was under, was completely lacking. The issue of the team not being privy to deadlines was just accepted by Carol, who felt she did not know enough about the situation to have expected differently, but she acknowledged the negative impact it had.

To be honest with you, I think…we were all too far removed to even know what those deadlines were. I think we were always in a panic mode because we would get these deadlines last minute that we needed to [meet].

Like Rose, despite feeling kept in the dark about important aspects of what was expected by the grant, Carol enjoyed the work and attributed the lack of information to a decision by the grant director to not inform the team members.

I did enjoy it, I really did enjoy it. But, I think I was just a low one on the totem pole so I wasn't really privy to any deadlines and everything that was going on. I think that was by decision of the grant director. I think [she] kind of liked it that way, I think she liked having that control of kind of keeping us out—"let me just handle this"—and maybe that was the best way. I don't know because I really had no idea what was going on…

Although Carol gave Tara the benefit of the doubt as to her motives for the lack of communication, she appeared to be the only participant who was inclined to do so.

Sofia felt the team was also not consulted by those in charge of the grant when making decisions, characterizing decisions as "totally arbitrary, dictatorial." She also had a litany of items she took issue with.

> To begin with I would have liked to have been able, for example, to get LEHs which was never arranged in advance so people can dedicate the time. Second, resources, like a place where we can meet; not only that, but the computers that we ordered from the grant—it turns out that they didn't service them, because they weren't on their list. So, in other words, college-wide and administrator-wide, we didn't receive any support. We pretty much did everything [ourselves].

Sofia's disappointment at the lack of support from administration left her feeling like the team had to be totally self-reliant.

Andrea also exhibited the sentiment of other participants regarding the strange disinterest and slowness of action by the administration, feeling like the team was left to its own devices and unnecessarily handicapped by perceived resistance by the administration to provide help.

> [The administrator] never met with us, nothing, at all. Just literally, it was like, "do it." And then, "I'm going to be resistant; I'm going to give you a hard time when you need anything." So, I kinda felt like our little group was kinda fighting against the tide in some ways with the administration. They just liked the idea of it, they liked that we did something cool and successful, and [that] they can take credit for that.

While the participants shared the view that the college administrator did not have an understanding of what a project like this entailed and many characterized the struggle as a

"fight" to get the project completed, Andrea also felt "forever bonded" to the team leader, "because I felt like he fought, he fought, he fought to try to get them to understand what this was really like." As did the other participants, she took issue with the reluctance of the administration to provide the requested LEH to compensate the team for the time they spent on the project, remembering, "And it took a long time to get them to understand" how deserving the team was of LEH. The ordeal gave Andrea a cynical take on the about face, after the denial for such a long time and then a swift release of the LEH.

> …what broke them eventually was the realization that we're not going to get this completed. And they're like 'oh no, no, no, we have to be successful, so what do you need to be successful?' All of a sudden, they're like "here's all the LEH you need," after we've been killing ourselves for a year.

In the end, Andrea appeared to have reconciled her thoughts and feelings somewhat, providing a bit more generous and restrained synopsis of the experience.

> So, I think that, like so many projects, you have these great ideas and the actual creation time bringing that idea to fruition is usually so much more than you think it's going to be. And it's hard when the person in charge of the idea is not actually one of the workers. So, it becomes this delegation of 'make this happen,' but you're not actually there seeing what it takes and making sure the material and resources are there to make it happen.

To the participants, a lot of the ill will generated could have been prevented by just having the administrator show a little interest and at least check in with the team to see how they were doing and what they needed help with.

Beth started her involvement with the project while she was still the chair for the Biology department, when she along with Tara and the team leader worked with the college administrator to devise the grant project. Because of this involvement, she considered herself in a position to advocate for the team with college administrators who had authority over the grant project. As the project progressed, she recognized a communication vacuum existed between the leadership of the college, the grant oversight on the consortium end, and the grant director on the project team. She worked to bring some clarity to what the deadlines were for meeting grant objectives because it had become obvious to her that the deadline dates were different depending on to whom she spoke. The discrepancy in information apparently led to the team unknowingly missing two deadlines "…because we either got it wrong when we were first told, or we were told multiple dates. That was very frustrating." Beth's sense of responsibility to the team and to the success of the project prompted her to act to overcome the observed dysfunction of communication between the administrators of the grant and the team, and she noted, "I think that could have been better."

The participants felt ignored and abandoned by the college leadership in their efforts to achieve a great endeavor on behalf of the college, as well as not acknowledged for all the hard work involved. The lack of timely communication from leadership regarding important information created stress and frustration. The slow release of grant funds was attributed to inexperience within the administration with the grant process and problems with the grant consortium. The participants had expected LEH to compensate them for the extra time they had spent on the project, and the reticence with which it was granted was a sore point amongst team members.

Power Dynamics of the Team

Participants revealed two main challenges around the way the team handled internal conflicts and power struggles. One involved the conflict between Tara, as grant director, and the team leader, which often cropped up in earlier team meetings. The other challenge was how the disparate views of the individual team members were handled.

Grant Director Breaks From the Team

Besides the lack of support from the administrators, another issue facing the team were internal power struggles, especially at first the one involving the grant director and the team leader. Tara provided her perspective about the episode, as it affected her whole experience.

> If I could go back in time, it would have been to put me and [team leader] on together at the same time. We could have worked well together and avoided that power thing. I could have taken the details that he hates, he could have taken the big picture that I'm not so good at, and so that would have been my one thing…I would have preferred to have worked from the very beginning on the IBIC project with the team. I felt like the team fell apart at the end.

The four months it took for the college to set up the funding of Tara's position as grant director were months that Tara was not active with the project. The delay proved in Tara's retrospect to have ruined any chance of creating a more cooperative dynamic between her and the team leader, and it doomed her expected influence on the project and with the team. Tara believed that because she was an academician, and the team leader had a different background outside of academia, that he always thought of her "as a big threat" even before the grant project, and that perception partly set up the ensuing power

struggle. Struggles were "mostly about authority…mostly about who's leading this grant, who's in charge here, that never got resolved."

The power struggle between Tara and the team leader did not go unnoticed by the team members. After Tara began attending meetings, the tension was high between the two, and it was one of the reasons Tara stopped coming to meetings after a while. The team members were left largely to speculate about the situation, based on what they witnessed without knowing what was going on behind the scenes. Rose spoke of the conflict that she felt caused Tara to depart the team.

> I thought there were issues with Tara who felt like her role as the leader of the project had been usurped. I don't think [the team leader] handled that very well. I don't think it was over content or over any of the stuff that was really important. I think it was just over her role as a member of the team, and she sort of self-selected herself out of that.

Rose's perception was that the grant director decided to quit attending the team's weekly meetings because she felt she was not recognized as leader by the team, adding, "She (Tara) just stopped coming. She stopped participating. And, excused herself from the whole process." Andrea also commented on the situation with the grant director and the team, expressing her disappointment and surprise at how things went. "I think she bought into the idea, but not into the collaborative nature of the development of it….That just surprised me, it really did." Andrea continued in her assessment of the experience, as she remembered how confusing the situation was to the team members,

> At first, everybody was trying to kinda feel out what was happening and how to get her re-engaged with the group, and then eventually everyone went, "Ok, well

that's just not going to happen."…And I was really proud of everybody for really

actively trying…and then it just went, "Ok, well, we'll heal and move on, won't

we?"

Carol revealed, "I really felt not having the director at the beginning was really

tough…but, there were times where I almost thought we needed a little bit more maybe

dictatorial [leadership]." Likewise, Sofia lamented, "We did not have clear who was

doing what." The participants, included Tara, ultimately attributed a lot of the turmoil to

the lack of a clear division of leadership responsibilities in the beginning.

The inexperience of the team and its leaders with a project of this scope resulted

in lack of clarity in direction which impacted the timeliness of producing the IBIC and

contributed to the participants' stress because of the leadership power struggles. The

participants recalled their experience with the grant director as being traumatic as she

tried to impose her authority on the team, which she felt was her place to do. They felt

confused and rejected by her when she chose to quit attending the team meetings to work

independently, and they did not understand the root of the problem because they were not

privy to the discussions with leadership.

Team Members Adopt a "Collaborative Dynamic"

Internal team conflicts on the road to the successful completion of the project

were also recalled by the participants. The direction of the project and setting its goals

were major issues the team members struggled through, and team meetings were the

venue where personality differences were most expressed. Additionally, there were

perceptions of ill treatment by some team members. Overall, it seemed the interaction

was remembered as more positive rather than negative. Carol began her remarks by remembering the good aspects as she provided her view on the team dynamics.

I think for the most part, it [the team experience] was positive. You know, I think we had a lot of support [from the faculty], and support for each other….At times, we were working well as a team where everyone had a shared power structure— where no one really bossed anybody else or told anyone else what to do.

Carol's review of the team dynamic turned negative, however, when she provided her thoughts on what was especially disconcerting to her.

I think what most bothered…me about this was…the way certain people on our team were treated as people….I think that we had some team members that did a really, really good job, but because their personality wasn't like the personality of others, that their opinion was kinda thrown to the side and their contributions to the team were not acknowledged at all….That was probably the most disappointing to me.

Carol was the only participant who took issue with the way some team members had been treated, except for Sofia, who felt she was on the receiving end of some of the ill treatment. She felt her ideas were "brushed over, you're not [acknowledged], and then your idea is incorporated." She had quit attending team meetings as a result, but after some prodding by another team member, she began attending again, "I said let me try again, and things had changed when I went back." Once Sofia rejoined the team, she had an easier time finding a place and felt her voice was heard. She referred to some team members as "the most cooperative ones," who "would literally sit there and make the

tests all together and had fun coming up with [them] very democratically…" which she felt was not always the case for team activities.

Beth recalled several instances when the strengths of some team members became obstacles to the process, but the team members worked through their differences, and the project continued with little disruption. In this way, the power dynamics worked in a positive way, and she described it as a "collaborative dynamic." She gave the example of one member who she felt was an outstanding editor yet was too wordy: "And because of the way the rest of the team treated her with respect and valued her for what she did very well, it worked out." She credited two team members with bringing "such a warm collegiality and respect, that I observed them being the glue [of the team]." Beth also recalled that even when some members of the team were at odds over the direction of the project, and she was worried that the arguments would cause the team to fracture, the team responded in a professional and nurturing manner. She acknowledged the conflicts about project direction were "detrimental" to the team functioning, and that members "were really worried that it was going to blow the thing sky high." She expected there to be conflict, but it was handled well enough to enable the end result to be well received.

> If there wasn't any conflict, I would have been amazed, but the fact that they
>
> really did get pretty well resolved, and the product is so good, and the people who
>
> oversaw the grant, they were just blown away by what we did….

Beth emphasized the final product exceeded the expectations of the grant providers, and, if conflict did not result in a better product, at least it did not get in the way of it. While things were said that were strong pronouncements concerning the direction of the project,

the team spent enough time with each other that sufficient personal and professional

capital developed between team members to always achieve a solution.

Rose was assigned the task of managing the team meetings by the team leader to

keep the meeting time constructive. She was in a position to observe the team dynamics

from a different vantage point of the other team members. She talked of her assessment

of that experience and compared it to the power dynamics she had witnessed in her IBIC,

where some people were more vocal, and others restrained.

> You've got the leaders at the table, and then you've got the shy people who
>
> maybe sit back and stay out of the fray because they don't want to get stomped,
>
> which I don't think ever really happened, but they did not want to be thought
>
> poorly of by the people who were the leaders.

Rose thought the team meetings were less participatory in the presence of the "leaders,"

or the participants who were the "most passionate" and "felt very strongly about certain

things." Despite clashes, she still looked forward to attending the meetings and felt that at

the end of the meetings, everyone left on friendly terms with each other and team

dynamics were good.

Some participants expressed frustration at the profuse discussion and oftentimes,

lack of direction and goals for the meeting. Tara pointed to a lack of clear goals and a

defect in the way the team was formed as factors contributing to team conflict and

impeding the team's progress. Personality differences were acknowledged by each of the

participants, as were diverse passions, background experiences and expectations, and

interaction styles. For Rose, it seemed that, perhaps by not stifling the creative process,

the group was able to get it all out on the table and come to a consensus about the issue

more often than not and move forward together unified. She provided more information on how the team functioned to resolve its conflicts and how she personally provided the opportunity for consensus, crediting herself with being "…big enough to just sit there with my mouth shut and let them argue it out…" which allowed the point to be deliberated and opportunity for others to express an opinion until it was time to "…get back to the problem at hand…." Rose continued, "I think we were able to synthesize all of that on the spot," ultimately resulting in doing "what we all thought was best for the program." Rose identified the challenge was that often "philosophical discussions would jump against actual *things* that we were trying to get done…." She gave a lot of leeway to her colleagues because of her immense respect for and acknowledgement of people who were acting in the best interest of the project. She interpreted the passionate discussion as indicative of "gifted and talented educators" who were focused on creating an exemplary product. Andrea also remarked on the exchange of passionate viewpoints and considered "strong opinions" to be expected from a group of teachers whose normal modus operandi was as independent operators, "used to making a unilateral decision, especially about course material." Andrea thought the team "did a good job of respecting each other's strengths," and despite suspecting members were experiencing thoughts of "it drives me crazy that you do this," they remained professional, knowing "that [the discourse is] contributing a lot to the process, and…we're going to produce a better product because of that."

Like Rose, Andrea acknowledged the "louder presence" of some of the members, but unlike Carol and Sofia, Andrea did not think anyone was mistreated, characterizing the departures of a few people as just not finding the team to be a fit for them. To a

greater degree than perhaps some of the other participants, she also thought that everyone had an opportunity to have "their day of power…their point where they were the loud one."

Tara believed that the team formation should have been more deliberate and intentional, which may have alleviated some of the tensions on the team, revealing,

> …I may be wrong about this, but it was mostly people who volunteered rather than [the team leader] actually sitting down and saying "who would make a good member of a team like this?"…and doing the selecting himself rather than calling for volunteers.

Addressing the personality differences on the team, Tara continued, "I think that putting a team [together]…you have to be very, very conscious of who is going to interact with whom, who is going to be disruptive in a situation." However, most of the team members had been asked to be on the team by the team leader. Tara's view was not supported by the responses of the other participants who felt that the team leader did a remarkable job of assembling the team; that he picked the "right" people for the job. The team dynamics in their view worked well and was a strength of the group.

The fact the project was grant driven added another layer of complexity that brought its own complications to the team dynamics. The grant timelines and objectives coupled with the leadership dilemma and lack of communication from administrators greatly added to the tensions within the team dynamics.

Despite these challenges, the team continued its work, exhibiting a dynamic of mutual cooperation and respect for the most part. Meetings were often marked by passionate exchanges, but the participants were proud of the way the team deliberated to

a consensus on issues that had different viewpoints, and participants considered the experience highly collaborative where everyone contributed their strengths.

Educators' Perceptions of Adult Learning and Teaching After Designing and Implementing an Inverted Classroom

The Inverted Classroom Works, and It Was Worth It

While participants were busy developing the curriculum, materials, and activities for the project, nobody could know for sure whether the hard work and hopes would culminate into a design that worked in the classroom and achieved the learning objectives desired. Rose had her doubts that the inverted classroom was going to work but kept an open mind.

> I have to admit I wasn't too sure about the whole thing…It was really, really cool for *me* to see all of it come together, and then to start to implement it in the classroom, and see how it really, really, worked.

In fact, to Rose, the whole transition to the inverted classroom was a revelation and a "brilliant" choice for the introductory biology course.

> My whole concept [of teaching] was standing in front of a class and imparting my vast amount of information. I have found that I like leading students to their own knowledge—not spoon-feeding it by yapping at them about it—and being a participant in that learning. I really like this model. Now, I'm not sure it works for everything, but for IBIC, it's brilliant—absolutely brilliant—because you get so many different levels and such a wide diversity of people and experience in that class.

Rose previously taught by lecturing only, but now she had been introduced to the inverted classroom. As Rose discussed her experiences, the emotions coming from her narrative made it obvious that she was sold on the inverted classroom. She continued with her thoughts:

…it's simple, but it's not stupid simple. And it's complex, but it's not complex to the point that people don't get it. And, once again, it's fun...they're playing games in a sense—they don't realize that they're learning while they're playing the game, and, they actually see their own progress. And that's one of the things that I really, really like about this—and [that] I'm not responsible for all of their progress—they've got some part of it that's their responsibility.

Rose's ringing endorsement of the inverted classroom to teach an introductory biology course included her appreciation for the fact that not only did students have fun learning, but their active participation also allowed them to witness their own progress in real time and cemented their own learning through their participation.

When posed the question of whether she thought the effort to redesign the introductory biology course and teach it as an inverted classroom was worth it, Beth responded, "I am going to say 'yes' because I think it's making a difference." Beth elaborated on her response, stating, "Well, I think, one, it works," citing statistics to back up her claim, "I think we have a 90% success rate in those students who didn't drop." The success rate Beth referred to was the rate at which students passed the introductory course, a gateway to more advanced courses. The objective of the redesign was to increase the success rate and Beth considered that objective accomplished.

Beth also found that the impact of the IBIC went beyond the classroom in which it was taught and was evident in the way the faculty improved the course delivery in the traditional introductory biology classes, too, which struck her as being a benefit for the college. Even if traditional class faculty did not adopt the inverted class method "100%," other faculty had the ability to "pick and choose what you want from it."

Sofia found the contrast between her old and new way of teaching to be very distinct. Not only was the IBIC an easier way for her to teach, finding it had been "much harder for me to deliver the material just lecturing," but it also worked better for the students. Sofia already had been using guided notes to engage her students in learning course content prior to her use of guided notes in the inverted classroom. But her experience taught her that the guided notes were much more effective when combined with the other elements of the inverted classroom, such as the activities which were often a "hands on" way to reinforce the same topic or process found in the guided notes. When asked if all the work and time that went into the project was worth it, she replied, "no doubt," adding that the participants became "better teachers …in the process."

Andrea reflected on her experience teaching the IBIC at different campuses for the college, after the first year when the small project team taught it from the same classroom. To her, it worked for all students, but some groups of students were especially benefited by its use.

> It is *absolutely* effective for certain student populations. I feel like it's the only
> effective way for students who are academically less prepared. At certain
> locations, I'll have about five or six students who don't need [it]—they would get
> an A in the driest lecture class—they would be fine with a textbook and they

could get an A. These students just don't need any special attention. But, it's the other half, even sometimes two-thirds of the class—they need [inverted classroom teaching]. They need the tactile-ness of [it], they need the variety of [it]— especially students who have attention issues—they've got to have [it]. Some of the students need personal effort, [they] have confidence issues so you can really "build them" personally. So, there's a student population that [inverted classroom teaching] is not only helpful, but I think really required.

Andrea's experience convinced her that the inverted classroom is necessary as a teaching method for the majority of students she encountered in the introductory biology course. The method helped these students develop study and thinking skills that were lacking, building confidence in their ability to learn. The inverted class fostered these skills by allowing for personalized education.

At the time of the interviews for this study, the introductory biology course had been taught as an inverted classroom for several years. Carol acknowledged the evolution of the IBIC and how it was taught, noting that each instructor had modified their process from the initial delivery of the IBIC to suit their own style and to better respond to the needs of the class. For her, she realized after a couple of semesters, "I'm not 100 percent comfortable just doing activities in class. My students need me to stop, explain things to them, and go from there. So, I really love it. I use it all the time now." Carol underscored the flexibility of the method. The method allowed for instructors to play to their teaching strengths and adjust to what was going on in the classroom to address the students' needs, such as incorporating peer-to-peer teaching, which Carol said helped "99 percent of the students." Carol considered that all the work and stress of creating the modules to make

the course interactive was "worth it" because of how she saw students respond to and be helped by the accessibility to the course content online. She stated, "the students like it [the modules]…because of the walking through, the assessments throughout, and the fact that students can go back [to review material]."

Carol also commented on the positive difference the inverted classroom was making on her students by the contrast she saw in later classes, declaring that " I can pick out a student who's had our inverted course and who hasn't. On the second day of class, I can literally tell if a student has had our inverted course." The experience of the IBIC instructors was that the IBIC produced more confident students, what Andrea referred to as "building them," and which Carol could recognize by their ability to engage more, frame thoughtful questions, exhibit more subject matter knowledge, and demonstrate advanced skill at taking notes and outline content.

Tara's insight came from her adult education background. She explained why she considered the inverted classroom to be so effective for adult learning.

> …because it appeals to the adult brain—and for all of our diversity—one thing we do have in common is we all have the same adult brains. And so, if we play to that, to me that is the big leveling field. And if we could help our students to get away from thinking of learning as memorization and towards learning as problem solving, then…they go…"Oh! Well that's so easy." Yeah, because you get that left brain not fighting anymore.

Although a certain amount of material in a biology course does require memorization, Tara was referring to activating parts of the adult brain that made sense of material by being challenged to think, thereby constructing its own learning.

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The consensus of the participants was that the inverted classroom was a game changer for adult education. By creating a curriculum that built confidence through allowing time for personalized education, included active learning and multiple ways to learn, and transitioned learning from memorization to problem solving, participants called it "brilliant," "absolutely effective," and "required" for certain student populations. The format of the class can be endlessly modified to suit teaching styles and to better respond to the class needs of adult students with a diverse array of backgrounds and education, creating a fun, active learning environment that promotes student engagement. Students not only "experience" their learning during class, which reinforces their confidence in their ability to learn, but participants found it an easier, yet more fun and rewarding way to teach over traditional teaching.

Professional Development for the Inverted Classroom Based on the IBIC Experience: Training Is Needed, Preferably With Collaboration and Support

The experiences of developing and implementing the new version of the introductory biology course as an inverted classroom allowed the participants to understand that this type of project would be difficult to implement by an instructor without assistance, mentoring, and training. Each of the participants provided their ideas on what was necessary for instructors interested in successfully adopting the inverted classroom. They believed instructors could become better informed and perhaps recruited to use the method by lowering the threshold to learning about it, ideally through workshops, mentoring, and opportunities to shadow experienced instructors in the classroom for a time before working on their own.

In particular, Beth and Andrea identified important characteristics of what training should include for faculty who wanted to implement an inverted classroom methodology. Beth explained,

I think [it is important to provide] training ahead of time, mentoring them, or having them sit in on our classes so that they observe it. I feel really blessed that the first time I taught [IBIC] I could sit in on Rose's class before mine and observe her—or ask her to stay…. That setup let the students go to either one of us for office hours. More training is necessary for success with the inverted classroom.

Similarly, Andrea offered, "we really need to have [training]. We're all doing a million other things…" She added,

I really, really think we need an in-person mentoring process for [IBIC], in general, for any flipped classroom. The reason that we got it going was because we had each other to kind of look at and depend [on]…not just by email….[but] if you can have an experienced person to watch or to at least be there, it would make such a difference.

Professional development, such as in on-the-job workshops, was also emphasized. Beth felt this kind of training would make the transition to the inverted classroom easier and reduce the anxiety an instructor new to the inverted classroom might feel. She outlined professional development that her experience told her would be essential:

I think we need to conduct a faculty workshop that demonstrates a typical day in the classroom. And then from there invite people to sign up and commit to a semester's worth of observing. The faculty would be essentially [unpaid] student

teacher[s] in the classroom…[because] we can't pay them. The payoff is they'll

be better teachers, but if they don't have the time…

Once the redesign was complete and the IBIC had been implemented for a

semester, Andrea became involved with recruiting additional instructors to try teaching

the class. Andrea provided direction and advice to the novice IBIC instructors, but the

transition was tedious for some because of all the work that needed to be done prior to a

class period. Even though the course content was available in an organized manner for

the implementation of the inverted classroom, and much of the material could be emailed

to new IBIC instructors, Andrea advocated for doing more than just passing along

material. Participants agreed that, if an instructor does not have the proper training to

implement and use pre-designed materials in the inverted classroom, the likelihood of the

recruitment and implementation being successful was not great.

The participants, because of their shared experience of being completely new to

the inverted classroom and of having to struggle to attain the goals of the project,

developed insight into the type of professional development they considered necessary in

order for novice faculty to be successful with the IBIC. They understood the essence of

what mattered in the implementation of the IBIC—having other people to serve as

examples, to problem solve with, and to help as needed—that is, collaboration, training,

and support while learning to navigate a new teaching method. However, they

acknowledged there were obstacles for successful recruitment, including lack of time to

devote to training activities and potentially lack of funds available for training.

Future Faculty Buy-In

While the participants each had positive experiences with using the inverted classroom in biology, they were aware of the lack of faculty recruitment to use the already developed course and "packaged resources." The participants discussed that faculty were not willing to undertake implementing a content delivery platform that entailed a large input of time when they were already very comfortable with their current delivery method. Rose discussed her observation of the lack of interest from the biology faculty:

> I think if they [faculty] were…taken step-by-step through it, that they would be more inclined to use it. I think a lot of instructors are a little intimidated by it. They weren't part of the process, they think it's "secret" kind of stuff.

She continued with her assessment of why more biology faculty were not willing to give the inverted classroom a chance in their courses, adding, "I think we have not done enough to promote the program within our own community." Andrea regretted that, "Instead of it being like a cool, new way to develop and change and grow, it became a 'well, that's your thing, that's not my thing.'" She continued, "I don't know if that's just personality, like there's certain people that you have to get involved in the development of it for them to buy in."

Participants believed that the project team did not do a good job of promoting, educating, and inspiring other faculty members to use the inverted classroom, but they also felt the department did not advocate for its use amongst faculty and, therefore, missed an opportunity to add it as "a mindset" to the whole department. Andrea voiced her frustration,

To me…one of the great missteps of all of this, was we had some of [the faculty]

drink the Kool-Aid, but even if you didn't drink the Kool-Aid, other people in the

department could have at least expanded their vision of their own classroom a

little bit more. I kinda feel like that was the lack of departmental support and the

other was our peers.

Carol felt trained instructors were vital to the proper implementation of the IBIC

with students, and she felt a keen responsibility to provide the training, although she did

not have the time to do it. From her perspective, with a new process like the inverted

classroom, mistakes would be magnified, making faculty unwilling to try something new

if a mistake were to be discovered, fearing,

If we even put one little screen [mistake on the module] on there, and someone

catches it, that's it, we've lost their respect, we've lost their buy-in. We won't be

able to get other faculty to buy in until it's correct content, that's all there is to

it—in my mind. I just know the other faculty will not participate, no way, no way.

Carol's concern derived from her role with the team, which was being one of the few

team members trained to use the software to create the interactive modules, and she was

aware there were some mistakes made by the part-time employees who were hired to

produce modules and who did not have sufficient background for the subject matter. She

had not yet had time to go through the modules to ensure complete accuracy, and the

team instructors had used them knowing that they may have to verbally correct

information for their students. Carol had encountered a situation where an instructor who

had not been part of the original team made dismissive comments about one of the

modules that contained a mistake, the sting from which now colored her perspective on

training—that is, the course materials would need to be flawless before other faculty would accept what had been created and use it. Carol appeared very sensitive to the impression any training would make on the faculty in order to ensure their buy-in, advising that not only did the materials need to be above reproach, but the trainer would need to possess an engaging presentation style and IBIC experience with teaching strategies to win over the faculty.

The lack of buy-in by other faculty for the inverted classroom was a source of disappointment and frustration for all of the participants, because their experience was that the method had revolutionized their teaching, and therefore they felt it should be adopted by everyone. Participants encountered various forms of resistance, such as claims that faculty were already doing something similar, or the sense that some faculty were either intimidated by change, or they were dismissive of the method because they were not included in the original project. A concern was expressed by a participant that, if training were done, the materials would have to be flawless or else it would invite disparagement by faculty, and they would not be able to see the potential of the method and they would not buy in. Participants felt not enough effort was put into promoting the method by the department, and so an opportunity was lost in gaining adoption by other faculty.

Continual Improvement: Keep It Fresh. Keep It Relevant

The participants believed that in order to maintain the effectiveness of the IBIC, periodic changes needed to be made to the content. Beth believed that the project monies and time invested by the project team were well spent to develop a good product, but she

raised the issue of evaluation of what had been done in a timely fashion so changes could be made accordingly.

> If you put time and effort into something, the next question should be, now what? Where are we going with it? If it was a success, how can we build on it? If it was a failure, why didn't we recognize this before we spent all of this money on it? So, yeah, bringing that approach to anything at [the college] from my business background sometimes is what drives me up the wall.

Beth felt the potential could be more fully realized if reflective questions were asked to aid evaluation and direct action toward improvement. As it was, the lack of a program evaluation by the college administrators missed opportunities to introduce the IBIC as a successful learning method department-wide and to aid faculty buy-in.

> With regard to keeping the activities relevant, Tara advised, "you tweak them, and you have fun with them so they stay fresh, too…." Carol maintained that certain content and activities that worked well should be retained as "core" materials in order to be an effective inverted classroom instructor. She also understood that the individual members of the team over time were going to adopt new ways of reaching and engaging students. Carol wanted those new approaches to be shared with the other team members so they could be assessed and used to keep the material fresh and effective. Additionally, she welcomed feedback on which activities worked better than others, so that effort was directed to improving the more effective activities, providing as an example,

> …if you're not doing it because you say, "eh that's not effective…," you know what? We've got these three things for this module. Out of these three, our experience over all these semesters has been these two are more effective. Let's

not do this one, let's instead improve these two, make these two solid," and go

from there.

Sofia similarly shared that there was a "disadvantage" that the team effort stopped at the

end of the project explaining, "we cannot perfect it, improve it, change it, introduce new

things…because we stopped so now everybody is on his own." She felt the teachers

should come together to continue to share experiences about application, modifications,

and results. Participants wished they would have continued to identify what worked well

and weed out what did not so that only the best was used.

Andrea recognized that continued collaborative work after the project was

completed would have taken additional time that many of the faculty do not have. In her

interview, she proposed getting together for a "Best Practice" session "at the [faculty

development workshop]" to continue to improve and to keep the content fresh,

recognizing, "So many of us have so much material that we're not sharing. And it's

hard—like how do you share it?"

Over half of the respondents expressed a desire for the team members to get

together at some time frequency to discuss the content and share their experiences so that

new content could be added and used by other instructors. Participants valued the input of

best practice sessions like they had during the early days of the IBIC, and they saw a need

to continue sharing with each other. Additionally, one member wanted to see an

evaluation by college administrators done to help determine the future development of

the product and to ensure the time, effort, and money investment yielded the most

success. A positive evaluation by the administration would have lent credibility to the

team's effort and product and perhaps paved the way to adopt the inverted classroom innovation department- or college-wide.

Not For Every Faculty Member to Implement

The participants were asked to talk about what personality or teaching style they felt worked or did not work for the inverted classroom, and there was general consensus that not every faculty member was a good fit. These IBIC faculty agreed that to be successful with the inverted classroom, a faculty member must be comfortable with non-structured engagement with the students. In Beth's words, "You have to leave the dogma at the door; you have to leave the ego at the door…the professor who wants to profess is not going to fit."

The participants' experiences led them to understand that the instructor must be comfortable with a more immersive learning experience and not be the kind who had the need to be the undisputed authority in the classroom. Carol's impression was someone who was not austere but comfortable with engagement, the type that likes "to have fun in the class" and is not "just all business." A person who does not care if their students "get it or not, but I've done my job and I'm out [of here]" is not the type of faculty member Carol thought "would enjoy this type of class." Even introverts in Carol's opinion could still succeed in the classroom as long as "they love teaching and they love students. I think that's a key thing.…" Andrea stressed the need for an instructor to be comfortable with their availability to the students and the investment—both time wise and on an emotional level, because "The professor who's teaching it has to commit their time—it takes a lot more time, and it takes a lot more emotional energy. It takes a *lot* more emotional energy."

Tara added that if an instructor were thinking about teaching IBIC "you should sit

in on a little bit of it and see whether you like it." She also did not think everyone was a

good fit to teach the inverted classroom, stating "I think we need to be a little judicious

about who would be a good person to teach IBIC," suggesting that she thought

department chairs often just acted on a need for a "warm body" to fill the slot for an

instructor in a classroom, rather than having the luxury to pick and choose based on

personality and teaching style that would be most suitable for success with the inverted

classroom.

The experience of the team members with the IBIC formed their opinions that not

every faculty member would make a good IBIC instructor because the platform requires a

learning environment that fosters interaction between instructor and students. Instructors

who are not comfortable with more interaction would probably not be a good fit.

Advice to Future Instructors for Developing and Implementing an Inverted

Classroom

While advice about developing, implementing, and teaching an inverted

classroom can be gleaned throughout the Findings chapters, this last section documents

responses to the specific question to provide advice. Rose's perspective was that

instructors who wanted to transition to an inverted classroom should consider

collaborating with other instructors because of the amount of work it takes to create this

type of content.

Be ready for a lot of blood, sweat, and tears. Don't do it by yourself. If you're

intent on doing this, you need a team of at least three or four people who have the

same vision and who are going to help you start now. And plan on implementing

it two years from now, maybe, and be prepared for a lot of sleepless nights.

She advocated a team approach and to give oneself a timeline that is doable to avoid the

stressors that the members of this project endured. Carol also advocated a team approach,

sharing, "I would definitely take it on as a team…you don't have to invent the whole

course in one semester…get your content first…then everything flows from there." Carol

suggested to continue teaching as usual while developing the new content, then, "Next

semester, add your activities. Third [semester], add your whatever [is next]." Beth agreed

a gradual approach was best, and she advised a thoughtful implementation.

Observe. Participate a little bit as you observe. Start practicing some of these

things. Start small. Don't decide you're going to do the whole package all at once,

but "I'm going to use *this* activity on *this* day." The next day, "I'm not doing an

activity. Maybe I'll do one the following week."—so that you don't feel like

you're just going through the motions of "do the activities," "do the card sets,"

but to use them as meaningful tools, because they fit into *your* program. You have

to make it a bit how you teach.

Intentional application of the activities to make sure their use augments the learning

rather than just as busy work was a point Beth wanted to make, while Sofia agreed with

Beth about faculty needing to be themselves when using the inverted classroom,

incorporating "their personal style."

Tara reiterated that instructors should try to play to their strengths when using the

inverted classroom. She encouraged those who would want to implement the inverted

classroom to create a course bank of materials so that the instructors might choose what

would work best for their course, personality, and teaching style. Tara stated, "I think we would have been stronger if we would have encouraged everyone's strength and set up basically a course bank." Tara believed that some of the problems early on were brought on by the decision to try to standardize the inverted classroom, stating, "We would have been a much more powerful dynamic, and I think that most of the problem we had was trying to shoehorn everything into uniformity." However, not everyone believed that uniformity would be a negative approach for new faculty learning to teach the inverted classroom. Sofia characterized the uniformity as a positive:

> There wasn't any competition amongst the professors anymore.…The style was still there, but we had to follow a certain way of presenting it [IBIC], and that kind of leveled off differences in the material, differences in what we cover…So I think that made it a little bit less stressful for the students *and* for the professors.

When asked what advice she would give to new instructors, Andrea laughed and said, "I always say the first warning is it's a *lot* of work, especially the first semester." The assembling of all the materials and "organizing your day," because "you're not just showing up, you've got to have *all* of your stuff, right?" is a time and thought consuming endeavor. Andrea shared that the faculty new to the process are going to try things that are not going to work the first time and that they will never have complete control over everything that might occur when using the inverted classroom, cautioning, "you have to be flexible." Andrea also acknowledged that a well-designed space for the class makes "such a difference," elaborating, "A dry, sterile, rigid classroom is not going to be nearly as successful in this as one that's got some life and energy in it."

Participants engaged in the novel experience of designing, implementing, and teaching an inverted classroom, which, while rewarding, was also memorable for the stress it induced. They offered specific advice that would have reduced their stress loads if they had had prior knowledge or guidance. To recap, participants offered these tips:

- Collaborate and work with a team;

- Develop and transition in stages, starting small and building from one semester to the next;

- Play to teaching strengths and develop a course bank of materials for resources;

- Stay organized and flexible; and

- Arrange physical space to support active learning.

The participants' perceptions of adult learning and teaching after designing and implementing an inverted classroom included their evaluation that the inverted classroom was a worthwhile project and effective in delivering content and in engaging the students in learning. For most of the participants, the experience represented their first acquaintance with the inverted classroom, building a course, and the grant process. Despite the uniqueness of the experience, it yielded certain shared perceptions of what worked with the inverted classroom, how to make it better, and who the inverted classroom is ideally suited for, both as student and instructor. When asked what specific advice they would give to those who may want to initiate an inverted class, their responses included a number of tips that derived directly from their experiences of what benefited their efforts or would have alleviated a lot of the stress.

6. DISCUSSION

When this study was initiated, scarce data existed that documented the use of the inverted classroom in higher education for STEM disciplines (Brown, 2012; Picciano & Dziuban, 2007), much less for biology. Since the inception of this study, the inverted classroom has become more popular in higher educations as its application has become more understood (Beumer, 2018; Malto et al., 2017; Matawali et al., 2019; Wolf, 2020). However, research focused on the inverted classroom from an instructor's perspective is still limited. Brown (2012) conducted a similar approach to studying the phenomenon of instructors using the inverted classroom, but their study was different in several ways: the participants were from different learning institutions, the participants taught courses in different disciplines, and videos were used to deliver the course content.

This study was designed to examine the lived experiences of a group of biology instructors employed by a central Texas community college by documenting their unique experiences with the facets of the redesign, implementation, and instruction of an introductory biology course in the inverted classroom platform. This study was unique because the participants knew each other, they taught at the same institution in the same discipline, and they designed and taught the same introductory biology course in the inverted classroom platform. The study offers important insight into professional development needed to support the process instructors undergo to move from traditional instructional approaches to inverted classroom methodologies.

By adding to the limited collection of research literature focused on the experiences of the instructors using inverted classrooms in higher education, other educators, who would like to transform their teaching and courses to an inverted

classroom learning environment, may become better informed. While this study is focused on the experiences of instructors who are teaching biology at a community college, the findings from this study can be used to inform others who have a desire to implement an inverted classroom in STEM or other disciplines.

This qualitative study recorded the phenomenological experiences of six instructors who were involved with the design, building, implementation, and teaching of an introductory biology course in the inverted classroom platform. Data were gathered from personal interviews and a CIT focus group. The research question for this study was: What has been the experience of college instructors who have adopted the inverted classroom model for their introductory biology course? There were several sub-questions that were also addressed by the research:

- What have been the motivations and professional influences of the instructors for transitioning to the inverted classroom for the introductory biology course?

- In what ways have the participants' teaching practices changed (if any) as a result of the transition to the inverted classroom?

- What were the benefits and challenges in teaching the inverted classroom?

- How do educators perceive adult learning and teaching now that they have designed and implemented an inverted classroom?

The participants in this study provided insight through reflecting on their conversations with their students and their own observations to the challenges that community colleges face preparing students for academic success and workforce placement. As noted by Adams and Gingras (2017), some incoming college students

were found ill-prepared for the rigor that higher education demands. The fact that students are not prepared for the rigor of college courses is particularly true at the community college because of the open-door registration for courses (Eagan & Jaeger, 2009). The faculty need to be able to teach students who are underprepared and to inspire the students to believe in their ability to be successful (McGuire & McGuire, 2015).

A method that has proven to be effective in providing a platform for student success at the college level is the inverted classroom. Research conducted on the inverted classroom approach showed more often than not that the method has led to academic growth and success, as well as individual growth of the participating students (Al-Samarraie et al., 2019; Hew et al., 2021; Limaymanta et al., 2021; Long et al., 2017; Onodipe et al., 2020). The IBIC grant project was conceived to address the issue of unacceptable rates of student completion of prerequisite biology courses due to underprepared students, ultimately with the end goal to increase the rates of student success and readiness for progression to other science programs.

This research project was inspired by the success of the IBIC project and the hard work that was conducted by the instructors who designed, built, implemented, and taught using the finished product. After the success of the project, I wanted to be sure that the voices of the instructors were heard by other instructors, administrators, and researchers who would be interested in employing the inverted classroom platform to engage their students in an effective method for content delivery and student learning. While this project focused on the experiences of six biology instructors, the results of this study can be used by instructors in various academic disciplines to help them navigate the development of their courses.

The inverted classroom has become a very popular platform to deliver course content for different courses at colleges and universities (Gilboy et al., 2015). Yet, as echoed in the comments of the participants in this study regarding their colleagues, there remains a threshold of unfamiliarity that needs to be breached before instructors realize its potential and are comfortable with moving forward with introducing at least some aspects of an inverted classroom into their own teaching. The participants found that although the IBIC was well received by students and some faculty members, other faculty members were resistant to the use of the inverted classroom, so it was deemed an underutilized teaching tool by the participants. Some other studies, too, have either reported mixed results or results that show no real benefit while using the inverted classroom (Bezdicek et al., 2015; Heyborne & Perrett, 2016; Pociask et al., 2017), which could contribute to the resistance or apathy of instructors to investigate it further if they are aware of this research.

From the study results, I formulated adult learning recommendations to help other instructors who might be interested in implementing a student-centered learning model gain some insight into using an inverted classroom. I was specifically interested in sharing the ideas that were generated from the experiences of the participants in this study to inform other instructors who are interested in helping their students be successful by using a student-centered inverted classroom. This study captured the essence of the phenomenon experienced by the participants during the process of developing, implementing, and teaching the IBIC. I will discuss the results of this study as they relate to implications for theory, educational practice, and policy in the hope that it will familiarize instructors with the use of the inverted classroom as a method to deliver

course content in a student-centered format and perhaps help lower the threshold to embarking on a new journey in teaching.

What Have Been the Motivations and Professional Influences That Prompted the Instructors to Join the Project to Create a New and Improved Introductory Biology Course?

The findings for this subquestion indicated that participants were both drawn to the opportunity because of the team aspect, which offered participants a collaborative effort they felt would produce a better instructional approach and materials/resources, and to the challenge of helping students succeed by enhancing the learning experience. Additionally, a couple of participants viewed it as an opportunity to network with more established faculty that could result in career advancement.

Lai et al. (2018) hypothesized that one of the motivations of continued use of the inverted classroom was the mutual interaction with other faculty in sharing ideas about the inverted classroom. A finding of the current study was similar in that instructors were interested in the sharing of best practices of the inverted classroom, but they also relished working with each other as a team toward the common goal of making the course better, even if it meant long hours working on mundane tasks, like making components for in-class activities.

The participants of the current study were also motivated to join the team because the stated project purpose was to redesign the introductory biology class to help more students succeed. Because of the instructors' experiences teaching community college students, they had an awareness of the difficulties many of the students faced trying to attend class, complete assignments, and study for tests, while juggling jobs and often

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family responsibilities, extreme poverty, and even homelessness. Moreover, the participants had found a vast range of academic preparedness existed for the student body they taught in any given introductory class, and they were frustrated by traditional teaching methods that left many of the students disengaged and overwhelmed. As has also been well documented by a number of researchers, the participants recognized that students enrolling in community college were coming into higher education academically unprepared and with familial responsibilities that form barriers to their success in college (Bahr et al., 2017; McPherson & Arbelo-Marreno, 2021; Wang et al., 2019).

My participants found that the course needed to be designed so that adult college students believed they were supported by the way the course was presented. Zainuddin and Halili (2016) discussed the support of students in their review of trends in the application of the inverted classroom. The study participants were empathetic to the students' needs to be supported, as many students at the community college struggle with the completion of the first two years of college until they developed the necessary skills to be a successful college student (Bahr, 2017).

Student engagement and active learning have long been facets of a learning environment that have facilitated success of students in higher education (Cavinato et al., 2021; Marlina & Sugito, 2019; Smith et al., 2018). The participants were interested in adhering to this established concept of developing course content that would engage the students using methods that adhered to adult learning principles. In the participants' experiences, engagement of the students was part of the active learning component that was important for students' understanding of course content and thereby their success.

In What Ways Have the Participants' Teaching Practices Changed as a Result of the Transition to the Inverted Classroom?

A recurring theme in this study's findings was the importance of student engagement in learning. Student engagement has been linked to student success (Cavinato et al., 2021; Marlina & Sugito, 2019; Smith et al., 2018), and the participants found that student engagement was important in motivating students to learn, which led to their success in the course. The participants found they needed to facilitate student engagement in their courses in order for students to have a greater opportunity to be successful.

The participants found that they became advocates for the students, as the increased interaction possible in an active learning classroom promoted personalized teaching, which the instructors believed helped build the students' confidence in their ability to learn. The participants needed to be flexible in order to adapt to the changes needed in the classroom to facilitate learning. Advocacy and flexibility were important teaching practices that the participants found to work exceptionally well. The need for flexibility was reported by researchers studying the motivation of instructors to continue to use the inverted classroom. The current study's findings reiterate previous research that highlighted flexibility was a mandatory attribute for the success of the inverted classroom (Lai et al., 2018). The participants of this study became mindful of these practices through their own experiences and employed them into their teaching practices.

The respondents also learned about themselves and their teaching practices while working on the IBIC project. While there have been researchers who have studied practices that have facilitated instructors getting better at their teaching practices (Meyer

et al., 2018; Solheim et al., 2018; Thomson, 2015; Thomson & Barrie, 2021), there is little mention of instructors learning about their own teaching practice through the use of the inverted classroom. The participants of this dissertation research were specific in stating that their teaching practice improved by what they had observed and learned from working on the process of the IBIC.

What Were the Benefits and Challenges in Teaching the Inverted Classroom?

The benefits attributed to teaching the inverted classroom included the support from other team members and the advantages of the inverted classroom versus a traditional classroom with regard to student learning. The challenges included the amount of work and stress experienced, software and technical problems, the lack of support from administrators, and power dynamics within the IBIC team.

Benefits of the Team Approach

Several studies have reported that faculty teaching in the inverted classroom formed a community of practice (CoP) in order to problem solve and share best practices (Boschman et al., 2021; Poole et al., 2019; Seyedmonir et al., 2014; Thomson & Barrie, 2021; Thomson & Trigwell, 2018). However, the team approach used by the participants in this study was unique; that is, no previous studies have reported on a team approach to designing, developing, and implementing an inverted classroom, much less teaching it. The team approach not only facilitated the easy formation of a CoP by the participants while teaching the inverted classroom, but also the formation of long-lasting professional relationships that bonded them to each other and to the college. The strength of the bonds that were formed by the participants was not expected and was seen as one of the best aspects of the project, helping to resurrect the participants' enthusiasm for their

profession; this development was part of their lived experiences and part of the IBIC phenomenon.

Benefits of the Inverted Classroom as a Teaching Method

Student Engagement

The IBIC method for content delivery allowed for the participants to use activities to engage students in active learning. The participants were willing to get to know about their students and form mentor relationships with them in order to build trust so the students would feel comfortable with engaging in learning. Several studies have discussed the importance of student engagement in learning. These studies also reported that the inverted classroom is a platform which facilitates student engagement and active learning (Kim et al., 2016; McCallum et al., 2015; Tomas et al., 2019).

An important aspect of getting students to engage in learning activities was to build an environment where the students felt safe enough to get out of their comfort zone and interact with other individuals. The participants in this study aligned with these ideals of student engagement during the development and facilitation of the IBIC.

Multiple Ways for Students to Learn and Reinforce Learning

Young (2016) reported the need to help prepare students for the academic challenges of higher education by providing exposure to multiple ways of learning. The participants knew this to be especially true for students attending community college from their first-hand experience in the classroom. The participants developed multiple ways of reinforcing the course content by using different activities in the classroom to complement the course content that students were introduced to prior to the in-classroom meetings. These different activities exposed the students to multiple ways to engage the

course content. There have been a number of research studies that have discussed the importance of using multiple ways of learning to maximize student success in courses (Chuang et al., 2018; Khojasteh et al., 2021). The students appeared to enjoy the multiple ways of engaging and learning in the IBIC content, according to the participants.

Students Responsible for Their Own Learning

Studies and books have described the importance of students taking responsibility for their own learning as an integral part of the inverted classroom (Hava, 2021; Lai et al., 2018; Malto et al., 2018; Murphree, 2016; Pardimin et al., 2020; Talbert, 2017). The participants reported that students became responsible for their own learning as they learned study skills and gained confidence in their ability to learn. As an introductory biology class, teaching study skills was often part of the active learning component of the classroom, and instructors reinforced the concept of the students' responsibility for their own learning by verbally stating that expectation. Additionally, the inverted class format fostered expectations that students came to class having reviewed the material on their own and were ready to participate in class activities.

Challenges of the Inverted Classroom

A Lot of Work for Everyone and a Whole Lot of Stress for Some

As the participants spoke about the considerable and, for some, the overwhelming amount of work necessary to make the IBIC project successful, they shared how the negative impact of the time commitment and the stress affected their teaching and personal lives. Several studies have discussed the large amount of time needed by instructors to ready the course content for the inverted classroom, especially at the beginning of the process (Anderson et al., 2014; Cevikbas & Kaiser, 2020; Long et al.,

2017; Roe et al., 2018; Rohani et al., 2020). However, there has not been research

discussing the stresses associated with building a course like the IBIC. The fact that the

stress reported by the participants of the IBIC project has not been mentioned in the

literature leads one to believe that stress may have been situational due to the

circumstances involved and timeline necessary to deliver the product of the IBIC project.

Difficult Software and Lack of Technical Assistance to Build Course Content

When discussing the application of the inverted classroom, several articles in the

literature mention an array of different types of technology used to deliver the course

content (Azeta, et al., 2018; Christopher, 2018; Roe et al., 2019; Rohani et al., 2020;

Telford & Senior, 2017). Although the software selected for the IBIC project was cutting

edge and made the modules interactive, the amount of time necessary to become

proficient with the software was overwhelming for the majority of the IBIC team

members, and only three IBIC team members became proficient. The consensus of the

participants was that the interactive software became an obstacle to be overcome for the

IBIC project team to complete their course objectives, serving as a major source of stress

for the member developing the modules and a constraint for the instructors who were

teaching the IBIC.

Support From the Grant Leaders and College Administrators Was Lacking

The participants were surprised and disappointed by the perceived lack of support

from the college administrator in charge of the grant project. Additionally, the participant

who had been appointed grant director by the college administrator to act as a liaison

with the grant consortium remarked on the frustration she experienced dealing with the

chaotic disorganization of the consortium. The lack of communication and the

miscommunication from those in charge of the grant administration contributed greatly to the stress the team was under, as did the delays in releasing funds and authorizing the hiring of additional help for the team. Thompson and Martin (2016) also reported that some faculty felt they were not supported by their administration and want to inform faculty interested in using the inverted classroom to open communications to garnish support by the leaders of the institutions. The faculty in the current study felt the administration did not value their efforts with inverted classroom design and the large time commitment involved because they were not granted LEH to compensate for their efforts.

Power Dynamics of the Team

The IBIC team did have some challenging power dynamics within the group. The power struggle between the two individuals who were vying for the leadership role of the IBIC team was ultimately resolved by the administrator clarifying their positions, but not before considerable tension was experienced by participants at the team meetings. As a consequence of the tension and a redefining of her role, the grant director chose to disengage from the collaborative aspect of the IBIC project and proceed on her own. The participants felt abandoned and confused by the grant director's decision to leave the team but did not have time to dwell on the development nor the background information to understand her decision. The inevitable disagreements between team members on the direction of the project were characterized by participants as collaborative and, although challenging, were considered a constructive part of the process.

The project team would have benefited if the roles of the leaders had been established early in the process so there would have been a clear division of power. This

simple act would have lessened the stress on the project team and perhaps may have facilitated the inclusion of all members. As it was, the team lost the grant director's involvement in the development of the IBIC due to the power struggle, but the team could have benefitted from her input and experience if she had stayed engaged with the team.

How Do Educators Perceive Adult Learning and Teaching Now That They Have Designed and Implemented an Inverted Classroom?

The Inverted Classroom Works, and It Was Worth It

The participants discovered the inverted classroom works and were fully committed to it as a teaching method. Their experience teaching the IBIC provided the proof of the effectiveness of the IBIC. There are many studies that have supported the use and effectiveness of the inverted classroom as well (Beumer, 2018; Hava, 2021; Malto et al., 2017; Matawali et al., 2019; O'Flaherty & Phillips, 2015; Telford & Senior, 2017; Wolf, 2020). These studies were generally focused on student outcomes or student satisfaction, however. These results also aligned with the experiences of the participants of this current study.

Although the qualitative data from my study indicated positive results from the use of the inverted classroom, the literature documents inverted classroom research which reported other than positive outcomes. In some studies, no significant difference was found when comparing the time of the course using the inverted classroom with a traditional classroom setting (Blazquez et al., 2019). Other studies reported mixed results when comparing different aspects of the inverted classroom method to a traditional classroom setting. A study reported mixed results when evaluating student engagement,

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student achievement, and student perceptions of the inverted classroom (Clark et al., 2016). Another evaluated multiple choice exams and free response exams which yielded no significant difference (Clark & Kaw, 2020). Calimeris (2018) investigated student satisfaction with course spacing and schedule in an inverted classroom which concluded mixed results. Another study compared student performance in an inverted-hybrid classroom to a traditional classroom and reported no significant difference in final grades or student satisfaction (Haughton & Kelly, 2015).

There are many scholars that have evaluated and reported varying results associated with the use of the inverted classroom. It is hard to compare these studies due to the different approaches and elements of the inverted classroom that were evaluated. What should be considered when reviewing the literature is that, like this study, there continues to be emerging data that are qualitative by design and which are adding to our understanding of the application of the inverted classroom.

Professional Development for the Inverted Classroom Based on the IBIC Experience: Training Is Needed, Preferably With Collaboration and Support

An important aspect that was discovered in this study was the need for professional development and mentoring to help other faculty wanting to use the inverted classroom be successful. Training was deemed elemental to demonstrate how the inverted classroom should be designed, how the inverted classroom worked, and to advise of the pitfalls that the participants had experienced when developing, implementing, and teaching a course using the inverted classroom.

Since the initiation of this study, two books were published describing the process of using the inverted classroom (Bowdon et al., 2016; Talbert, 2017), which discuss the

need for professional development to assist faculty members who were interested in using the inverted classroom. The participants in this current study believed that professional development was an import aspect to support future faculty's success with the inverted classroom. These viewpoints of the instructors have also been reported by researchers working with understanding the inverted classroom (Donmez et al., 2017; Long et al., 2020; Zawilinski, 2020). Researchers reported the need for training workshops, collaboration between instructors, and best practices as ways to help instructors navigate the process of understanding the inverted classroom.

In addition to initial training, the participants believed that a mentoring program for faculty was also important for successful use of the inverted classroom. The seasoned faculty could answer questions and also share their experiences with the first-time users of the inverted classroom. Other researchers recommend mentorships as one of several ways that new instructors might be able to acquire professional development specific to the use of the inverted (McLaughlin et al., 2016; Scott, 2014; Weinhandl & Lavicza, 2019).

The participants believed the need for professional development was so incredibly important that almost all of them made specific mention of it in their interviews. While the participants were excited about the project throughout its duration, they were teaching the course as they were designing and creating content for the course, in some cases just hours before the course was to meet face-to-face, which was highly stress invoking. Their experience informed their responses that training should be mandatory for other instructors who were interested in using the inverted classroom in their teaching practices, to spare others some of the stress they endured.

Future Faculty Buy-In

The participants felt faculty buy-in was necessary before more instructors would consider adopting an inverted classroom methodology in their classroom. This finding was similar to that discussed by Rodriguez (2016). The participants conveyed their belief that if potential users of the inverted classroom understood its effectiveness and application, the faculty would be more willing to accept the inverted classroom as a method of teaching their courses. They further observed that some faculty would be more amenable to a change in teaching practice if they had a voice in its development. Educators have stated that new pedagogical methods are difficult to get faculty to adopt if they are not aware of the benefits of the methods (Maxon & Kacir, 2015). This tendency is especially true if faculty members have been using a teaching delivery method for years in their practice. Faculty need to be involved in the processes or methods they might be investigating as a potential application in their courses.

Continual Improvement: Keep It Fresh. Keep It Relevant

The participants believed there should be periodic change to the inverted classroom to maintain the course as an asset to teaching and to keep the course an engaging way to instruct. The inverted classroom allows for multiple activities to be used during the face-to-face class meetings, and several studies have noted creative activities can be used and updated to keep the course from becoming stagnant (Adams & Gringas, 2017; Fink, 2013; Solbach-Solbach et al., 2019). Feedback from students may also serve as a basis for designing learning materials and face-to-face activities (Long et al., 2017). Naing et al. (2019) reported various modifications, such as content delivery, group work

and learning activities, that could be incorporated into the delivery of the course content in an inverted classroom that could be used for any discipline.

Not for Every Faculty Member to Implement

The participants identified an instructor "type" for whom the inverted classroom would work better than for others. The consensus was that instructors who were comfortable engaging with students and with being a facilitator of learning would be a natural fit. The extra pre-class work associated with using the inverted classroom may be a turn off to some faculty, which was one of the more common challenges that was reported by the participants. This finding was supported by previous studies that observed the amount of time was a true barrier to using the inverted classroom (Anderson et al., 2014; Cevikbas & Kaiser, 2020; Long et al., 2017; Roe et al., 2018; Rohani et al., 2020). The participants suggested that individuals wanting to use the inverted classroom should implement only a few facets of the model in a semester, building upon each prior semester, to downsize the time investment per semester.

Another challenge that the faculty faced was the need to embrace a change in their roles while in the classroom. Rotellar & Cain (2016) explained that many faculty members are reluctant to let go of their role as the center of the teaching experience. This predicament can be especially true if the faculty are trying to implement the inverted classroom alone and are uncomfortable with the short time they have been exposed to the newly developed course content that is to be used in the classroom. The participants of this study became aware of this issue and overcame the challenge by working together to develop the content and then providing each other with feedback and the best practices that made the use of the content relevant and successful.

Reflections on the Theoretical Framework

Interpretative phenomenology is focused on understanding the lived experiences of the participants (Smith et al., 2009) and is the theoretical framework for this study of instructors who came together as a team to design, implement, and teach an introductory biology course as an inverted classroom at a central Texas community college. To study the phenomenological aspects of the lived experiences of the participants, the researcher records the experiences of the participants, reflects on and analyzes the voices of the participants, and writes about the interpretation of the meaning of the experiences as reported by the participants (van Manen, 2014). It is important that the researcher capture the true implied nature of the voices of the participants to ensure that there are no biases that confound the voice of the participants. In this way, the lived experiences of the participants can be used to learn about the processes the participants engaged. This method seemed to work well for this study.

Because I was part of the IBIC team, I had personally interacted with the participants and possessed insider knowledge of the details that the participants experienced. The insider knowledge proved to be an asset when I began to analyze the data, as I was able to interpret the experiences of the participants within the situational context. Interpretative phenomenology is interested in learning about the details of an individual's experiences and, in the case of this study, to find similarities and contrasts among the participants' lived experiences (Smith et al., 2009). My interpretive role of researcher allowed me to portray and convey the data in a way that would facilitate the understanding of others who did not personally experience the phenomenon while staying true to the voice of the participants.

As I became immersed in the analyses of the data, I paid attention to ensuring that I did not add my voice to the conclusions that were constructed from the study results, taking extra time to reflect on my results to specifically check for researcher bias. Additionally, I used two different data collection techniques (interviews and a focus group) to be sure that data could be triangulated and thereby confirmed to be the authentic lived experiences of the participants.

Once the data were analyzed, I used member checks to be sure that I was representing the voices of the participants as they had intended when they participated in the interviews and in the focus group. Four of the six participants who were involved in the study volunteered to read the results chapters and provided feedback confirming the results reported were true to their lived experiences and voices. I collected documented evidence of their approval to the results of this study, which was shared with my dissertation chair to inform of compliance of qualitative research method. I am confident that the lived experiences and voice of the participants were represented accurately.

Implications for Educational Practice

As was found in the current study, when instructors decide to use the inverted classroom platform, planning for how the course will be developed and implemented is important and should be organized so all pertinent questions are answered, and the directions and guidelines are established (Yildirim, 2017). At the beginning of the project, the IBIC instructors were not sure how to proceed. Some of the instructors had not even heard of the inverted classroom, yet they were required to design the course with the new approach in the same semester that they were tasked to teach it. Planning for the different facets of the course was important and, even though the direction did change

several times, the inverted classroom became the method to deliver the course content and facilitate learning.

While the implementation of the inverted classroom can be done by an instructor working on their own, the finding of this study was that the amount of work necessary for an individual attempting this endeavor would make it difficult to accomplish. This finding has been observed and reported by many studies (Anderson et al., 2014; Cevikbas & Kaiser, 2020; Lo, 2018; Long et al., 2017; Roe et al., 2018; Rohani et al., 2020). It is recommended that instructors interested in using the inverted classroom work with other instructors to implement the inverted classroom or implement the inverted classroom in smaller manageable components.

The participants in this study saw it as necessary to synergize the strengths of each of the individuals in the group. The formation of roles in the group became one of the most interesting facets of the IBIC phenomenon and contributed to the overall success of the project. This study's findings reiterated the importance of establishing a community of instructors who are willing to convert to the inverted classroom to optimize the success of the development, management, and teaching of the course using the inverted classroom (Sipple & Lightner, 2013). As a team, faculty members can develop the different components of the course content and benefit from the synergy of the collaboration. The IBIC incorporated this philosophy and benefited from the process. Findings highlight that future groups of educators engaged in this kind of teaching methodological change should consider the importance and power of group processes, dividing the tasks of developing the course content into three groups: classroom activities, topic delivery, and assessment. Working as a group is also recommended by

other researchers to make the inverted classroom a method easier to implement (Long et al., 2020; Seyedmonir et al., 2014).

An interesting aspect of this study was that the team members formed a CoP while engaged in the development and teaching of the IBIC. While CoPs are not new to faculty in education, the participants in this study quickly saw the advantage of collective learning and sharing of knowledge to become more efficient and effective together as they worked on the IBIC project. The team approach applied by the participants led to some synergies in the project: in-class assistance to the instructor teaching the class, emotional support and reassurance when it was needed, workload sharing, seamless substitute teaching for each other, facilitation of an IBIC study connection between students and the option for students to get help from other IBIC instructors, and best-practice exposure through team meetings and sitting in on each other's classes, especially the first time the content was being delivered.

The participants of this study talked fondly of each other during the interviews and noted how the team approach had allowed them to form personal bonds with each other that have become long-lasting. The participants had continued to rely on each other for advice and camaraderie outside of the IBIC project. It is evident that the participants' time together during the IBIC project led to not only mutual respect for each other, but life-long friendships forged by the IBIC phenomenon. If it is not possible to work with others in collaboration to develop and implement a course in the inverted classroom, instructors should implement small facets of the inverted classroom and master the process of using those implemented facets of inverted classroom strategies in their

teaching process. Once instructors have been successful with a few aspects of the inverted classroom, then a few more components can be added to the course.

The results of this study suggest that instructors should start slowly to convert their courses to the inverted classroom approach due to the significant learning curve and amount of work associated with the complexity of the inverted classroom. The instructors should make sure the components implemented into the inverted classroom work prior to attempting additional changes to the course. The implementation of a few new elements into the inverted classroom allows for the ability to examine how the content works and then augment to optimize success of the use of the content. Once the instructors gain a little confidence and understanding of what content will work with the inverted classroom, then the implementation of additional content and activities becomes easier.

This study's findings provided advice for instructors with a mutual interest in developing an inverted classroom for course delivery. The instructors should work in a collaborative group to research and design the course, and as a group, commit to the process of materializing the design. The advantages ascribed to a group effort approach to develop and teach the inverted classroom were numerous and potentially decrease the overwhelm encountered by the enormity of the endeavor while improving the end result compared to tackling it by oneself.

If an instructor decided to implement the inverted classroom alone, the instructor should start small and implement parts of the inverted classroom that can be managed easily. As the instructor becomes more familiar with the inverted classroom, the instructor can expand on implementing additional components to their course. Several studies have described the time constraints when implementing the inverted classroom

(Anderson et al., 2014; Cevikbas & Kaiser, 2020; Lo, 2018; Long et al., 2017; Roe et al., 2018; Rohani et al., 2020). The findings of this study align in supporting this implementation direction due to the amount of time need to implement an inverted classroom.

Some of the content or activities may not work as anticipated. Instructors working as a group will need to be able to analyze the use of the content and then make changes that may make the content or activity more suitable for the course. The analysis of the implemented activities should be conducted by the group of instructors where the sharing of ideas and experience can be used to change the parts of the content that did not work well. This collaboration will evolve into best practices for the content that can be shared with other faculty interested in using the inverted classroom.

Instructors should fully understand that, even with the best planning for the implementation of the course content, not everything attempted will work initially. They need to be flexible with the course content and activities. The instructor needs to make observations of the student interaction with the content and adjust so the content or activities can be utilized optimally. In some instances, the content delivery or in-class activity may need to be augmented several times before it is in a suitable format that makes it effective in the inverted classroom and the learners therein.

Importantly, findings indicated shared best practices was a "force multiplier," achieved through the collaboration between the instructors. This development of a CoP was also reported as essential by Seyedmonir et al. (2014) for smaller institutions that lack the resources or necessary support to implement the inverted classroom. Collaboration among instructors provides the support to implement the inverted

classroom and is an important finding in this study. The instructors need to reflect upon and share the facets of the inverted classroom that work, those that proved challenging to implement, and those aspects that did not work. Participants shared their perspectives on collaboration and how it made the IBIC course successful because of the changes that were made in the instructional design based on feedback of what worked for the different facets of the IBIC.

Training is another important aspect that was found necessary to make the inverted classroom successful in the IBIC project. Participants emphasized that the inverted classroom is a dynamic teaching method that is a learned skill to facilitate correctly. The participants indicated training should incorporate workshops to discuss how the inverted classroom would be best used. Interested instructors could also spend time in an already integrated inverted classroom course. In this way, the instructors participate in on-the-job training and receive an appreciation of the process of how the inverted classroom is used effectively. Analysis of the instructors' experiences highlights the sentiment that it would be a disservice to any instructor to be given the materials with no real guidance on how to deliver the content or engage the students in an activity.

Findings also stress that instructors interested in using the inverted classroom have a mentor to be able to seek advice when implementing the inverted classroom. Mentoring is a great alternative to a group approach to design and implementation, especially if there are not many faculty members who would be interested in using the inverted classroom, or if professional development and training programs are not formally supported.

Implications for Policy

The participants in this study talked about obstacles that impeded the progress of the IBIC project. The voices of the participants offer insights to drive improvements that could be used to change the systems at institutions of higher learning and help to support the innovation that is required to implement change and a project the size of the IBIC.

One of the significant factors undermining the progress of the IBIC project was the lack of support from the administrators. The participants recalled three situations which did not receive the attention needed: timely release of funds to purchase equipment and hire support staff, time off from regular teaching duties to work and create the necessary content for the IBIC, and professional development to cultivate more inverted classroom faculty.

 A need exists to support faculty with release time and funds to compensate for their efforts in implementing the inverted classroom. To that point, project fund release to support the development of the inverted classroom needs to be efficient and timely. While administrators may need to vet each of the purchases, timeliness for needed resources is paramount for successful design and implementation. The delay in the release of the grant monies was a factor that impeded the advancement of the project, leading to increased stress on the instructors involved in the course development when expected supplies and equipment, as well as personnel, were delayed or never arrived.

The participants spoke about the large amount of time that was needed to create the inverted classroom. Another point needing to be addressed is the support of time to create the content. There have been several publications (Anderson et al., 2014; Cevikbas & Kaiser, 2020; Lo, 2018; Long et al., 2017; Roe et al., 2018; Rohani et al., 2020) that

have referred to this constraint, and this study's findings reiterate that this problem was a central disappointment lived by the participants. As is the case for most higher education instructors who are involved in instructional change and innovative approaches to teaching, the participants in the current study were also responsible for teaching other courses during the period for which they were responsible for developing the IBIC. There is a need to have relief from the normal teaching responsibility to be able to spend the necessary time to create the content and instructional methodologies for the inverted classroom.

Fink (2013) explained the competing priorities and time issue by stating that faculty are not credited for innovating their courses, but instead only receive advancement for either publishing papers or teaching courses. Most institutions have policies that provide major impediments to faculty who want to improve or change their courses to be more learner-centered like the inverted classroom (Fink, 2013). Instructors who want to implement an inverted classroom need to communicate with the institution's leadership so plans can be made to allow for relief time for the development of the inverted classroom. Faculty at colleges and universities are evaluated for tenure according to their teaching, their service to the institution, and the scholarship they provide to their discipline (Clement, 2010). Policies need to be established at institutions of higher learning that will allow faculty to receive credit for improving their courses; otherwise, there will be fewer faculty who would be willing to put in the additional work. Faculty who are vying to be considered for tenure are less likely to attempt the inverted classroom because of the amount of time and commitment necessary to successfully implement the inverted classroom. The support of faculty who are willing to take a risk

on improving their course and instruction is imperative so that the changes can be made in a timely and effective manner (Sauer, 2016).

Another lesson learned from this study is that communication and designation of leadership needs to be established when working on a team project that is grant supported. The team members should be informed of the grant objectives and the direction of the project to avoid confusion and dysfunction of the team. The team members should be kept informed of any changes to the direction of the project initiatives so that delays of meeting the grant objectives are minimized.

Limitations/Delimitations of This Study

This study was not intended to be representative of all institutions of higher education. While there are many good outcomes derived from this study that may be used to inform other individuals and groups of instructors who may be interested in developing an inverted classroom for their courses, the results of this study are based on a small sample size of participants who hail from a community college setting.

Individuals who are interested in using the inverted classroom may use the findings of this study to help guide them in understanding the potential obstacles they may face and the interventions that may be taken to overcome those obstacles. The successes that the participants reported through their interviews may not be applicable for all learning situations, environments, or student populations. Prospective instructors interested in the inverted classroom will likely need to be flexible in their approach to implementing different facets of the course delivery and adjust their teaching based on the experiences with students in their unique classrooms.

Future Research Recommendations

The digital environment we live in today and the ease of procuring devices to interact with the internet has greatly changed the way students acquire and learn new information (Schindler et al., 2017). Online courses have become popular in the last decade as younger students have become so accustomed to many different online platforms as a means to obtain information or entertainment. As I was investigating the research questions for this study, I began to appreciate the potential of the inverted classroom for teaching courses online, firstly, as a way to engage students, who are apt in using social media and different types of web resources, in learning and, secondly, to disseminate learning content. The mass migration to online learning due to the COVID19 pandemic has really increased the use of web meeting platforms to instruct courses. These platforms and the potential use of blogs, wikis, and gaming are excellent tools that could be used with the inverted classroom to teach courses (Schindler et al., 2017).

The COVID19 pandemic forced educators to reconfigure their course to an online mode. Because the inverted classroom facilitates student engagement and the use of technology (Talbert, 2017), it would seem the teaching model would be well suited for an online course. When the effects of the COVID19 pandemic subsides, many of the innovations employed during the pandemic could continue to be utilized for online and hybrid courses. Research needs to be focused on how the inverted classroom could be used effectively with online and hybrid courses.

Researchers interested in promoting success for future students whose use of online resources is second nature need to address how we might engage students using a modified inverted platform for distance learning or remote teaching. The focus for future

studies should be centered on student engagement which will drive the student's motivation to learn and perform well in courses (Rios et al., 2018).

This study found that professional development and mentoring were identified as valuable assets for the successful design, implementation, and instruction of courses using the inverted classroom. Future research should be focused on how training could be effectively used to inform instructors' knowledge about the inverted classroom. Additionally, the most effective way to use mentoring as a tool to help instructors acclimate to and master the inverted classroom should be studied.

Another interesting aspect of student learning that needs to be investigated is the use of social media in combination with the inverted classroom. Students are often constantly tuned in to their social media accounts. Seventy-eight percent of faculty in higher education use at least one social media site to support their professional careers (Moran et al., 2011). Future research should investigate the potential synergy that could be used to help students learn course content by using social media platforms.

One of the most important issues that needs further attention is the training and guidance of faculty wanting to use the inverted classroom. The amount of time and technical expertise needed to navigate the use of the inverted classroom can be daunting, as the study participants conveyed. The professional development should be conducted by trainers who have had experience implementing and using the inverted classroom so that they are able to apply their own experiences to the training sessions and to answer questions posed by the faculty.

Mentoring was also identified as an important component of understanding how to implement and use the inverted classroom by faculty who are new to the platform. The

best mentors would be those individuals who are experienced, preferably in the same discipline, with using the inverted classroom. To have an experienced individual to talk through challenges and new ideas is an invaluable resource that should be utilized by faculty new to the inverted classroom so they do not feel isolated and are then more likely to continue to use and revise the course they teach using the inverted classroom.

Final Thoughts

Many of the challenges experienced by the participants of this study were reported by Yildirim (2017). The implementation and teaching of the IBIC were not without issue, and the difficulty of teaching class when the interactive modules were completed only hours before the in-classroom meetings for the course, or sometimes not available until after the class met in person, made for a challenging session. Even with the timing problem of the release of the modules, the instructors were so supportive of each other, they overcame the obstacles by improvising other ways to provide course content, resulting in very few complaints from the students, while not blaming the module creators.

The participants identified the lack of a clear leader at the beginning of the IBIC project as a detriment. Part of the messiness of the project was due to it being grant funded and two individuals each claimed the team leader role which led to the early team dysfunction. Because different individuals were vying for the lead and the direction of the project, the rest of the team members were confused about what needed to be tasked and accomplished. Once the leadership role was established, the team functioned without that added stress to successfully complete the IBIC project. Much of the problems at the

beginning of the IBIC project could have been resolved with effective communication, including the designation of the leader.

The instructors decided to instruct the IBIC so that all instructors each week were presenting the same course content and using the same materials for every class being taught using the IBIC. This lockstep approach was initially used to ensure the course content was being delivered in the manner it was designed. This approach led to another problem for the instructors as they soon began to appreciate that the lockstep delivery was not working as effectively as they anticipated. By communicating with each other throughout the process, the instructors were able to improve the delivery of the course content from one class to the next as the day progressed. During the first IBIC, observations about what worked were shared with the other instructors so they could adjust and not have the same issues. The sharing of best practices and of problems that arose in the IBIC allowed for the instructors to quickly learn what worked best in the delivery of the course content.

The other issue that was notable due to the lockstep delivery was it interfered with the individual's teaching style and personality. This uniformity made at least one instructor feel awkward in the classroom and led to additional stress placed on the instructor. This predicament was discussed, and the instructors backed off their initial decision to teach in lockstep so that instructors could play to their strengths when delivering the course content. This change appeared to work well for the instructors as they continued to share their experiences, now with the leeway to deliver the content in their course in a manner they decided. The decision also allowed the instructors to

continue to experiment and connect personally with the inverted classroom and the IBIC content.

One of the primary responses from the participants was the need for professional development and training in the use of the inverted classroom. It is the belief of the participants that using the inverted classroom is more than simply accepting that the instructor is no longer the center of the course; it is a change in "mindset" to being a facilitator in the understanding of the course content instead of just a purveyor (or conveyor) of information. The participants found that implementing the inverted classroom was a complex process. An instructor needs to do more than just accept the idea; an instructor needs to practice the delivery of the content, so they become a facilitator of learning content and not just the distributor of the course content.

In addition to the paradigm role shift, the participants believed it was important for anyone who wanted to use the inverted classroom to be exposed to its application by training and mentoring. There are many aspects of the inverted classroom that are not intuitive and must be learned by an instructor who wants to use the method in their teaching practice. The participants were able to navigate the implementation of the IBIC because they supported each other throughout the process, but they experienced the steep learning curve that is associated with the effective implementation of the student-centered learning method. Because of their experience, the participants advocated for specific training to be conducted for all instructors wanting to attempt to use the inverted classroom. The faculty wishing to implement the inverted classroom should consider the time constraints necessary to design an effective course. In addition, it is noteworthy that members of the project developed skills using technology that are useful for their other

courses, but the most important aspect of the project was that they learned more about themselves which has helped them grow personally and professionally.

There has been another shift in education brought upon by the policies of Betsy DeVos during her appointment as U.S. Secretary of Education and by the COVID19 pandemic. These two factors have widened the educational gap of the students in the United States. The new learning environment leans heavily on remote learning and access to the internet. Affluent families have pooled their resources and built learning pods where their children will be able to be challenged and learn. These children will be students at our universities in the future. The children whose families did not have the monetary or educational resources have been left with less effective ways of learning, as many of them do not have access to the internet. These students have been left behind to fend for themselves.

The COVID19 pandemic has certainly caused educators to reconsider the approach they have used to teach their courses. Technology and online applications have been embraced to deliver courses to students during the pandemic. While this has been true for all institutions of higher learning, the community colleges will be tasked with helping these students obtain the necessary tools and education necessary for them to be successful adult learners and part of a productive work force.

A growing body of evidence exists for use of the inverted classroom as an effective method to help close the educational gap. The application of the inverted classroom needs to be fully investigated as a platform to deliver course content, engage students, and facilitate a sense of community in the classroom. When the pandemic does subside, courses will return to the classroom, but many of the tools and applications

adopted while teaching online will continue to be utilized by instructors. It is from this perspective that the inverted classroom may offer effective alternative paths for teaching courses.

There has been a lot of interest in the inverted classroom because of the active learning components associated with the method (Stohr & Adawi, 2018). And while there are many ways to use the inverted classroom, and studies report positive outcomes (Yildirim, 2017), Bagley (2020) reported that some students felt isolated from their professors who participated in a course where the inverted classroom was conducted online with videos and limited access to the professor. This concern also needs to be worked on to be sure educators are sharing practices that work online so the course can be taught effectively.

For the participants of this study, the phenomenon of the IBIC had a lasting impression on expanding their teaching practices. The participants became more engaging in their approach to teaching. They became advocates for the students. But it was the time they worked together on the IBIC project that was really the transformational element for their understanding of themselves as an instructor and of the learning processes of adults. The friendships and the long-lasting bonds that the IBIC project fostered are today what the participants of this study cherish the most.

APPENDIX SECTION

APPENDIX A: Interview Questions

This study is investigating the experiences of designing, implementing, and teaching in the inverted classroom. The goal is to describe the essence of those experiences across the participants in the study in order to inform faculty professional development and instructional practice

What did you understand about the inverted classroom prior to your joining the Biology

Innovation Lab team?

Why did you decide to join the BIL team?

Tell me about your experiences with the BIL development process and the tasks you were

assigned.

Please provide your thoughts regarding how much time you spent developing BIL

materials in your first semester as part of the BIL team? How might this have affected

your other work responsibilities?

Tell me about the most rewarding experience about being part of the BIL process.

Explain what was the most frustrating part about being part of the BIL process.

Please explain what you learned about yourself and your teaching philosophies during the

development of the BIL and the process of working as part of the BIL team.

Tell me how your teaching practice may have changed because of your association with the BIL process.

Describe the advantages you perceive of engaging in inverted classroom instruction.

Describe the disadvantages you perceive of engaging the inverted classroom instruction?

Please tell me how you use the in-class time with your students. Please explain why you structure your instruction in this way?

Please explain your thoughts about learning effectiveness in your experiences teaching in the inverted classroom model.

How would you describe the power dynamics with the members of the BIL team during the design of the BIL inverted classroom?

In what ways do you feel the power dynamics may have affected the overall process and final product of the BIL inverted classroom?

Tell me about what important event or events during the process of developing the BIL can you suggest affected the completion of the course development.

Describe the support you received that helped your teaching practice/instructional development in the inverted classroom.

Please explain what support may have been missing or needed additional focus.

Tell me about facets of developing the BIL inverted classroom that may have impeded its progress.

Given that I am interested in researching the phenomenon of instructors who have transitioned their teaching practices to an inverted classroom model, are there any important facets of the process, your development, or teaching practice using the inverted classroom that we have not covered that you would like to discuss?

Knowing what you know now, was the effort to design, implement, and teach with the inverted classroom approach worth the work you put into its development?

Please explain any suggestions you would make to allow the BIL teaching method to be more effective.

What advice or insight would you have for others thinking about making this change?

Tell me what would you change about the BIL to make it better?

APPENDIX B: Inverted Classroom Critical Incident Protocol

The participants will be asked to come to the focus group ready to discuss critical incidents in their teaching practice that have occurred during their tenure of developing, implementing and/or teaching the introductory biology course in the inverted platform.

The participants will be asked to discuss these questions as part of the focus group:

1. Tell us about a significant experience or experiences in your growth in teaching while being part of the team that developed, implemented, and taught the introductory biology course in our inverted classroom platform?

2. Explain why the experience was important to you?

3. How would you describe your teaching practice now as it relates to this particular incident?

4. Tell us about the feelings you have when you think about the incident that you have described as being influential to your growth as an instructor.

5. If you could change any part of the experience you have described, how would you change it?

APPENDIX C: Emergent Codes, Categories, and Themes

Codes

We had a lot of
emotional support
from each other

Sharing best
practices/learning
from each other

Everybody
pitching in

Bounce ideas off
each other

_____

Bonds were
created, like a
community

One big
team/disagreed but
could still be
friends

Became like a little
family

Look forward to
department
meetings

Camaraderie
between members
made tough times
better

Categories

Faculty
Supporting Each
Other

Bonding and Long
Lasting Professional
Relationships

Theme

Benefits of Team
Approach

Codes

10 to 18 extra hours
a week

Husband gave me a
hard time about the
work

Focused on the
project/saturated my
entire life

Sleep
deprived/burnout

Lot of pressure

Chosen software
huge impediment

Needed more
technical people

Tried to be too
cutting edge

Lack of leadership
from grant
consortium, college
administrators

Nightmarish
situation/total chaos

No LEH

Missed deadlines
because we didn't
know about them

Administrator never
met with us

Categories

A Lot of Work
for Everyone and
a Whole Lot of
Stress for Some

The Selected
Software and Lack
of Technical
Assistance to
Build Course
Content

Support from
Grant Leaders and
College
Administrators
was Lacking

Theme

Challenges of the
Inverted
Classroom

Codes

Brilliant choice/
simple but not stupid

90% success rate

Improved the faculty

Easier way to teach

Absolutely effective

Necessary for a large
segment of students

Training, mentoring,
observing

Workshops

More than just passing
along material

Instructor must be
comfortable with non-
structured engagement

Dogma left at door

Loves teaching and
helping students

Not for everyone

Categories

Inverted
Classroom Works

Professional
Development is
Needed

Not for Every
Faculty Member
to Implement

Theme

Educator's
Perceptions of
Adult Learning
and Teaching

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