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Innovative instruction: learning in blended human anatomy education

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INNOVATIVE INSTRUCTION: LEARNING IN BLENDED HUMAN ANATOMY EDUCATION

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Doctor of Education in Learning Technologies

by

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DEDICATION

To my husband Dru, I am forever grateful for your unwavering support, patience, and love. What is done in love is done well. To my daughter Reagan Nova, you are my greatest gift. Learn from everything you can.

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Finally, to my husband Dru and daughter Reagan, you both have shown me that no matter what, love really does conquer all.

VITA

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ABSTRACT

Despite the robust literature surrounding the benefits of blended learning including improved student learning and positive student perceptions of learning (Bishop & Verleger, 2013; O'Flaherty & Phillips, 2015), simply rearranging the structure of activities or incorporating technology does not ensure a more meaningful learning experience (Duffy & McDonald, 2008; Gopal et al., 2010; Lim & Morris, 2009; Mitchell & Honore, 2007; Okojie, Olinzock, & Boulder, 2006). There exists a danger of educators attempting the transition to blended learning without thoroughly understanding how it works (Ash, 2012). Considering the definition of blended learning as "the organic integration of thoughtfully selected and complementary F2F and online approaches and technologies" (Garrison & Vaughan, 2008, p. 148), achieving meaningful learning in the blended classroom requires intentional design, mindful collaboration, and complete integration between the F2F experience and asynchronous online technology. Therefore, this study aimed to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course. By conducting formal research that is focused on understanding the experiences of anatomy faculty in their blended learning course through the theoretical framework of community of inquiry, collaborative learning, and discovery learning, this study informs current and future undergraduate anatomy education by providing insight into how learning happens within this space.

Chapter 1: Introduction

> Neither the purpose, the methods, nor the population for whom education is intended today, bear any resemblance to those on which formal education is historically based.
>
> (Pond, 2002, para. 2)

Human Anatomy Education: Then and Now

Historically, general anatomy is known for its instructionist pedagogy (Brown & Manogue, 2001; Collins, Given, Hulsebosch, & Miller, 1994; Friesen & Roth, 2014; Klestinec, 2004; Sharpey, 1840) and standard lecture format, a historical tradition that dates back to the anatomy theater of the 16th century (Klestinec, 2004). Although campuses today continue to examine and evaluate policies that encourage technological innovation and novel pedagogy to improve the student experience (Garrison & Kanuka, 2004; Jacob & Hellstrom, 2014), evidence that human anatomy as a discipline continues its long-standing didactic traditions includes: the use of the PowerPoint lecture as the dominant method of instruction, student reported reliance on memorization to study anatomy, and the use of assessments like the multiple choice exam or identification practicum to test for knowledge acquisition and remembering (Baxter, Elder, & Glaser, 1996; Collins, 2009; Farey et al., 2018; Mayer, 2001; Mayer, 2009; Notebaert, 2009; Phye, 1997; Smith & Mathias, 2011). Although the last two decades have been marked by significant curricular reform across many higher education departments, the discipline of anatomy has been nearly lost in the shuffle (Joslin, 2008).

Although student-centered engagement appears to be preferred over top-down and teacher-centered instruction (Ernst & Colthorpe, 2007; Griff, 2016; Knight & Wood, 2005; O'Connor & Ferreri, 2013), it is widely speculated that the traditional lecture has endured due to constraints such as large student enrollment and lack of resources (Deem, Mock, & Lucas, 2008; Jacob & Hellstrom, 2014; Lochner, Wieser, Waldboth, & Mischo-Kelling, 2016; Rhoades & Sporn, 2002). With the advent of 21st century technologies in education, these constraints along with other barriers like time, distance, space, and diversity of students in the classroom are less of an obstacle (Jacob & Hellstrom, 2014). Further, the pervasive use of the Internet in the 21st century has opened up a wide range of easily accessible technology in the form of applications, online videos, forums, and social media to assist educators in managing both their inside and outside of class activities and time (Graham, 2005; Garrison & Kanuka, 2004; Porter, Graham, Spring, & Welch, 2014; Walsh, 2014). In light of emerging technology, the blended learning approach is quickly gaining momentum across higher education (Devers & Panke, 2017).

Exploring Blended Learning

Blended learning fuses the two opposite ends of the relevant classroom formats by offering the accessibility and affordability of virtual learning with the contact hours and reflective experiences of face-to-face (F2F) interaction (Slomanson, 2014). Literature suggests that this innovative approach is better suited to meet the highly active student learning objectives of the typical general undergraduate science course (Boevé et al., 2017; Darda, 2010; Smith, Martinez-Álvarez, & McHanwell, 2014). Blended learning creates opportunities to build a community of inquiry and facilitate

cooperative and discovery learning experiences, and in doing so, is better prepared to achieve the profoundly active learning objectives of undergraduate anatomy education (Garrison & Kanuka, 2004; Malandra, 2008; Middlehurst, 2006; Rhode, Richter, Gowen, Miller, & Wills, 2017; Spanbauer, 2010).

Some blended learning strategies promote student-centered learning by rearranging the traditional classroom environment and incorporating technology to facilitate learning (Bazelais & Doleck, 2018; Owston, York, & Murtha, 2013; Porter & Graham, 2016; Porter et al., 2014). For example, the flipped approach is a type of blended learning strategy that *flips* the activities that normally take place in the classroom (lecture) with the activities that normally take place outside of the classroom (reflection and problem-solving) so that F2F time can be used to communicate, collaborate, problem-solve, and reflect across peers and instructor (O'Flaherty & Phillips, 2015; Pierce & Fox, 2012). Beyond reordering the structure and time of the course to increase active learning in the F2F, it is proposed that the flipped model also reduces cognitive load by allowing students to better manage their working memory due to the self-paced nature of addressing the lecture content asynchronously (Abeysekera & Dawson, 2015).

The 21st century anatomy laboratory has recently began to utilize innovative blended learning strategies to prepare students prior to attending the lab (Fleagle, Borcherding, Harris, & Hoffmann, 2018; Mehta, Hull, Young, & Stoller, 2013). With this practice, F2F time can be used to rotate small groups of students to stations throughout the room to work together to solve a problem, discuss a case study, or complete some

other collaborative task that encourages students to work together and discover answers for themselves and among peers (Hake, 2002; Staker & Horn, 2012).

Blended learning rearranges the classroom environment to create opportunities for students to communicate openly and collaborate together in a low-risk space (*social presence*), allows students to exchange information and connect and apply ideas (*cognitive presence*), and allows the instructor to facilitate discourse and shape the constructive exchange happening between students (*teacher presence;* Vaughan, Garrison, & Clevland-Innes, 2014). When cognitive presence, social presence, and teaching presence are integrated, the classroom is considered a community of inquiry (Garrison & Kanuka, 2004; Garrison, Anderson, & Archer, 2001; Lipman, 2003). Vaughan et al. (2014) argue that the blended learning approach creates opportunities for this integration to take place. The benefits of integration are two-fold: instructors improve the effectiveness of their teaching and students increase their learning (Gopal et al., 2010).

It is especially critical for educators who use blended learning to link asynchronous online lectures to F2F activities, and to shift their role from a deliverer of knowledge to one of a facilitator and guide of active learning (O'Flaherty & Phillips, 2015). The critical discourse and reflective thinking born out of the cognitive and social level of belonging and sense of community (Garrison & Cleveland-Innes, 2003) combined with the management of the environment and facilitation from learning experiences by strong teaching presence (Garrison & Kanuka, 2004) produces interactive dialogue and facilitation of critical thinking (Lipman, 2003; Vaughan et al., 2014).

Using the blended approach, students must access the knowledge-base learned from the presentation of material outside of the classroom to engage in the hands on F2F meeting where the discovery part of their learning typically takes place (Fleagle et al., 2018; Heylings, 2002). Discovery learning is an inquiry-based approach to learning where the student utilizes their existing knowledge to interact with content, explore questions, discuss ideas, perform experiments, and discover relationships and facts for themselves (Bruner, 1961). The interaction and discovery that students may experience in the laboratory are the experiences that solidify deeper learning, as students are more likely to understand concepts and develop knowledge if they discover it on their own (Bruner, 2009). Opportunities for discovery learning in anatomy include *problem-based learning* (Barrows, 1996; Hung, Jonassen, & Liu, 2008; Memon, 2009; Tucker, 2012), *simulation-based learning* (Ferrer-Torregrosa et al., 2015; Koot, 2017; Samur & Evans, 2011), *case-based learning* (Davis et al., 2007; Goodenough, 1994), and *incidental learning* (Arcade, 2008; Schank & Cleary, 1996).

Concerns and Barriers

There exists a danger of educators attempting the transition to blended learning without thoroughly understanding how it works (Ash, 2012). One major conception of blended learning that emerged from literature is the ambiguity across definitions (Bishop & Verleger, 2013; Demetry, 2010; Foertsch, Moses, Strikwerda, & Litzkow, 2002; Lage, Platt, & Treglia, 2000; Toto & Nguyen, 2009; Warter-Perez & Dong, 2012; Zappe, Lieicht, Messner, Litzinger, & Woo Lee, 2009). Lage et al. (2000) for example generally define the flipped blended learning approach simply as “events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa”

(p. 32). Rather than conceiving a single definition of what blended learning is and is not, some literature suggests to instead list essential components of what a successfully blended course would encompass: in short, these components included learning that facilitates engagement, transfer of knowledge, problem-solving, and opportunities for collaborative critical thinking (Bazelais, 2018; Bishop & Verleger, 2013; Boevé et al., 2017; Garrison & Kanuka, 2004; Mehta et al., 2013). These essential components of a successfully blended course align with the following approaches to discovery learning, that take place within a community of inquiry:

- Problem-based learning: this approach to learning holds that students learn best when knowledge is centered around a problem in context that is relevant to the field of practice (Tawfik, Trueman, Lorz, & Tawfik, 2013). Problem-based learning experiences allow students to engage in investigating ill-structured problems that have multiple solutions, and in doing so, learn both the concepts and the problem-solving skills relevant to their community of practice (Hmelo-Silver, 2013).
- Simulation-based learning: this approach to learning is similar to the idea of role-playing where students are presented with an artificial environment that facilitates the development of skills or application of an abstract concept (Samur & Evans, 2011).
- Case-based learning: this approach to learning allows students to analyze a real-world scenario and provides a rich basis for fostering students' decision making and problem-solving skills (Goodenough, 1994).

- Incidental learning: incidental learning activities are when learning happens in passing (Schank & Cleary, 1996). This works well with rote memorization or dense topics perceived by students to be uninteresting because they typically take the form of a game (Bicknell-Holmes & Hoffman, 2000; Castronova, 2000).

In these inquiry-based approaches to learning, the students utilize their existing knowledge to interact with content, explore questions, discuss ideas, perform experiments, and *discover* relationships and facts for themselves (Bruner, 1961).

Beyond Technology and Inversion

For effective teaching to occur, the technology must be an integral part of the blended learning experience and not stand alone in instruction (Duffy & McDonald, 2008; Okojie et al., 2006). Using Garrison and Vaughan's (2008) definition of blended learning as "the organic integration of thoughtfully selected and complementary F2F and online approaches and technologies" (p. 148) and considering Garrison et al.'s (2000) theoretical framework of community of inquiry, Vaughan et al. (2014) define seven principles that align with the actuality of 21st century communication technologies and the expectations and intentions of the contemporary higher education student (Hadjerrouit, 2008). The principles presented by Vaughan et al. (2014) move beyond traditional practices and serve as a framework for creating and sustaining communities of inquiry – these principles provide a purposeful map for the blended learning approach:

- Plan for the creating of open communication and trust.
- Plan for critical reflection and discourse.

- Establish community and cohesion.
- Establish inquiry dynamics (purposeful inquiry).
- Sustain respect and responsibility.
- Sustain inquiry that moves to resolution.
- Ensure assessment is congruent with intended processes and outcomes. (p. 17)

> Principles of practice intended to develop teaching presence in blended learning communities must account for new, emerging possibilities and roles. […] The seven principles emerge out of the requirements of a collaborative community of inquiry, where learning is situated in purposeful inquiry and where students collaboratively assumed shared responsibility and control to design, facilitate, and direct inquiry. (Vaughan et al., 2014, p. 4)

The impact of blended learning has been mostly positive in research citing the improved learning and engagement that takes place when constructivist learning practices are used in health-related courses (Foon & Kwan, 2018; McLean & Attardi, 2018). Despite the positive attention surrounding constructivist approaches (Dirks-Naylor, 2016; Hmelo-Silver, 2013; Sutinen, 2008), creating these engaging learning experiences in content heavy courses with clinical underpinnings like human anatomy requires students to first have a foundational knowledge to draw from (Gogalniceanu et al., 2010). Some argue that inquiry based and collaborative learning approaches such as problem-based learning can only encourage reflection and discovery if students already have a baseline of information behind the target problem, and so these activities rely on a foundational knowledge to be conveyed in the material presented outside of the classroom to function successfully (Gogalniceanu et al., 2010; Lochner et al., 2016).

This dependent relationship and complete integration between the synchronous F2F activities and asynchronous presentation of content is necessary to produce meaningful learning within the blended approach (Duffy & McDonald, 2008; Okojie et al., 2006). A robust amount of literature exists focusing on the types of resources utilized for pre-class preparation and asynchronous presentation of material including pre-recorded lecture (Allen, 2013; Ash, 2012; Barkley, 2010; Coates, 2006; Davies, Dean, & Ball, 2013; Forsey, Low, & Glance, 2013; Gannod, Burge, & Helmick, 2008), videos from an online repository like the Khan Academy (Albert & Beatty, 2014; Anderson, Krathwohl, & Airasian, 2001), readings, study guides, and automated tutoring systems (Anderson et al., 2001; Anderson, Allen, Peckham, & Goodwin, 2008; Gilboy, Heinerichs, & Pazzaglia, 2015; O'Flaherty & Phillips, 2015). Likewise, there exists a large body of literature describing the activities used in the blended F2F classroom including problem solving by team-based collaborative discussions, expert led discourse, information sharing, debates, case-based inquiry, think-pair-share activities, and asking questions with the opportunity to provide immediate feedback (Anderson et al., 2008; Arksey & O'Malley, 2005; Coates, 2006; Critz & Wright, 2013; Davies et al., 2013; O'Flaherty & Phillips, 2015). Although literature thoroughly describes the options for blended learning activities inside and outside of the classroom, there exists a danger of educators attempting the transition to blended learning without thoroughly understanding how it works (Ash, 2012).

The quality of the collaboration happening in the F2F class is of critical importance to achieving a true community of inquiry in the blended classroom (Garrison & Kanuka, 2004; Lipman, 2003; Vaughan et al., 2014). "Cooperative learning represents

the most carefully structured end of the collaborative learning continuum” (Smith & MacGregor, 1992, p. 15) and aligns with the active learning goals of the blended approach (Boevé et al., 2017; McDaniel, Lister, Hanna, & Roy, 2008; Mehta et al., 2013; O’Flaherty & Phillips, 2015). Bishop and Verleger (2013) summarized the three fundamental parts of cooperative learning as described by Foot and Howe (1998):

- Students work in teams toward the attainment of some superordinate goal.
- Labor is divided between team members, such that each individual takes responsibility for a different sub-goal.
- Individual contributions are pooled into a composite product to ensure that the goal is reached. (p. 8)

Although there is not a complete consensus on the exact elements that constitute cooperative learning, critical components include "positive interdependence, F2F interaction, individual accountability, small group and interpersonal skills, and group self-evaluation" (Doolittle, 1995, p. 13). These components distinguish cooperative learning from traditional learning (Bishop & Verleger, 2013; Doolittle, 1995) can act as guidelines for best practices within blended learning courses (Boevé et al., 2017; McDaniel et al., 2008; Mehta et al., 2013; O’Flaherty & Phillips, 2015). These distinguishing features provide a guide for constructive and collaborative discovery learning in the transition to establishing a community of inquiry in blended learning courses (Boevé et al., 2017; Doolittle, 1995; Rottier & Ogan, 1991; Sharan, 1990; Sutinen, 2008; Vaughan et al., 2014).

The emphasis must shift from assimilating information to constructing meaning and confirming understanding in a community of inquiry. This process is about

> discourse that challenges accepted beliefs, which is rarely accomplished by students in isolation. At the same time, to be a critical thinker is to take control of one's thought processes and gain a metacognitive understanding of these processes. (Garrison & Kanuka, 2004, p. 98)

The community of inquiry frames the practical implications for the blended learning approach by integrating *social presence* (communication, collaboration, and cohesion across the group members) *cognitive presence* (application of concepts, inquiry, and exploration of ideas), and *teaching presence* (intentional structuring of activities to facilitate engagement and discourse; Garrison & Kanuka, 2004; Garrison et al., 2001; Vaughan et al., 2014), and in doing so, encourages the fusing of "critical and creative cognitive processing known as higher-order thinking" (Lipman, 2003, p. 204). For example, in a community of inquiry within an anatomy course, indicators of *social presence* may include students communicating online and/or during F2F to collaborate and learn anatomy together in a low risk environment; indicators of *cognitive presence* may include inquiry rooted discourse such as connecting lecture concepts to laboratory experiences and applying knowledge to solve problems and case studies; and lastly, *teaching presence* in the classroom may present as the instructor developing a blended learning curriculum that introduces and organizes content to facilitate discourse and resolve questions (Vaughan et al., 2014). Ultimately, the integration of the three elements of community of inquiry within a blended course creates a space where:

> Students listen to another with respect, build on one another's ideas, challenge one another to supply reasons for otherwise unsupported opinions, assist each

other in drawing inferences from what has been said, and seek to identify one another's assumptions. (Lipman, 2003, p. 20)

Need for Research

There exists a danger of educators attempting the transition to blended learning without thoroughly understanding how it works (Ash, 2012). Considering the definition of blended learning as "the organic integration of thoughtfully selected and complementary F2F and online approaches and technologies" (Garrison & Vaughan, 2008, p. 148), achieving meaningful learning in the blended classroom requires intentional design, mindful collaboration, and complete integration between the F2F experience and asynchronous online technology.

Therefore, the purpose of this study is to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course. By conducting formal research that is focused on understanding the experiences of anatomy faculty in their blended learning course through the theoretical framework of community of inquiry, collaborative learning, and discovery learning, this study will provide insight into how learning happens within that space.

Research questions. This study aims to explore blended learning instruction through the lived experiences of anatomy instructors to further understand their dilemmas and successes to inform current and future undergraduate anatomy education.

RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?

a) What methods are employed by anatomy educators to create meaningful learning experiences in this space?
b) What types of problem-based learning instruction techniques do anatomy educators use?
c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

RQ2: What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

Significance of the study. By exploring the lived experiences of anatomy faculty that utilize blended learning strategies in their undergraduate human anatomy course, this study will address how meaningful learning takes place within the context of learning theory. This study is informed by three bodies of learning theory research including community of inquiry, cooperative learning, and discovery learning, which together provide a theoretical framework for how learning happens in this space.

***Significance for diversity in STEM*.** Investing in the quality of undergraduate anatomy education has widespread implications for the large and hugely diverse population of students that take part in the course every semester (AAHC, 2008; Brown, White, & Power, 2016; 2017; Sturges & Maurer, 2013). Although diversity in the sciences is slowly improving (Lim et al., 2013), leaders within the higher education institution must make concerted efforts to support students who have been historically marginalized and are at-risk for dropping, withdrawing, or failing human anatomy. This outcome has major implications for diversity in the sciences due to anatomy's status as

a critical prerequisite course to allied health programs across the United States. Faculty who utilize the blended approach can support inclusion by helping their students not only pass the course and continue towards their allied health career goals, but also build the skills that they need to grow into competent, confident, and independent learners (Weaver, Burgess, Childress, & Slakey, 2016).

The incorporation of blended student-centered teaching practices transforms the instructor's role to one that is about much more than merely teaching content (Garrison & Kanuka, 2004; O'Flaherty & Phillips, 2015; Weaver et al., 2016). With blended learning, faculty transition to a facilitator and guide and are positioned to help students discover and build their identity as an academic, practitioner, and professional (Bishop & Verleger, 2013; Mattheis & Jensen, 2014). By encouraging students to take charge of their own learning, blended strategies increase accessibility to afford both the resources and time for students to self-pace the lecture experience outside of class to reduce cognitive load as well as affords time for faculty to encourage engagement and collaboration to empower their students with the skills that they need to be successful both in and beyond their course (Ash, 2012; López-Pérez, Pérez-López, & Rodríguez-Ariza, 2011; Owston et al., 2013; Pereira et al., 2007). By providing students with the accessible resources and a learning experience that fosters identity building in the sciences, the blended approach has the opportunity to retain at-risk student populations and encourage students to

***Significance for nursing and allied health education*.** The need to arm pre-professional students with a complete and workable knowledge of anatomy is critical (Mitchell, 2003). As a foundational course requirement of nursing and various allied

health career paths (Brown et al., 2016; Brown et al., 2017; Sturges & Maurer, 2013), it is important for leaders to recognize the great responsibility that comes with this opportunity to introduce so many students to a subject that will be relevant in their personal, academic, and professional lives (Breckler & Joun, 2009). Students must develop a foundational anatomy knowledge that is deep and flexible enough to apply to future upper division courses and practice (Smith & Mathias, 2011). This transfer of knowledge is critical to safe and competent patient care (Collins, 2009; Ellis, 2002; Farey et al., 2018).

***Significance for higher anatomy education*.** This study aims to explore the present-day practices of blended anatomy instruction at the higher education institution and does so in a way that is surprisingly absent from the literature (Porter & Graham, 2016) – by directly asking anatomy faculty what they do, and then analyzing their responses within the context of learning theories that align with the characteristics of the blended approach. Before blended learning can guarantee meaningful learning in the human anatomy classroom, it is critical to understand the experiences of the people at the heart of the phenomenon (Buchanan, Sainter, & Saunders, 2013; Kopcha, 2012; Rose, 2016; Scott, 2013). By asking anatomy faculty about their lived experiences employing blended learning in their anatomy course, this study will be able to fill the gap regarding the best strategies and practices used to facilitate meaningful learning in this space.

Limitations and assumptions of the study. The following are known limitations of this study:

- The sample is limited to higher education anatomy faculty that describe their

anatomy course as utilizing blended strategies, and therefore not representative of the complete anatomy faculty community.

- These limitations have the power to potentially impact the results of the study in regard to scalability (Creswell, 2014) to the complete global anatomy faculty population within higher education.

The following are known assumptions of this study:

- Participants hold faculty status and have taught blended undergraduate general human anatomy for at least one semester.
- Participants describe their instructional strategy as either embracing blended learning or utilizing blended strategies.
- Participants will be honest in their responses and are able to coherently describe their opinions and experiences as requested.

Definition of Terms

The definitions listed below are identified terms used in this research and how they are defined in this study:

- *Active learning*: Learning activities that incorporate higher-order objectives including synthesis and analysis. This process encourages critical evaluation and integration of information and discourages the fragmented understanding students typically receive from traditional lecture and note-taking activities (Dirks-Naylor, 2016).
- *Blended learning*: The utilization of web-based materials to complement F2F classes. The aim is to provide more opportunities for students to comprehend and engage with the content (López-Pérez et al., 2011).

- *Constructivism*: An educational theory centered around the idea that individuals learn as a result of their experiences interacting with, constructing, modifying, and interpreting the information that they encounter in their environment. The learner is thus able to construct their own thoughts and understanding of the experience. Central to constructivism is that knowledge and understanding happen somewhere in between the learner's own actions and the educator's acts of education (Sutinen, 2008).
- *Epistemology***:** From the Greek word “knowledge”, epistemology is the study of justified belief and knowledge (Bounjour, 2004).
- *Innovative pedagogy*: A novel conception of teaching methods, that for this study, assumes the use of the Internet, technology, and active learning techniques (Berndt et al., 2015; Bossaller, 2016).
- *Millennial*: Referring to students born after 1980 and are a part of a generation that utilizes technology and expects learning to be both reactionary and immediate (O’Flaherty & Phillips, 2015)
- *Problem-based learning*: The goals of this type of learning are to help students develop flexible knowledge, become intrinsically motivated, improve their problem-solving and self-directed learning skills, and collaborate with peers (Bishop & Verleger, 2013).
- *Student-centered learning*: Any method of instruction where students are actively engaged in the learning process including blended, collaborative, and problem-based learning methods (Bishop & Verleger, 2013).

- *Teaching presence*: Activity and effort concerning the facilitation, direction, and design of processes in learning communities to achieve personally meaningful deep learning experiences (Vaughan et al., 2014).
- *Traditional instructionist pedagogy*: Professor-centered lecture format for conventional delivery of information by a top-down structure where the economically, geographically, or socially privileged have sole access. In this pedagogy, the mind is considered to be a blank sheet of paper where information is transcribed from the lecture to the paper (Van Dusen, 1997).

Summary

This chapter presented an overview of the unsettling similarities between 16th and 21st century anatomy instruction (Friesen & Roth, 2014; Klestinec, 2004; Persaud, Loukas, & Tubbs, 2014) and described the didactic learning practices that continue to dominate the landscape of higher anatomy education (Collins et al., 1994; Mehta et al., 2013; Trowler, Fanghanel, & Wareham, 2005). Undergraduate general human anatomy courses demand much more engagement than the existing model can provide (Collins, 2009; Ellis, 2002; Leithwood, Louis, Anderson, & Wahlstrom, 2004; Smith & Mathias, 2011), yet literature suggests that it can be found in the blended approach (Bazelais & Doleck, 2018; D. R. Garrison & Cleveland-Innes, 2003; D. R. Garrison & Kanuka, 2004; Gopal et al., 2010; Knight & Wood, 2005; McDaniel et al., 2008; Swan & Shih, 2005; Wirth & Perkins, 2005). Literature points out that specifically within STEM education, blended learning results in students acquiring more skills, conceptualizing and problem-solving, and performing at a higher level (Bazelais & Doleck, 2018; Gopal et al., 2010; López-Pérez et al., 2011).

By conducting formal research that is focused on understanding the experiences of anatomy faculty in their blended learning course, their responses can be considered within a theoretical context to provide insight into how learning happens within that space. This introduction segues into chapter two which provides a theoretical framework in which to place the blended anatomy course and conceptual literature review of these concepts.

Chapter 2: Literature Review

Despite the robust literature surrounding the benefits of blended learning including improved student learning and positive student perceptions of learning (Bishop & Verleger, 2013; O'Flaherty & Phillips, 2015), simply rearranging the structure of activities or incorporating technology does not ensure a more meaningful learning experience (Duffy & McDonald, 2008; Gopal et al., 2010; Lim & Morris, 2009; Mitchell & Honore, 2007; Okojie et al., 2006). This study aims to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course and uses three areas of research to inform this study. First, the body of research into building a community of inquiry provides context for how learning is taking place in the blended classroom (Garrison et al., 2001; Garrison & Kanuka, 2004; Vaughan et al., 2014). Second, because collaboration spans the social presence, cognitive presence, and teaching presence that define a community of inquiry (Vaughan et al., 2014) the body of research into cooperative learning frames the quality of collaboration happening across members within the blended learning space (Boevé et al., 2017; McDaniel et al., 2008; Mehta et al., 2013; O'Flaherty & Phillips, 2015; Smith & MacGregor, 1992). Third, because the components of a successfully blended course facilitate engagement, transfer of knowledge, problem-solving, and opportunities for collaborative critical thinking (Bazelais & Doleck, 2018; Bishop & Verleger, 2013; Boevé et al., 2017; Garrison & Kanuka, 2004; Mehta et al., 2013), the body of knowledge surrounding discovery learning, specifically problem-based learning (Tawfik et al., 2013), simulation-based learning (Samur & Evans, 2011), case-based learning (Goodenough, 1994), and

incidental learning (Schank & Cleary, 1996) informs the inquiry based activities that take place within the blended anatomy course.

Expanding Learning

Although the effectiveness of the traditional lecture in presenting information is recognized (Lochner et al., 2016), it is also highly criticized for the lack of contact time and discourse required for deep learning to take place (Knight & Wood, 2005; Lochner et al., 2016). This method of teaching has become highly scrutinized in literature (Bligh, 2000; Matheson, 2008; Tworek, Ellaway, & Dornan, 2013), especially in undergraduate anatomical sciences where some argue it fails to fulfill the active and constructive learning outcomes of the general human anatomy course (Lochner et al., 2016), and especially those outcomes that involve the application of knowledge (Cuthrell, 2007; Park, 2008; Pereira et al., 2007).

The hands-on cadaver dissection and anatomy museum tutorials that historically have accompanied the dense anatomy lecture in medical school curriculum to balance the heavy lecture load (Sugand, Abrahams, & Khurana, 2010) typically not found in the general undergraduate anatomy course (Griff, 2016). Even at the medical school level, recent reforms worldwide have led to a decrease in opportunities for hands-on application (Gogalniceanu et al., 2010; Sugand et al., 2010; Warner & Rizzolo, 2006; Williams & Lau, 2004). Gogalniceanu (2010) notes two in particular: (a) "dissection in particular has been ostracized from the curriculum to the extent that many medical schools don't even have gross anatomical facilities" (p. 6) and (b) "the abolition of the anatomy demonstrator posts" (p. 6). These reforms have recently become a highly criticized topic in literature with some describing them as a "deliberate reduction of

factual knowledge" and "a triumph of evangelism over common sense" (Williams & Lau, 2004).

What is especially concerning about the learning taking place in the traditional undergraduate anatomy lecture is the role that students take on as passive recipients of large quantities of information that ultimately results in the inability to actively engage with the content and process of learning (Lochner et al., 2016; Notebaert, 2009). Some then question if learning is truly taking place in this space (Garrison & Kanuka, 2004; Hicks, Reid, & George, 2001). Lachman (1997) notes that the traditional definition of learning used in many texts: "a change in behavior as a result of practice or experience" (Atkinson, Atkinson, Smith, Bem, & Nolen-Hoeksema, 1996, p. 227; Baron, 1996, p. 615; Carlson, 1989, p. 94; Chance, 1979, p. 224; Feldman, 1996, p. 684; Holonen & Santrock, 1996, p. 479) is insufficient. Washburne's (1936) long established definition of learning states that "learning is an increase, through experience, of ability to gain goals in spite of obstacles" (Washburne, 1936, p. 603). Literature suggests that the definition of learning should be enlarged past this simple idea of goal attainment, as the goal may only include retention and remembrance rather than a more complete range of cognitive processes (Kafai, 2002; Mayer, 2009; Sutinen, 2008). Some contend that the *process* in which knowledge is formed is the backbone of learning, and so the definition of learning should then be expanded to include cognitive processes related to knowledge transfer including understanding, application, collaboration, analyzation, evaluation, and creation, ideas that have grown in popularity in 21st century research and practice (Cohen, 1994; Huxham, 2003; Michalchik & Gallagher, 2010; Scardamalia & Bereiter, 2006; Tawfik & Lilly, 2015). In recent times, many argue that opportunities for facilitating

this expanded definition of learning can take place by blending the traditional lecture with novel active learning experiences and technological advancements, and has become a popular topic in educational research (Owston et al., 2013; Porter & Graham, 2016; Porter et al., 2014).

Obstacles to Learning

Literature reveals that students report memorization as their primary method of learning anatomy and believe that the course is about memorizing structures and remembering anatomical terminology (Notebaert, 2009). This focus on memorization is problematic and indicative of instructors taking a knowledge acquisition view of learning, what is widely known as *remembering* (Mayer, 2009). This approach does little to facilitate meaningful learning experiences as it avoids opportunities for both discovery learning and collaborative cooperative learning to take place (Ferrer-Torregrosa et al., 2015; Fleagle et al., 2018; Jacob, 1999; Memon, 2009) and fails to integrate the social, cognitive, and teaching presence required to build a community of inquiry (De Marzio, 2017; Golding, 2011). This knowledge acquisition view of learning also has implications for assessment, where instructors simply test to see how much presented content students are able to recall (Baxter et al., 1996; Mayer, 2001; Phye, 1997).

Undergraduate allied health students reported difficulties with memorization, had concerns about having to go beyond knowing facts such as connecting the facts to understand systems, and had difficulties in dealing with receiving large quantities of information without knowing how to approach or interact with it - all of these obstacles were cited by students as important factors that contribute to why they perceived their anatomy and physiology (AP) course as difficult (Sturges & Maurer, 2013):

- It is a lot of information at one time and every detail builds upon something else.
- It is much more than just knowing facts, but also understanding them and why things are the way they are.
- Especially for AP I, I think [the] majority [of] the students try and memorize the facts and have little or no connection between major concepts. (p. 3)

The same group of students reported that the teacher expected too much to be learned at one time and students stated that they would prefer if the teacher could explain things in simpler terms, slower, and for beginners. Further, they added that the material being presented too quickly made it difficult to understand and write down. Content overload was described as the most important factor to contribute to the difficulty of their anatomy and physiology course (Sturges & Maurer, 2013):

- It is difficult to learn because to most of the students it's like learning a new language (just a scientific one).
- It's just a lot of information to learn.
- The sheer number of terms that is required of a student to remember is a bit extreme.
- It is a lot of information (very specific details) that make it difficult to learn in a short time. (p. 4)

Variations in the traditional lecture. Despite the popular criticisms surrounding the prevailing use of the instructionist lecture, it is also important to recognize the small yet innovative variations in its traditional format described in recent literature that present some opportunities for student engagement to happen within the lecture, even

in classes with large enrollment (Chaudhury, 2011). Peer instruction, an interactive strategy to engage students by asking them carefully selected questions during the lecture period, allows students to interact with one another for select periods of time to discuss assigned questions and correct any misunderstandings, and in doing so, students are able to learn from their peers (Mazur, 1997). Other variations of the interactive lecture include the incorporation of engaging student-centered activities like group discussion for dedicated portions of the lecture class time (Knight & Wood, 2005), rearranging seating in the lecture room to form groups or position seats in a circular working group (Beichner, 2007; Hake, 2002), miming (Dickson & Stephens, 2015), and clicker technology (Bruff, 2009; Duncan, 2005).

Some lectures even designed the collaborative group activities in a way that achieved cooperative learning by using incentives to encourage groups to work effectively and productively together and providing both information about why working in groups will be valuable for their learning and pointers on how to manage group dynamics (Knight & Wood, 2005). Despite the efforts of Student Centered Activities for Large Enrollment Undergraduate Programs (SCALE-UP) (Beichner, 2007), the majority of anatomy lectures do not yet utilize these interactive variations (Lochner & Gijselaers, 2011; Lochner et al., 2016), and anatomy students continue to report memorization and remembering anatomical terminology as their primary method of learning anatomy (Notebaert, 2009).

Retention and transfer. Two of the most important educational goals are to promote *retention* and to promote *transfer* (which, when it occurs, indicates meaningful learning):

> *Retention* is the ability to remember material at some later time in much the same way it was presented during instruction. *Transfer* is the ability to use what was learned to solve new problems, answer new questions, or facilitate learning new subject matter. (Mayer, 2009, p. 226)

Students that achieve *retention* remember the content that they learned in the past, and students that achieve *transfer* use that content of the past to apply to and make sense of their learning in the future (Bransford, Brown, & Cocking, 1999; Detterman & Sternber, 1993; Haskell, 2001; Mayer & Wittrock, 1996; Mayer, 2009). Students must utilize superficial approaches (memorization) to achieve retention and deep approaches (emphasis placed on understanding and interacting with the material to be learned) to successfully transfer their anatomy knowledge to future courses (Pandey & Zimitat, 2007). Due to the reduced ability of the structure of the traditional didactic lecture alone to achieve both retention and transfer (McDaniel et al., 2008), innovative 21st century educators have recently begun to *blend* traditional and online learning to better facilitate positive outcomes for both goals (Bishop & Verleger, 2013; Leithwood et al., 2012; O'Flaherty & Phillips, 2015).

Blended Learning

In blended learning, instructors use technology to make learning accessible both inside and outside of the classroom, an approach that transcends the traditional boundaries of education (Garrison & Kanuka, 2004; Staker & Horn, 2012). Many institutions now employ blended learning strategies to supplement or replace traditional instruction (Staker & Horn, 2012) and of the many different blended learning models, the flipped classroom model has become particularly widespread (Giannakos, Krogstie,

& Chrisochoides, 2014; Karabulut-Ilgu, Jaramillo, & Jahren, 2017; O'Flaherty & Phillips, 2015).

Defining blended learning. Blended learning strategies promote student-centered learning by rearranging the traditional classroom environment and incorporating technology to facilitate constructivist approaches to learning (Bazelais & Doleck, 2018; Owston et al., 2013; Porter & Graham, 2016; Porter et al., 2014). Garrison and Kanuka (2004) define blended learning as:

> Both simple and complex. At its simplest, blended learning is the thoughtful integration of classroom F2F learning experiences with online learning experiences. There is considerable intuitive appeal to the concept of integrating the strengths of synchronous (F2F) and asynchronous (Internet) learning activities. At the same time, there is considerable complexity in its implementation with the challenge of virtually limitless design possibilities and applicability to so many contexts. The real test of blended learning is the effective integration of the two main components (F2F and Internet technology) such that we are not just adding on to the existing dominant approach or method. (p. 97)

Blended learning creates opportunities for students to be presented with content outside of the classroom so that F2F time can be used to communicate, collaborate, problem-solve, and reflect across peers and instructor (O'Flaherty & Phillips, 2015; Pierce & Fox, 2012). Beyond reordering the structure and time of the course to dedicate F2F meetings to collaborative and reflective learning activities, it is proposed that the flipped model also reduces cognitive load by allowing students to better manage their

working memory due to the self-paced nature of receiving lecture content asynchronously and online (Abeysekera & Dawson, 2015).

Blended learning in human anatomy. Literature suggests that this innovative approach is better suited to meet the highly active student learning objectives of the typical undergraduate general human anatomy course (Boevé et al., 2017; Darda, 2010; Smith et al., 2014). Students enrolled in traditional anatomy lectures too often leave the course with a superficial understanding of anatomy and lack the ability to apply their surface-level knowledge to future upper division classes and professional programs which require a deep, working comprehension of the content (Terrell, 2006). The blended learning approach is designed to address these concerns by utilizing technology to facilitate a space where social, cognitive, and teaching presence can be integrated to form a community of inquiry and facilitate cooperative and discovery learning experiences from the knowledge presented in the lecture (Garrison & Kanuka, 2004; Malandra, 2008; Middlehurst, 2006; Spanbauer, 2010). In doing so, the blended approach is better prepared to achieve the profoundly active learning objectives of human anatomy courses compared to traditional didactic lecture alone (Garrison & Kanuka, 2004; Malandra, 2008; Middlehurst, 2006; Rhode et al., 2017; Spanbauer, 2010). In short, the essential components of a successful blended course include learning that facilitates engagement, transfer of knowledge, problem-solving, and opportunities for collaborative critical thinking (Bazelais & Doleck, 2018; Bishop & Verleger, 2013; Boevé et al., 2017; Garrison & Kanuka, 2004; Mehta et al., 2013).

The impact of the blended learning has been mostly positive in research citing the improved learning and engagement that takes place when used in health-related

courses (Foon & Kwan, 2018; McLean & Attardi, 2018). Despite the increasing popularity of using the flipped model in anatomy laboratory classes (Fleagle et al., 2018), there is little academic research on how knowledge is formed in that space. To fill this gap, this study frames the learning that takes place within the blended anatomy course from a constructivist perspective within the context of a community of inquiry, cooperative learning, and discovery learning.

Constructivist Approach to Anatomy Education

Blended learning can facilitate active student-centered learning experiences (Garrison & Kanuka, 2004) by utilizing the constructivist approaches established by seminal learning theorists including Dewey (1955), Vygotsky (1978), Bruner (1961), and Schank (1999). Iterating, working, discussing, and applying feedback to the learning process are examples of constructivism (Windschitl, 1999), a theory of how deep learning takes place (Cobern, 1993; Yager, 1991). Critical aspects of constructivist approaches include problem-based learning, inquiry, activities that help students make sense of subject matter, introducing students to various resources and alternative ideas, opportunities for students to test and establish their comprehension of the topic, and open dialogue with instructor and peers (Dewey, 1955; Garrison, 1999; Sutinen, 2008; Tawfik & Lilly, 2015; Windschitl, 1999). Constructivism requires that the instructor consider the background knowledge of their students and how that knowledge may affect their learning experience (O'Loughlin, 1992; Tobin, 1993; Windschitl, 1999). Constructivist activities allow for engagement and the application of knowledge so that students can make sense of the subject matter, which will ultimately lead to deeper

learning than instructionism alone (Cobern, 1993; Dewey, 1938; Piaget, 1963; Tobin, 1993; Yager, 1991).

Linking lecture. Despite the positive attention surrounding constructivist approaches (Dirks-Naylor, 2016; Hmelo-Silver, 2013; Sutinen, 2008), creating engaging learning experiences in content heavy courses with clinical underpinnings like human anatomy requires students to have a foundational knowledge to draw from (Gogalniceanu et al., 2010). Some argue that inquiry based and collaborative learning approaches such as problem-based learning can only have a reflective role if students are already knowledgeable about the facts behind the problem in question (Gogalniceanu et al., 2010; Lochner et al., 2016).

Because these reflective activities rely on a baseline of knowledge to be conveyed in the lecture component to function successfully (Gogalniceanu et al., 2010; Lim & Morris, 2009; Lochner et al., 2016), the necessity of first presenting and then linking and integrating lecture content to thoughtfully planned F2F activities is essential to reap the benefits of the blended approach (Cook, 2006; Gogalniceanu et al., 2010; Harden, 2008; Khogali et al., 2011; Lim & Morris, 2009; Williams et al., 2011). Garrison and Kanuka (2004) describe the need to truly *blend* the online and F2F approaches:

> A blended learning design represents a significant departure from either of these approaches. It represents a fundamental reconceptualization and reorganization of the teaching and learning dynamic, starting with various specific contextual needs and contingencies (e.g., discipline, developmental level, and resources). In this respect, no two blended learning designs are identical. This introduces the great complexity of blended learning. (p. 97)

At the heart of their argument, Garrison and Kanuka (2004) contend that when thoughtfully integrated, the quality and quantity of the engagement, discourse, and collaboration in a community of inquiry, accomplished through the intentional assimilation of technology, is what expands the educational possibilities of the blended course. It is the ability of blended learning to nurture a community of inquiry that makes the learning within the blended approach uniquely meaningful (Garrison & Cleveland-Innes, 2003; Swan & Shih, 2005).

Community of inquiry and anatomy education. Community of inquiry was first applied to the educational setting by John Dewey (1902), and later Matthew Lipman (2003) borrowed this idea to consider the classroom as a community of inquiry. The three foundational elements of a community of inquiry (see Figure 1) include connecting and applying ideas (*cognitive presence),* communicating and collaborating across peers and instructor *(social presence),* and intentionally creating a curriculum that focuses and guides participation and discourse *(teaching presence;* Garrison et al., 2001; Garrison & Kanuka, 2004). Vaughan et al. (2014) argue that the blended learning approach creates opportunities for the integration of these three elements.

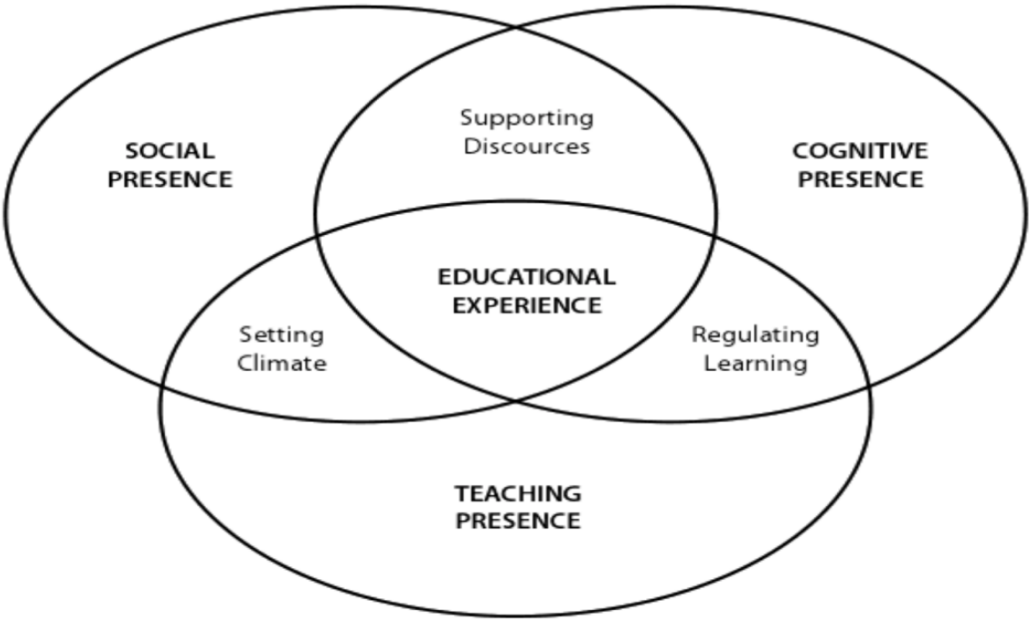

Figure 1. Community of inquiry. From *Teaching in blended learning environments: creating and sustaining communities of inquiry*, (p.11), by Vaughan, Garrison, & Clevland-Innes, Athabasca, Canada: Athabasca University Press. 2014, p. 11. Copyright 2014 by Vaughan, Garrison, & Clevland-Innes. Reprinted with permission.

Within blended learning, the use of online communication and information tools supply flexibility and allow for more adaptability in F2F learning and educational discourse compared to traditional instructionist practices, facilitating a unique ability to encourage a community of inquiry within the blended approach (Garrison & Kanuka, 2004; Weiss et al., 2013). “The community of inquiry is perhaps the most promising methodology for the encouragement of that fusion of critical and creative cognitive processing known as higher-order thinking” (Lipman, 2003, p. 204). The critical discourse and reflective thinking born out of the cognitive and social level of belonging and sense of community (Hudson, 2002) combined with the management of the environment and facilitation from learning experiences by strong teaching presence

(Garrison & Kanuka, 2004) produces interactive dialogue and facilitation of critical thinking (Lipman, 2003; Vaughan et al., 2014).

> The emphasis must shift from assimilating information to constructing meaning and confirming understanding in a community of inquiry. This process is about discourse that challenges accepted beliefs, which is rarely accomplished by students in isolation. At the same time, to be a critical thinker is to take control of one's thought processes and gain a metacognitive understanding of these processes. (Garrison & Kanuka, 2004, p. 98)

For example, in a community of inquiry within a blended anatomy course, indicators of social presence may include students communicating online in forums or discussion boards on their learning management system (LMS) and/or during the F2F laboratory to collaborate and learn together in a low risk environment; indicators of cognitive presence may include inquiry rooted discourse such as connecting lecture concepts to laboratory experiences and applying knowledge to solve problems and case studies; lastly, teaching presence in the classroom may present as the instructor developing a blended learning curriculum that introduces and organizes content in the lecture, facilitates discourse online in forums or discussion boards, and regulates learning in the laboratory to facilitate opportunities for students to focus on issues and resolve questions (Vaughan et al., 2014).

Elements	*Categories*	*Indicators* (*examples only*)
Social Presence	Personal/Affective	Self projection/expressing emotions
	Open Communication	Learning climate/risk-free expression
	Group Cohesion	Group identity/collaboration
Cognitive Presence	Triggering Event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas
	Resolution	Applying new ideas
Teaching Presence	Design & Organization	Setting curriculum & methods
	Facilitating Discourse	Shaping constructive exchange
	Direct Instruction	Focusing and resolving issues

Figure 2. Community of inquiry categories and indicators. From *Teaching in blended learning environments: creating and sustaining communities of inquiry*, (p.11), by Vaughan, Garrison, & Clevland-Innes, Athabasca, Canada: Athabasca University Press. 2014, p. 12. Copyright 2014 by Vaughan, Garrison, & Clevland-Innes. Reprinted with permission.

The community of inquiry frames the practical implications for the blended learning approach (see Figure 2), as it affords instructors and students both the increased control and increased independence needed to develop higher-order and reflective thinking (Garrison, 2011; Garrison & Kanuka, 2004).

> Students listen to one another with respect, build on one another's ideas, challenge one another to supply reasons for otherwise unsupported opinions, assist each other in drawing inferences from what has been said, and seek to identify one another's assumptions. (Lipman, 2003, p. 20)

The blended approach can foster an interactive dialogue within the class space where critical discourse and reflective thinking between students and instructors facilitates a

social and *cognitive* sense of belonging within the environment, which is managed by a strong *teaching* presence to focus and facilitate the learning experiences in a community of inquiry (Garrison, Anderson, & Archer, 2000; Garrison et al., 2001; Hudson, 2002). At the heart of the educational experience, born out of the integration of social, cognitive, and teaching presence, is the collaboration that happens between students and with their instructor. The quality of all collaborative experiences is not the same, and so this study frames the learning that takes place within student groups through the context of cooperative learning.

Cooperative learning and anatomy education. Cooperative learning provides a guide for constructive and collaborative group learning in the transition to establishing a blended learning course (Boevé et al., 2017; Doolittle, 1995; Rottier & Ogan, 1991; Sharan, 1990; Sutinen, 2008): “Cooperative learning represents the most carefully structured end of the collaborative learning continuum” (Smith & MacGregor, 1992, p. 15). Bishop & Verleger (2013) summarized the three fundamental parts of cooperative learning as described by Foot and Howe (1998):

- Students work in teams toward the attainment of some superordinate goal.
- Labor is divided between team members, such that each individual takes responsibility for a different sub-goal.
- Individual contributions are pooled into a composite product to ensure that the goal is reached. (p. 8)

The ideas behind cooperative learning are grounded in the works of seminal learning theorists including Vygotsky (1978) and Piaget (1963). Vygotsky's (1978) work highlights the benefits of working together with a more knowledgeable peer so that the

learner can carry out the task jointly with the expert and thus add it to their own repertoire of abilities. Piaget's (1963) work highlights the cognitive conflicts born out of collaboration between students and cites the benefits of these conflicts, due to their ability to expose misconceptions and foster deeper understanding.

In the typical undergraduate anatomy laboratory class, students work together in small groups and rotate through stations throughout the laboratory to experience the 'hands-on' part of the course. Stations may include plastic models, prosected cadavers, problem-solving questions, microscopes, virtual cadaver software, case studies, bones, animal dissections, clay, art supplies, and various other ways of interacting with the content, all of which are highly dependent on the instructor and program, and may range from only plastic models to the complete spectrum of activities (Anderson et al., 2008; Arksey & O'Malley, 2005; Coates, 2006; Critz & Wright, 2013; Davies et al., 2013; Tijani, Owolabi, & Adekomi, 2017). The aim of this study is to develop an understanding of what practices and strategies that anatomy faculty use in their blended classes, and by considering the results within the context of cooperative learning, this study will hopefully shed light on the quality of the collaboration and knowledge formation happening within this space.

Although there is not a complete consensus on the exact elements that constitute cooperative learning, critical components include "positive interdependence, F2F interaction, individual accountability, small group and interpersonal skills, and group self-evaluation" (Doolittle, 1995, p. 13). These components distinguish cooperative learning from traditional learning (Bishop & Verleger, 2013; Doolittle, 1995) and can act as guidelines for best practices within blended learning courses (Boevé et al., 2017;

McDaniel et al., 2008; Mehta et al., 2013; O'Flaherty & Phillips, 2015). Nelson (2010) considered cooperative learning from the perspective of the biological sciences and identified four key components of cooperative learning in inquiry-based labs:

- extensive structuring of the learning tasks by the teacher;
- strongly interactive student-student execution of the tasks;
- immediate debriefing or other assessments to provide the teacher and students with prompt feedback about the success of the intended learning; and, importantly,
- instructional modifications by the teacher that take account of this feedback. (p. 121)

Evidence in literature suggests, that cooperative learning is an essential element to fostering basic conceptual understandings in science and that cooperative learning fosters higher-level problem-solving, application, and critical thinking goals (Crouch & Mazur, 2001; Hake, 1998, 2002; Nelson, 2010).

> In a nutshell, cooperative learning is a highly structured form of group work that focuses on the problem solving that - when directed by an effective teacher - can lead to deep learning, critical thinking, and genuine paradigm shifts in students' thinking. Two givens in the cooperative learning literature are positive interdependence and individual accountability. (Millis, 2010, p. 5)

Millis (2010) highlights the importance of a strong teaching presence in achieving *positive interdependence*, as the teacher must design the activity in a way that gives students a vested reason to work together on the task, while challenging the group and encouraging cooperation. Millis (2010) defines *individual accountability* as not allowing

students to "coast" on the grades of others, so that they are evaluated based on the work they perform and their overall contribution. Peer evaluations and self-critiques are often a part of promoting this individual accountability and achieving cooperative learning. The social presence (group collaboration and cohesion), cognitive presence (exploration and resolution), and teacher presence (design and organization) required to achieve cooperative learning indicates that this highly structured approach of the collaborative learning continuum belongs within a community of inquiry and can serve as another indicator of meaningful learning within the blended anatomy course.

Discovery learning and anatomy education. Discovery learning is an inquiry-based approach to learning where the student utilizes their existing knowledge to interact with content, explore questions, discuss ideas, perform experiments, and discover relationships and facts for themselves (Bruner, 1961). Typically, the combination of the lecture-laboratory experience in human anatomy courses facilitates this approach to learning: the didactic lecture portion provides students with the knowledge base that they need to engage in the hands-on laboratory portion of the course, and the laboratory is where the discovery part of their learning typically takes place (Heylings, 2002). The interaction and discovery that students may experience in the laboratory are the experiences that solidify deeper learning, as students are more likely to understand concepts and develop knowledge if they discover it on their own Bruner, 2009). Opportunities for discovery learning in anatomy include problem-based learning, simulation-based learning, case-based learning, and incidental learning.

Problem-based learning. Problem-based learning is an instructional strategy first developed as an alternative to the traditional didactic lecture (Barrows, 1996; Hung

et al., 2008). Problem-based learning posits that students learn best when knowledge is centered around a problem in a context that is relevant to the field of practice (Tawfik et al., 2013). For example, asking anatomy students to trace the pathway of eating carbohydrates and following the breakdown of those nutrients into glucose through the digestive system, passing glucose in the blood through the hepatic portal system to systemic circulation, moving back through the heart, and eventually tracing the pathway of the blood vessels that will allow the nutrient to engage with skeletal muscle creates a contextualized problem for students to solve, compared to out of context labeling and identification activities of discrete organ systems that often constitute the only form of inquiry and assessment in the laboratory. Problem-based learning experiences allow students to engage in investigating ill-structured problems that have multiple solutions, and in doing so, learn both the concepts and the problem-solving skills relevant to their community of practice (Hmelo-Silver & Eberbach, 2012). Hmelo-Silver and Eberbach (2012) outlined five principal goals of problem-based leaning, including helping students to develop:

- flexible knowledge,
- effective problem-solving skills,
- effective self-directed learning skills,
- effective collaboration skills, and
- intrinsic motivation. (p. 3)

Barrows (1996) investigated problem-based learning in medical curriculum and suggests that its nature is “active, integrated, and associated with the cues present in real-world professional problems (patients) and the cognitive processes used in problem

solving" (p. 8). Barrows (1996) defined six core characteristics in his definition of problem-based learning in the context of medical education:

- learning is student-centered,
- learning occurs in small student groups,
- teachers are facilitators or guides,
- problems form the organizing focus and stimulus for learning,
- problems are a vehicle for the development of clinical problem-solving skills, and
- new information is acquired through self-directed learning. (pp. 5-6)

The opportunities within the blended learning approach for collaborative learning, engagement with course content, open-ended problem-solving, and critical thinking are especially suited for content-heavy disciplines (Bazelais & Doleck, 2018; Fahey, 2012; Garrison & Kanuka, 2004). A blended anatomy course can provide opportunities for scaffolded self-directed learning and help students manage cognitive load as they explore the problem-space with their peers (Davies et al., 2013; Memon, 2009; Tawfik & Lilly, 2015; Tucker, 2012).

Simulation-based learning. Simulation-based learning is similar to the idea of role-playing where students are presented with an artificial environment that facilitates the development of skills or application of an abstract concept (Samur & Evans, 2011). For many anatomy students, cadaver dissection is not a part of the curriculum (students work with prepared prosected cadavers, plastic models, and virtual cadaver software, with some programs providing opportunities for the dissection of animal parts; Dobson, 2007). The benefit of simulated cadaver software programs is that they allow students

to engage in a much lower risk virtual cadaver dissection experience and can be manipulated to guide discovery at the appropriate level (Bicknell-Holmes & Hoffman, 2000). Due to the expense of cadavers, increased student enrollment, and limited prosected materials, virtual cadaver dissection software also provides greater accessibility (Fyfe, Fyfe, Dye, & Radley-Crabb, 2018).

Although simulation-based learning provides a solution to issues related to financial and accessibility concerns, cadaver dissection is highly preferred by anatomy students compared to virtual cadaver dissection software (Farey et al., 2018; Gogalniceanu et al., 2010). Further, the effectiveness of simulation-based learning is criticized by some (Collins, 2009; Ellis, 2002; Farey et al., 2018; Smith & Mathias, 2011), especially in anatomy courses involved in the preparation of medical doctors (Dobson, 2007): "Anatomy must not be taught at the operating table through the window of operation. It should be studied and understood before the trainee gets to the operating table" (p. 334). Despite these criticisms, the use of augmented reality to study 3D anatomical models and virtual cadavers is praised for its usability, owing to the fact that the 21st century student is comfortable handling the mediums this technology is available on, including the Internet, mobile phone applications, video games, MP3 players, and other technological devices (Tworek, Jamniczky, Jacob, Hallgrimsson, & Wright, 2013; Wilkinson, 2012). Augmented reality technology can make content both attractive and motivating (Di Serio, Ibanez, & Kloos, 2012) and has grown in popularity within the discipline of anatomy in recent times (Hongen, Inomata, Sakuma, & Dohi, 2010; Lamounier, Bucioli, Cardoso, Andrade, & Soares, 2010; Sakellarious, Ward, Charissis, Chanock, & Anderson, 2009; Thomas, John, & Delieu, 2010). Within the

blended anatomy course, simulation-based learning like virtual cadaver dissection is unique in that it can take place both inside and outside of the classroom and has the potential to be used as both a pre-class preparatory strategy as well as an interactive group-learning strategy.

Case-based learning*.* Case-based learning allows students to analyze a real-world scenario and provides a rich basis for fostering students' decision making and problem-solving skills (Goodenough, 1994). Students must apply and evaluate the information previously learned in texts or lectures to solve an issue, typically formatted as a story with a problem that needs to be resolved (Christensen & Hansen, 1987). A distinction between problem-based learning and case-based learning is the *story* behind the case: "a good case presents an interest-provoking issue and promotes empathy with the central characters. It delineates their individual perspectives and personal circumstances well enough to enable students to understand the characters' experience of the issue" (Boehrer & Linsky, 1990, p. 45). For example, an anatomy course may utilize a case study like the following:

> Dolores Welborn is a 28-year-old attorney living in Portland, Oregon. Dolores is in the second trimester of pregnancy with her first child, and though her pregnancy had been progressing normally, recently she has noticed that she tires very easily and is short of breath from even the slightest exertion. She also has experienced periods of light-headedness, though not to the point of fainting. Other changes she has noticed are cramping in her legs, a desire to crunch on ice, and the fact that her tongue is sore. She doubts that all of these symptoms are related to one another, but she is concerned, and she makes an appointment

> to see her physician. Upon examining Dolores, her physician finds that she has tachycardia, pale gums and nail beds, and her tongue is swollen. Given her history and the findings on her physical exam, the physician suspects that Dolores is anemic and orders a sample of her blood for examination. (Dean, 2006, p. 1)

The goal behind case-based learning is to apply learned concepts to real-world scenarios so that students learn to prioritize elements and develop their analytical thinking abilities (Foran, 2001), a useful skill for the allied health and medical anatomy student. In this case study example, students would read the blood sample results and address questions relating to the study. This example facilitates a rich discussion about the structure of the red blood cell and the function of hemoglobin in a context that students are likely to encounter as future healthcare practitioners. This case study provides an opportunity for students to work collaboratively, examine evidence, analyze and order information logically, consider multiple solutions, and raise questions (Bruner, 2002; Mitchell & Rosenstiel, 2003), all of which are considered critical components of a successful blended learning experience (Bazelais & Doleck, 2018; Bishop & Verleger, 2013; Boevé et al., 2017; Garrison & Kanuka, 2004; Mehta et al., 2013).

Incidental learning. Incidental learning activities are when learning happens "in passing" (Schank & Cleary, 1996). These work well with rote memorization or dense topics perceived by students to be uninteresting because they typically take the form of a game (Bicknell-Holmes & Hoffman, 2000; Castronova, 2000). Thus, incidental learning may provide an ideal strategy for engaging anatomy students in tedious tasks such as the identification and spelling of structures in anatomy. Websites like "Anatomy

Arcade" (Arcade, 2008) provide games for students to engage in activities that cover topics that require heavy memorization and identification including learning the location and names of the bones: Whack-A-Bone, Match-A-Bone, Bone Crossword, Skeletal System Word Search, Skeletal Jigsaw (AnatomyArcade.com, n.d.) and learning the location and names of the skeletal muscles: Poke-A-Muscle, Major Muscles Crossword, Major Muscles Word Search, Muscular System Jigsaw, Match-A-Muscle (AnatomyArcade.com, n.d.). Many anatomy crossword puzzle books and anatomy coloring books are also available to students (Biluk, 2012; Hansen, 2018; Kapit & Elson, 2014; Marieb, 2017; McCann & Wise, 2017; Tierney, 2012) and are examples of non-electronic methods of achieving incidental learning in anatomy. Other examples of the use of games to critical components include positive interdependence, F2F interaction, individual accountability, small group and interpersonal skills, and group self-evaluation promote learning in anatomy include: Jeopardy or other game-show like review methods that evoke competition (Cagiltay, Ozcelik, & Ozcelik, 2015); ClueConnect, a word array game that promotes student comprehension of key anatomical terminology (Burleson & Olimpo, 2016); and Kahoot!, a mobile-based game where students compete to answer anatomy questions from their own personal digital devices (Aktekin, Celebi, & Aktekin, 2018). The game-like quality of incidental learning invokes curiosity (Paradowski, 1967) and can be motivating to students because they are driven to look for the answers to complete the activity at hand (Rieber, 1991).

Blended Learning in Practice

Literature points out that blended learning has exceptionally high potential to make its mark in the undergraduate science classroom (Bazelais & Doleck, 2018; Gopal

et al., 2010; Knight & Wood, 2005; McDaniel et al., 2008; Wirth & Perkins, 2005). Specifically within STEM education, blended learning results in students acquiring more skills, conceptualizing and problem-solving, and performing at a higher level (Bazelais & Doleck, 2018; Gopal et al., 2010; López-Pérez et al., 2011).

Student perceptions. According to literature, students respond positively to active learning methods and peer learning compared to the traditional lecture-based course (Bazelais & Doleck, 2018; Mehta et al., 2013; Pereira et al., 2007) and report the effectiveness of technology-mediated instruction as helpful in constructing their own knowledge and improving their overall perception of and performance in the course (Bazelais & Doleck, 2018; Duffy & McDonald, 2008; Gopal et al., 2010; Okojie et al., 2006). Despite a general overall positive student response to blended learning (Bazelais & Doleck, 2018; López-Pérez et al., 2011; McDaniel et al., 2008; Mehta et al., 2013; Notebaert, 2009; Park & Howell, 2015; Pereira et al., 2007), student perceptions of blended learning differed based on achievement level (Owston et al., 2013). Owsten et al. (2013) found that high achievers gravitated towards the format of the blended courses, finding them to be more convenient and engaging (high achievers felt that they had a better grasp of course concepts compared to other traditional F2F courses they had previously taken) compared to low achievers who struggled to cope with the blended format and did not have the same positive experience as their high achieving peers. More research, however, needs to be conducted comparing different levels of student achievement and the effectiveness of blended learning practices based on those levels.

The flipped model. The flipped model has recently gained popularity in general basic sciences education (Bergmann & Sams, 2008; Giannakos et al., 2014) and is especially making its mark within the anatomical, health, and medical sciences (Betihavas, Bridgeman, Kornhaber, & Cross, 2016; Chen, Lui, & Martinelli, 2017; Cotta, Shah, Almgren, Macias-Moriarity, & Mody, 2016; Foon & Kwan, 2018; Lochner et al., 2016; Mehta et al., 2013; O'Flaherty & Phillips, 2015; Pierce & Fox, 2012; Presti, 2016; Singh & Min, 2017). Further, the use of the flipped model in the human anatomy laboratory has shown significant success in recent times compared to traditional laboratory instruction (Fleagle et al., 2018). The flipped approach (see Figure 3) is a specific subset of blended learning that begins with asynchronous delivery of instruction outside of class-time, usually in the form of a recorded video, followed by collaborative student-centered learning activities that take place during the F2F class (Tucker, 2012). Bishop and Verleger (2013) specify the use of video lectures, the most popular means of delivering the asynchronous content in the flipped model (Lochner et al., 2016; Moreno & Mayer, 2007; Singh & Min, 2017; Wouters, Tabbers, & Paas, 2007) in their definition of the flipped classroom:

> The flipped classroom is a pedagogical method, which employs asynchronous video lectures and practice problems as homework, and active, group-based problem-solving activities in the classroom. It represents a unique combination of learning theories once thought to be incompatible – active, problem-based learning activities founded upon a constructivist ideology and instructional lectures derived from the direct instruction methods founded upon behaviorist principles. (Bishop & Verleger, 2013, p. 2)

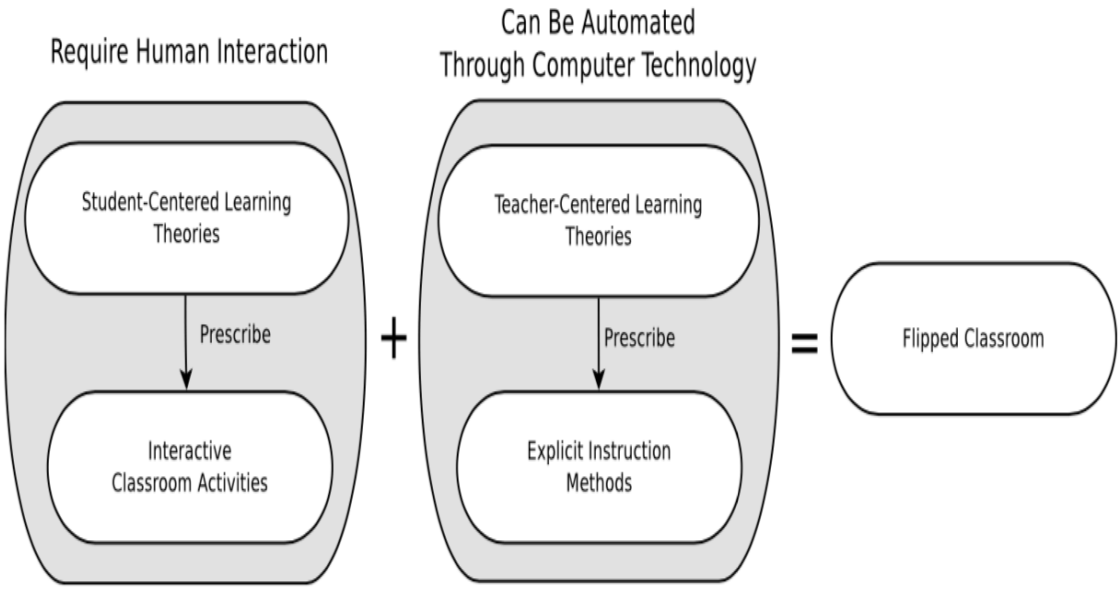

Figure 3. From *The Flipped Classroom: A Survey of the Research,* (p.6), by Bishop & Verleger. Paper presented at the Annual Conference of the American Society for Engineering Education, Atlanta, GA. Copyright 2013 by Bishop & Verleger. Reprinted with permission.

Bishop and Verleger (2013) specify the use of video lectures in their definition of blended learning over alternative sources of conveying information such as reading a textbook because of the evidence that video lectures are as effective as in-person lectures when they are conveying fundamental information (Cohen, Ebeling, & Kulik, 1981; McNeil, 1989) – thus, proponents of the flipped model question using up valuable F2F instructor-student time to describe information that students could easily watch asynchronously (Bishop & Verleger, 2013; Zhang, Zhou, Briggs, & Nunamakers, 2006). Instead, asynchronous video instruction is meant to present the fundamental information that the traditional lecture would typically deliver (Lage et al., 2000). This flipped approach is much better suited to meet the needs of the diverse student enrollment in general human anatomy (Gopal et al., 2010) due to students being

afforded the time to make their way through the material at their own pace (Huang & Huang, 2003), and shifts the responsibility of learning on to the student (Glass & Spiegelman, 2007). This method is especially useful for undergraduate digital-native millennials as they require reactionary and immediate engagement (O'Flaherty & Phillips, 2015). The resulting learning environment reduces cognitive load and encourages the higher order thinking and engagement (Bryson & Hand, 2007) that is critical to achieve meaningful student learning (Barkley, 2010; Coates, 2006; Hockings, Cooke, Yamashita, McGinty, & Bowl, 2008).

Technology Innovations in Anatomy

In the 21st century, various cutting-edge technologies are available for the innovative anatomy educator. Online instructional videos, photogrammetry, mobile applications, simulations such as virtual cadaver dissection, personal response systems, and learning management systems are widely available technologies that the blended anatomy instructor may employ in their innovative course. Understanding the technologies available to the anatomy educator will help place those technologies employed by faculty that teach blended anatomy courses within the framework of this study and help develop a better understanding of technology's role in how meaningful learning is conducted in this space.

Online instructional videos. Online instructional videos used in the pre-class preparatory activities within the flipped human anatomy classroom "offer a small advantage to overall student learning over interactive tutorials or textbook-style reading" (Jensen, Holt, Sowards, Heath Ogden, & West, 2018). Literature supports the benefits of video tutorials (He, Swenson, & Lents, 2012; Kay & Kletskin, 2012) which are cited as

the most common method of pre-class preparatory activities used in the flipped anatomy course (Bishop & Verleger, 2013; Jensen et al., 2018; O'Flaherty & Phillips, 2015). Jensen et al. (2018) considered dual coding theory as described by Paivio, (1990) to support the benefits of the dual visual and auditory information processing that accompanies video lectures over asynchronous tutorials or textbook-style reading: "according to this theory, the more sensory pathways that a student can use to interact with the material, the more likely they are to remember the content" (p. 525). The verbal and visual *memory traces* afforded by the use of video lectures allow that information to be more accessible to the learner (Thomas, 2014) while the self-paced nature of the video lecture allows students to better manage their working memory and reduce cognitive load (Abeysekera & Dawson, 2015). Popular video capture software for the flipped classroom include the following (TeachThought, 2016): *Panopto* - a widely used video capture tool in education that can be installed on a computer so that lectures, PowerPoint presentations, video images of the instructor, and screen sharing are all possible. Benefits of Panopto include the ability for videos to be easily uploaded to a learning management system and the ability for students to also be able to download the software on their own devices to create their own videos; *Tegrity* - this tool has audio, video, and tablet writing capabilities, depending on the devices added to the instructor's computer. Benefits of Tegrity include upload ability to a learning management site and the ability for students to search within a library of videos, bookmark videos, and send electronic questions to their instructor; *Screencast-o-matic* - this audio and visual recording tool does screen capture that allows students to see what the instructor is doing on their computer. Screencast-o-matic runs directly from the

website and does not require any software installation and allows direct publishing to YouTube; *Camtasia Studio* - a popular class-flipping tool, Camtasia allows the instructor to integrate a multitude of resources into their recording including flash cards, videos, music, PowerPoint presentations, visual effects, and games. In addition, file sharing and quiz creation are useful tools in the most updated version of Camtasia.

Photogrammetry of human specimens. Human anatomy students are exposed to a wide variation of anatomy study tools including photographs, artistic diagrams, 3D plastic models, and videos, yet these resources often over-simplify the true complexity of the anatomy of the human body and 3D plastic models are especially limited in their distribution and accessibility (Johnson, Charchanti, & Troupis, 2012; Lim, Loo, Goldi, Adams, & McMenamin, 2016). Although 2D photographic images of prosected cadaveric specimens are detailed, accurate, and accessible, the depth and dimension afforded by 3D resources is lost (Petriceks, Peterson, Angeles, Brown, & Srivastava, 2018). Many professionals agree that the use of photogrammetry to create 3D computer models of prosected cadaveric specimens is both an academically sound and cost-effective supplement to the traditional human anatomy curriculum (Azer & Azer, 2016; Keedy et al., 2011; Khot, Quinlan, Norman, & Wainman, 2013; McMenamin, Quayle, McHenry, & Adams, 2011). Petriceks et al. (2018) describe this cutting-edge process as follows:

> Photogrammetry - the applied science of using photographs to represent an object in 3D - combines the advantages of photographs, videos, and computerized models while avoiding most of their drawbacks. In

> photogrammetry, 2D photographs of an object are taken at varying angles and then overlaid using computer software to generate a 3D reconstruction. (p. 2)

The benefits of photogrammetry include increased accessibility, low cost, authenticity of the anatomy displayed in the computer-generated models, and interactive capabilities including the ability to annotate and manipulate the structures within the software that 2D photographs or 3D videos lack (Petriceks et al., 2018). Despite its positive reception, photogrammetry is limited in that it is only as accurate as the quality of the prosected cadaveric specimens that the images are obtained from (Petriceks et al., 2018).

Mobile applications. The use of various human anatomy mobile applications are increasing as the capabilities of mobile phones are rapidly expanding and as ownership of mobile and other hand held devices are increasing in popularity (Franko & Trillel, 2011; Trelease, 2008). Apple products are currently one of the most popular brands of hand-held devices with both for-purchase and free human anatomy applications available for download (Cornwall & Pollard, 2012). Due to the low-cost, free anatomy applications are an especially attractive and highly utilized resource for students in introductory and general anatomy courses (Sugand et al., 2010). Cornwall & Pollard (2012) explored the quality of multiple free applications for iPhone and iPod Touch, and rated the various applications to provide information to anatomy educators for product recommendations. 63 anatomy applications were identified and 11 of the applications met their inclusion criteria to be sampled, studied, and ranked by usability, level, quality, body region, and file size. The results were overall positive with the majority of the free mobile applications included in the study considered easy to use and relevant for both graduate and undergraduate level gross human anatomy education.

Simulations: virtual cadaver dissection. In the 21st century, traditional cadaver dissection in undergraduate education is disappearing and as a result, most undergraduate general anatomy students are taught cadaver anatomy through previously prosected specimens, virtual cadavers, and simulated dissection (Hanna & Tang, 2005; Older, 2004; Simpson, 2014; Turney, 2007). Anatomy and Physiology Revealed (APR) is a popular cadaver simulation program in undergraduate anatomy education that uses high resolution pictures to display a prosected cadaver with capabilities to highlight structures, practice identification and spelling, complete online quizzes, and rotate the specimen in 3D (Saltarelli, Roseth, & Saltarelli, 2014). Although there is increased accessibility and affordability with virtual dissection tools (Simpson, 2014), Saltarelli et al. (2014) warn that the use of multimedia simulations such as APR require that the instructor carefully align the learning task and performance measures and found that additional pedagogical approaches were needed to support the transfer of the simulated learning to real-world application. In addition to computer software, other virtual cadaver dissection mediums like the Anatomage table can provide anatomy simulations on a much larger scale using a life-size tablet positioned on a table so that students can dissect and explore the human body virtually (Lacasse, Press, Galvis, Table, & Le, 2018).

Personal response systems. Personal response systems (clickers) have generally been viewed positively (FitzPatrick, Finn, & Campisi, 2011):

> Across courses and years, students uniformly rated several dimensions of clicker use as providing good to great gain in engaging them in active learning, increasing participation and involvement during class, maintaining attention,

applying material immediately, providing feedback concerning their understanding, and offering an anonymous format for participation. (p. 280)

FitzPatrick et al. (2011) found that clickers in anatomy and physiology showed some overall quiz score improvement due to increased participation and active learning.

Learning management systems. Canvas and Blackboard are two popular learning management systems (LMS) in higher education that allow educators to distribute course content to students online, communicate in discussion boards and emails, carry out assessments, post videos, and manage grades (Rhode et al., 2017). Canvas is the LMS system for over 700 institutions (John, 2014) and BlackBoard for over 900 institutions (Whitmer, Nunez, Harfield, & Forteza, 2016). The use of LMS has become the norm in 21st century higher education due to its capabilities for community building, knowledge sharing, collaboration, and communication, yet there are concerns about lack of instructor and student online engagement as well as concerns surrounding the importance of the design behind online tasks and assessments - all of which are critical to positive outcomes (Zanjani, Edwards, Nykvist, & Geva, 2016).

Summary

Considering the definition of blended learning as “the organic integration of thoughtfully selected and complementary F2F and online approaches and technologies” (Garrison & Vaughan, 2008, p. 148), achieving meaningful learning in the blended classroom requires intentional design, mindful collaboration, and complete integration between the F2F experience and asynchronous online technology. By conducting formal research that is focused on understanding the experiences of anatomy faculty in their blended learning course through the theoretical framework of community of inquiry,

collaborative learning, and discovery learning, this study will provide insight into how learning happens within that space. By exploring blended anatomy instruction through the lived experiences of anatomy faculty, this study will be able to further understand their dilemmas and successes to inform current and future undergraduate anatomy education.

Chapter 3: Research Design and Methodology

"Qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring them" (Denzin & Lincoln, 2011, p. 3).

Introduction

Although literature surrounding the benefits of blended learning is mostly positive, (Bishop & Verleger, 2013; O'Flaherty & Phillips, 2015), rearranging the structure of activities or incorporating technology alone does not ensure a more meaningful learning experience (Duffy & McDonald, 2008; Gopal et al., 2010; Lim & Morris, 2009; Mitchell & Honore, 2007; Okojie et al., 2006). This study aimed to

understand the strategies and practices anatomy faculty employ to achieve meaningful learning within their blended anatomy course and is informed by three areas of research: community of inquiry, cooperative learning, and discovery learning. Phenomenological methods were used to examine the lived experiences of anatomy faculty in their blended anatomy course and represent a shift from previous studies by framing blended learning within the context of building a community of inquiry, cooperative learning in collaboration, and inquiry-based discovery learning experiences.

Re-Statement of Research Questions

This study aimed to explore blended learning instruction through the lived experiences of anatomy instructors to further understand their dilemmas and successes and inform current and future undergraduate anatomy education. In order to develop a better understanding of how meaningful learning is achieved in this space, this study examined the following research questions:

RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?

a) What methods are employed by anatomy educators to create meaningful learning experiences in this space?

b) What types of problem-based learning instruction techniques do anatomy educators use?

c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

RQ2: What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

Nature of the Study

Understanding the experiences and perceptions of participants requires rich and descriptive data. (Creswell, 2014) writes that if “a need exists to explore and describe the phenomena” (p. 110), a qualitative approach is the more appropriate method compared to quantitative procedures. Flick, Von Kardoff, and Steinke (2004) outlined the following key characteristics of qualitative research practice that relate to this qualitative study including "the appropriateness of methods, contextuality as a guiding principle, perspectives of participants, reflective capability of the investigator, and discovery and theory formation as a goal" (p. 5). This study addressed these characteristics in using semi-structured interviews to collect rich data about the lived experiences of anatomy faculty to better understand their perspectives and experiences within the context of the blended anatomy classroom. This investigation was informed by the theoretical framework of community of inquiry, cooperative learning, and discovery learning and the investigator bracketed their biases to ensure their objective reflective capability.

Philosophical assumptions. It is critical to highlight the philosophical underpinnings of qualitative research to understand that there is no single standard (Ritchie, Lewis, Micholls, & Ormston, 2013):

> Indeed, how researchers proceed depends upon a range of factors including their beliefs about the nature of the social world (ontology), the nature of

knowledge and how it can be acquired (epistemology), the purpose(s) and goals of the research, the characteristics of research participants, the audience for the research, the funders, and the positions and environments of the researchers themselves. (p. 2)

The way that the researcher approaches the qualitative research process is often rooted in their response to these philosophical questions: “what is the nature of the social world and what is there to know about it” (Ritchie et al., 2013, p. 4) and “how can we learn about the social world and what is the basis of our knowledge” (Ritchie et al., 2013, p. 4). Concerning qualitative research, the ontological position of multiple realities (Creswell, 2014) and the epistemological position of working closely with participants to collect subjective data (Creswell, 2014) allows the researcher to use inductive logic to build knowledge “from the bottom up through observations of the world, which in turn provide the basis for developing theories into laws” (Richie et al., 2013, p. 7). By collecting rich interview data from multiple anatomy faculty participants and framing their responses within the context of community of inquiry, cooperative learning, and discovery learning, this study will be positioned to understand how anatomy faculty are facilitating meaningful learning in their blended classrooms.

Research approaches. Within the qualitative design, there are various approaches to inquiry (Charmaz, 2006; Clandinin & Connelly, 2000; Moustakas, 1994; Stake, 1995; Strauss & Corbin, 1998; Wolcott, 2008; Yin, 2009). Creswell (2014) identified five primary qualitative approaches: (a) narrative research, (b) case study research, (c) grounded theory research, (d) ethnographic research, and (e) phenomenological research. This study utilized the phenomenological approach to

explore the lived experiences of anatomy faculty teaching a blended anatomy course. Creswell (2014) describes this approach as:

> [A] design of inquiry coming from philosophy and psychology in which the researcher describes the lived experiences of individuals about a phenomenon as described by participants. This description culminates in the essence of the experiences for several individuals who have experienced the phenomenon. (p. 14)

Phenomenological research typically utilizes interviews to study the 'lived experience' and find shared meaning across individuals that have experienced a common phenomenon (Creswell, 2014; Giorgi, 2009; Moustakas, 1994).

Strengths and weaknesses of qualitative research. Qualitative research is concerned with understanding and explaining social phenomena and relationships, rather than the quantification of data (Queiros, Faria, & Almeida, 2017). A strength of qualitative research is that this interpretive approach allows the researcher in this study to explore the phenomena of blended learning in anatomy education 'from the interior' (Flick et al., 2004) and provides a deep understanding of the perspectives, emotions, and behaviors of anatomy faculty participants at a greater depth compared to quantitative methods (Ritchie et al., 2013).

> Qualitative research is not concerned with numerical representivity, but with the deepening of understanding a given problem. In qualitative research, the researcher is both the subject and the object of his research. The objective of the qualitative methodology is to produce in-depth and illustrative information in order

to understand the various dimensions of the problem under analysis. (Queiros et al., 2017, p. 370)

Although qualitative methods allowed the researcher in this study to work in close proximity to the anatomy faculty participants to gather rich data about their experiences, (Creswell, 2014), this closeness could be considered a weakness if it results in subjectivity due to the researcher failing to separate their own predispositions and experiences from that of the participants (Carr, 1994). The researcher in this study had to bracket her biases to be aware of how her familiarity with the profession and space of anatomy education, as well as her experiences using blended learning strategies in her instruction, might influence the study. Carr (1994) warns against such close proximity: "In its most extreme form this is referred to as 'going native', where the researcher loses awareness of being a researcher and becomes a participant" (p. 718). Close proximity to the subject however is not always negative and may also be viewed as a strength in that it can facilitate a better understanding of the participant (Carr, 1994).

Methodology

The research methodology utilized in this study is phenomenology, a design of inquiry that describes the lived experiences of participants about a phenomenon (Creswell, 2014). Described as having strong philosophical underpinnings (Giorgi, 2009; Moustakas, 1994), the phenomenological research approach uncovers meaning and focuses on the essence of an experience (Creswell, 2014; Moustakas, 1994). Phenomenology is largely grouped into two different types: interpretive (hermeneutic) and descriptive (transcendental) phenomenology (Sloan & Bowe, 2014), each representing philosophical assumptions about experience and differing in how the

phenomenological data will be organized and analyzed (Moerer-Urdahl & Creswell, 2004).

Interpretive (hermeneutic) phenomenology requires the researcher read texts or transcripts of the participants descriptions of their experiences and then 'isolate themes' that can be viewed as explanations of their lived experience (Van Manen, 1997). "So in the application of hermeneutic phenomenology the requirement is to examine the text, to reflect on the content to discover something 'telling', something 'meaningful', something 'thematic' (Sloan & Bowe, 2014, p. 3).

This research study instead utilized the descriptive (transcendental) phenomenological approach, first described by Husserl (1931), who was concerned with discovering meaning and the essence of knowledge and considered any phenomenon to be "a suitable starting point for an investigation" (p.129). Moustakas (1994) considered Husserl's (1931) work in the context of qualitative research:

> The researcher following a transcendental phenomenological approach engages in disciplined and systematic efforts to set aside prejudgments regarding the phenomenon being investigated (known as the Epoch process) in order to launch the study as far as possible free of preconceptions, beliefs, and knowledge of the phenomenon from prior experience and professional studies – to be completely open, receptive, and naïve in listening to and hearing research participants describe their experience of the phenomenon being investigated. (p. 21)

For the purpose of this study, the transcendental phenomenological approach guided research in the framework of setting aside prejudgment (bracketing the biases the

researcher has due to their proximity to blended learning in human anatomy education) and thus seeing the phenomenon newly, so the true meaning of the experience (how meaningful learning takes place in the blended anatomy classroom) can be discovered (Moustakas, 1994).

Strengths. Transcendental phenomenology eliminates the duality between subjectivity and objectivity by permitting the researcher to collect the *subjective* experiences of individual participants, and in doing so, develop an *objective* essence of their lived experience (Moustakas, 1994; Simon & Goes, 2011). Moerer-Urdahl and Creswell (2004) also highlight the consistency of this approach with human science research in that it relies on the individual experiences of participants and tells their story from their perspective, instead of the experiences and perspectives of the researcher. Further, the depth and richness that comes out of the close proximity between the researcher and participant (Carr, 1994) can develop a deeper understanding of the shared meaning behind the lived experiences of anatomy faculty that use the blended approach in their course (Finlay, 2009; Moustakas, 1994).

Weaknesses. The researcher must be diligent in overcoming any challenges to achieving epoch within this approach (Moerer-Urdahl & Creswell, 2004). Achieving epoch depends on the researcher's ability to bracket their own experiences. The researcher in this study teaches human anatomy and utilized blended methods, experiencing the same phenomenon as the participants. Bracketing bias was critical to achieving objectivity in this study.

Research Design

The examination of the phenomenon of blended learning within higher anatomy education in a descriptive qualitative study, such as transcendental phenomenology (Creswell, 2014), allows for the subjective experiences of participating faculty to be captured and analyzed objectively (Moerer-Urdahl & Creswell, 2004) so that in-depth and rich data about their lived experiences can illuminate shared meaning (Moustakas, 1994; Sloan & Bowe, 2014).

Analysis unit. The unit of analysis for this study was defined as a human anatomy faculty instructor who uses blended learning techniques in his or her general human anatomy course. To fulfill identification of a unit of analysis, the following characteristics were identified: (a) currently employed under the classification of faculty at a higher education institution, (b) teach a general undergraduate human anatomy course for at least one semester, and (c) self-identify as using blended learning strategies in their anatomy course.

Population. The population for this study was comprised of anatomy faculty who employ blended learning strategies in their undergraduate general human anatomy course. The population for this study was drawn from an online discussion group called *Teaching Portfolios*, a discussion group facilitated by the Human Anatomy and Physiology Society (HAPS) that is open to the public. The mission of HAPS, a society that is open to anyone interested in anatomy and physiology education, is to promote excellence in teaching within this discipline. HAPS has over 1,700 members that hail from high school, private industry, and both two-year and four-year institutions of higher education.

Sample size. Qualitative research aims to describe the phenomenon as richly as possible (Creswell, 2014). In order to collect such extensive information about each participant, the sample size needs to be small in comparison to a quantitative design (Creswell, 2014; Oppong, 2013). In most cases, it is impossible to collect data from the complete target population of a study (Mack, Woodsong, MacQueen, Guest, & Namey, 2005), so a sample or subset of the population is selected "on the ground that they provide information considered relevant to the research problem" (Oppong, 2013, p. 203). Guetterman (2015) analyzed various phenomenological studies across education and found the mean sample size to be 15 with a range from 8 to 31 interview participants. Creswell (2014) describes the ideal sample size for a phenomenological study to be between 5 and 25 participants, which agrees with Guetterman's (2015) findings. Therefore, this study utilized a sample size of ten participants selected with maximum variation and criterion by use of purposive sampling.

Purposive sampling. The purposeful sampling method was best suited for this study, as it illuminated the ideas, experiences, and practices of a select group of individuals – anatomy faculty, who experience the same phenomenon – the adoption and use of blended learning strategies in higher anatomy education. The logic and power behind purposeful sampling is distinct from probability sampling (Emmel, 2017). The detailed insight provided by the selected cases is of more concern than randomization (an equal chance of all members of a population to be included as a participant in the study) or representativeness (guaranteeing that selected participants have the same shared characteristics from a population) (Emmel, 2017). Therefore, the type of purposive sampling strategy that was used in this study is maximum variation,

as the study chose diverse participants (anatomy faculty from various institutions of higher education) selected by specific criteria and characteristics (teaching a blended undergraduate general anatomy course; Creswell, 2014). Maximum variation ensures a diverse participant pool (Creswell, 2014) which is a particular challenge in qualitative research due to smaller sample sizes as a result of constraints in resources such as time, finances, and ability to analyze data (Patton, 2002). To capture variation in experience with such a small participant pool presents a challenge, and from that challenge arises the questions of how participants' diverse experiences can be compared (Emmel, 2017):

> [T]his strategy purposefully identifies common patterns and core experiences and shared aspects of the cases, while purposefully selecting cases because they varied in quite distinct and marked ways. This strategy allows for the collection of two kinds of data, first detailed descriptions of the uniqueness of the cases, and secondly the shared patterns that cut across cases. These common patterns found in variation provide insight into shared experience. (Emmel, 2017, p. 38)

Participation selection: sampling frame to create a master list. The participants for this study included human anatomy faculty that utilize blended learning strategies in their undergraduate general human anatomy course. Participant selection for this research study began by accessing the publicly available HAPS website: https://www.hapsweb.org.

Participation identification and selection were obtained through the following process:

1. On a web browser, visit https://www.hapsweb.org

2. From the top-right navigation menu, click "Communicate"
3. From the dropdown menu select and click "HAPS Discussion Groups"
4. From the resulting page, scroll down the page to find the list of hyperlinks to the four various HAPS discussion groups
5. Click on the hyperlink of the desired group name ("Teaching Portfolios")
6. From the resulting page, scroll down the page to find the list of two email address hyperlinks
    a) The first listed email address is the following hyperlink: TeachingPortfolios+subscribe@hapsconnect.org - Use this email address (either click the hyperlink or copy and paste into send field on an email browser) to contact HAPS administrators to request to apply to join the discussion group. Participation in this group is open to the public and does not require that you are first a registered member of HAPS.
    b) The second listed email address is the following hyperlink: TeachingPortfolios@hapsconnect.org - Use this email address (either click the hyperlink or copy and paste into send field on an email browser) to post content to the group.

Each potential participant was recruited by the researcher via the posting of a recruitment letter (see Appendix A) to the HAPS *Teaching Portfolios* discussion group. Ten respondents were selected for interviews and were e mailed further recruitment materials including an informed consent agreement (see Appendix B) that were stored

on the researcher's password protected personal computer in a Microsoft Word document.

Criteria for inclusion. To be considered for participation in this study, participants met the following inclusion criteria:

- Were currently employed as a faculty member in higher education;
- Had taught undergraduate general human anatomy for at least one semester;
- Used blended learning in their undergraduate general human anatomy course;

Criteria for exclusion. The criteria for exclusion from this study were as follows:

- Any participant that was a teaching assistant (TA);
- Any participant unwilling to sign an informed consent form;
- Any participant not available to be interviewed prior to February 28, 2019.

Purposive sampling maximum variation. With purposeful sampling, it is important to emphasize that the researcher's objective is to discover insight and understanding of both variation and shared patterns across cases, rather than prioritizing the generalization of findings (Patton, 2002). To ensure a diverse list of participants, maximum variation for heterogeneity sampling were applied to:

1. Gender – which was identified to ensure maximum variation of men and women;
2. Campus location – which was identified to ensure participants were from varying institutions of higher education;
3. Experience teaching anatomy – which was identified to ensure participants are from varying levels of experience in the field;

4. Experience teaching blended courses – which was identified to ensure a broad cross section of blended learning strategies are applied across the participant pool.
5. Institution - which was identified to ensure maximum variation of 2-year and 4-year institutions.

Protection of Human Subjects

All research involving human subjects is required to follow the Pepperdine University Institutional Review Board (IRB) standard for data collection before contacting potential participants (see Appendix C). This research study acted in accordance with the National Commission for the Protection of Human Subjects (The Belmont Report, 1979), Pepperdine University's IRB protocol that protects human subjects, and Title 45, Part 46 of the U.S. Code of Federal Regulations. The researcher completed the CITI Program course certification for the GSEP Education Division Social-Behavioral-Educational (SBE) 1 - Basic Course (Appendix H).

Informed consent. Each participant was provided with information regarding the central purpose of the study, the data collection process, confidentiality procedures, risks and benefits associated with participation, and information that clearly states the voluntary nature of their participation. The following steps were used to obtain informed consent from each participant:

1. Each potential faculty member was recruited through the HAPS discussion group (*Teaching Portfolios*) by the posting of a recruitment letter (see Appendix A) that provided information about the researcher and participation in the study.

a. The recruitment letter included information about the objectives and procedures related to the study, including information regarding the purpose of the study, data collection process, and the need to record participant audio during the interview process.
b. The recruitment letter provided contact information for scheduling interviews and next steps. In addition, the recruitment letter asked respondents to confirm their gender, campus location, experience teaching human anatomy, experience using blended strategies in the anatomy lecture, and information about if the potential participant is employed at a 2-year or 4-year institution to ensure maximum variation.

2. After contact with the faculty member had been confirmed and their willingness to participate identified, the potential participant were e mailed a set of prospective interview dates and be asked to indicate their preference for either phone or online video conferencing for the interview. The email will also include two attachments: (a) the informed consent agreement (see Appendix B) and (b) a copy of the research questions and corresponding interview questions (see Appendix D).
3. The participant signed the informed consent form and sent a copy back to the researcher along with a confirmed interview time and preferred method of contact, prior to the interview.
4. Upon receipt of the signed informed consent document, scheduled interview time, and preferred method of contact, the researcher confirmed these details

once more with the participant and sent a calendar notification.

5. The day prior to the interview, the researcher sent an e-mail reminder to the participant with information about the agreed upon time and method of contact with an attached copy of the interview questions.
6. This process was repeated until all 5 interviewees were conducted.

Confidentiality disclosure. To ensure confidentiality and protect the identity of participants and their respective institutions, the researcher alone had access to the recorded interviews, transcripts of interviews, and any other potential identifying information. All recorded data were stored under a pseudonym to ensure anonymity for all participants and saved on the researcher's private password protected computer. Within three years of the completion of this study, all copies of recordings and transcriptions, both physical and electronic, will be destroyed.

Storage protocol. As noted, all digital recordings and transcriptions were stored electronically on the researcher's private password protected computer and backed up on a physical external hard drive that will remain in the researcher's locked home office. All other physical documents with potential identifying information were stored in a confidential file in the researcher's locked home office. All electronic and physical data will be destroyed within three years of the completion of this study.

Information and any known risks associated with participation. Participation in this study presented minimal risk. Potential risks to the participant might include feeling fatigued due to the length of time required for the interview or feeling uncomfortable answering a question. If the participants wished to withdraw from the study, they could choose to do so at any time without prior notice. To minimize the risk

of breaches in confidentiality, pseudonyms were used for all participants and all electronic data were saved and stored on the researcher's private password protected personal computer. To further minimize the risk of online information hacking, electronic data were stored on a physical external hard drive that will remain in the researcher’s locked home office.

Pseudonyms were chosen using the website babynamewizard.com/voyager, an online name generator that allows the user to select a specific gender and year so that the generator can indicate the most popular names of the time within those criteria. The researcher used this website to input the participant's birth year and gender to generate a list of potential pseudonyms. The chosen pseudonym shared the first initial of the participant to make it easy for the researcher to recognize while still preserve the identity of the participant. For example, if a participant is 60 years old and her name is Deborah, the date entered into the name generator would be 1958 and the gender entered as female. The resulting options included Denise, Donna, Diane, and Dorothy in which the researcher could choose from to use as the pseudonym.

Risk minimization protocol. There were no known risks to the participants in this study, however, if the participant at any time wished to withdraw from the study, they could choose to do so at any time without prior notice. To reduce participant fatigue due to the length of time required for the interview, breaks during the interview were permitted at the participant's request. They could also elect to only answer questions that they were comfortable answering during the interview. To further protect the identity of participants and minimize risk of breaches in confidentiality, only audio from interviews were recorded, and not video.

Voluntary statement. Participation in this study was entirely voluntary and the participant could elect to only answer questions they were comfortable answering and could stop responding at any time they chose to do so. They could withdraw and discontinue participation in this study at any time without prior notice and without repercussion. There were no legal claims or rights being waived by participating in this research study.

Expected benefits. Participants in this study were compensated with both direct and indirect benefits.

Direct incentives. Participants in this study were given a $50 USD gift certificate to Amazon. Those who participated were also offered a copy of the study's findings at no cost. If a participant withdrew during the interview process or chose to not answer a question, the participant still received the $50 USD gift certificate to Amazon.

Indirect incentives. For those participating in this study, the potential indirect benefit to the participant is the knowledge that their participation contributed to an increased understanding of the use of innovative pedagogy in their field and contributed to the body of knowledge that may be used to improve the anatomy student's learning experience.

Data Collection

The process of data collection is a comprehensive process with extensive ethical and procedural considerations. Creswell (2014) outlined the major ethical concerns of qualitative data collection – the researcher must: (a) be aware of their impact and minimize their disruption to the participants and their physical setting, (b) avoid deception and exploitation of participants, (c) respect and have an understanding of the

potential power imbalances between the participant and data collector, and (d) avoid collecting information that violates the privacy of the participant. Although the process of qualitative data collection can take place through various methods including observation, analyzation of documents, and interviews (Paulus, Lester, & Dempster, 2014; Salmons, 2015), this study uses multiple semi-structured interviews, the typical data collection strategy for phenomenological studies (Creswell, 2014). "Researchers who want to understand the complexities of human drama often choose interviews as an entrée into another's inner reflections and thoughts, feelings, perceptions, and responses to the external world" (Salmons, 2015, p. 1).

Interview research is unique in its reliance on direct and immediate interaction between the researcher and participant. All interviews were recorded using Zoom, an audio/video conference software. If there were technical challenges or the participant preferred, the interview were conducted through a phone interview. All video conferencing recorded sessions were stored on Zoom's encrypted cloud server for 72 hours. At the end of 72 hours all digital recordings were downloaded and stored electronically on a password secured laptop and backed up on an external hard drive stored in the researcher's locked home office after which, all data on the encrypted Zoom server will be deleted. The audio from all phone interviews was recorded using a portable recording device that will be stored in the locked home office of the principle investigator. Video was not be recorded in any of the interviews. All participants agreed to be audio recorded prior to participation.

Interview techniques. Salmons (2015) highlights the ability of interviews to draw on the best of human qualities and provide a fullness of exchange between the researcher and participant:

> They demonstrate empathy and respect, and they inspire trust. Interview researchers use thoughtful questioning, sensitive probing, and reflective listening. When individuals respond and share their stories, observant researchers make note of nonverbal signals and listen to verbal expressions. Implications of physical setting and the interviewer's demeanor are carefully considered to develop the rapport and comfort necessary to collect robust data. (p. 2)

The semi-structured interviews employed in this study provided a balance between the preplanned questions of the structured approach while allowing for some of the flexibility afforded in the unstructured interview (Creswell, 2014; Salmons, 2015).

A list of the following detail-oriented follow-up questions as suggested by Patton (2002) was available to the researcher during the interview if there was a need to probe a response to obtain rich data and reach saturation:

- *When* did that happen?
- *Who* else was involved?
- *Where* were you during that time?
- *What* was your involvement in that situation?
- *How* did that come about?
- *Where* did that happen? (p. 372)

Interview protocol. The researcher used of the following detailed interview protocol components for asking questions and recording answers (Creswell, 2014):

- Noting the date, place, interviewer, and interviewee
- Step by step instructions for the interviewer to follow to ensure standard procedures are used across all participant interviews
- A list of the questions in the same order to be used from one interview to another
- Alignment of the guiding research questions and interview questions
- Probes to follow up with participants to elaborate on their response in greater detail

Relationship between research and interview questions. The interview protocol consisted of four open-ended questions informed by the research questions, purpose of the study, and background as outlined in the literature review. The central knowledge areas of the literature review included blended learning in undergraduate anatomy instruction framed within the context of building a community of inquiry and facilitating cooperative and discovery learning experiences.

Validity and reliability of the study. The following validity procedures were employed to ensure accuracy in this qualitative research study (Creswell, 2014):

- Triangulation of *various* knowledge sources and analyzing information to construct to a sound reasoning for themes.
- Use of *member checking* to understand the validity of the qualitative data by presenting the themes to participants so they can contribute input on the accuracy of the findings.

- Transmitting findings with rich and expressive descriptive data.
- Clarification of the researcher's own *bias* – self-reflection facilitates an honest narrative and is considered a core characteristic of good qualitative research.
- Presentation of *negative* or *discrepant information* that may contradict themes by presenting contradictory evidence to account for diverse perspectives.
- Spending *prolonged time* in the field to develop a richer understanding of the phenomenon.
- Use of *peer debriefing* to gain another perspective and interpretation beyond the researcher.
- Use an *external auditor* to review the entire project – an individual separate from the peer debriefer and one who is not familiar with the researcher or the study to gain an objective assessment of the project.

To determine reliability, qualitative researchers must document the data collection protocol in great detail to achieve consistency and allow others to easily follow and duplicate the procedures (Yin, 2009).

The reliability of the qualitative research study and its findings are concerned with the consistency and replicability of the instrument (Creswell, 2014). The Interview Protocol Refinement (IPR) framework refines interview protocol, increasing the consistency and replicability and thus reliability of the instrument (Montoya, 2016). The development of a detailed and vetted interview protocol is critical as it sets the precedent for interviews to follow and replicability of the data collection process (Salmons, 2015). The following Four-Phase Process to IPR framework was utilized in this study:

- Phase 1: Ensuring interview questions align with research questions,
- Phase 2: Constructing an inquiry-based conversation,
- Phase 3: Receiving feedback on interview protocols, and
- Phase 4: Piloting the interview protocol. (Montoya, 2016, p.812)

The presented IPR framework enhances the reliability of the interview protocol, increases the quality of the data obtained from the interviews, and is appropriate for the semi-structured interviews of this study (Jones, Torres, & Arminio, 2014).

Prima-facie validity. The term prima-facie concerns the face-value of the interview questions. The interview questions in this study were informed by the research questions, purpose of the study, and background as outlined in the literature review to ensure the interview questions would focus on illuminating a deeper understanding of the central phenomenon of the study.

Peer-review validity. This study utilized a peer review approach to build credibility (Creswell, 2014) whereby two peers engaged in a close reading of the corresponding interview questions. The researcher identified two peer doctoral candidates from Pepperdine University to act as peer reviewers, chosen based on their experience and familiarity in conducting qualitative phenomenological research as part of their doctoral dissertation. Both peer reviewers were sent a letter invitation by email with an attached copy of the study's research questions and corresponding interview questions for their review (see Appendix E). The original research question and corresponding interview questions are found in Appendix F. After receipt of the feedback from the peer-reviewers, changes were made to the phrasing of the questions within the interview protocol.

***Expert review validity*.** In case the peer review process did not reach a consensus, the researcher's dissertation committee would serve as the expert panel for the validity review process. As the peer review led to a consensus, it was not necessary to utilize the expert panel to review the interview questions. The final resulting research and interview questions include changes from the peer review process. The results and final interview questions (see Table 1) are also listed in Appendix G.

***Instrument reliability*.** Reliability of an instrument suggests that it is consistent (Creswell, 2014). To ensure reliability, the researcher employed:

- *Record keeping.* The researcher employed safe record keeping practices by keeping all electronic data stored on her private password protected personal computer kept in the locked home office of the principle investigator.
- *Pilot session*. To ensure that the interview protocol was reliable, the researcher conducted a single pilot interview with an individual that met the inclusion criteria of the study. The pilot interview allowed the researcher to trial the interview questions to make sure that they could be answered within the given timeframe of 60 minutes. The pilot session also helped the researcher gain experience in using the follow-up question list.
- *Review frequency*. Once the interviews were conducted and the recordings transcribed, the principle investigator reviewed the transcriptions at least two times to ensure they accurately reflected the participants verbal responses in the recordings.

Table 1

Final Research Questions and Corresponding Interview Questions

Research Question	Corresponding Interview Questions
RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?	IQ1: What methods do you use to create meaningful learning experiences for the students in your blended anatomy course? IQ2: What types of problem-based instructional techniques do you use to teach anatomy? IQ3) What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?
RQ2: What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?	IQ4) What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

Data Analysis

Described as having strong philosophical underpinnings (Giorgi, 2009; Moustakas, 1994), the phenomenological research approach uncovers meaning and focuses on the essence of an experience (Creswell, 2014; Moustakas, 1994). For the purpose of this study, the transcendental phenomenological approach guided research in the framework of setting aside prejudgment by means of bracketing (Creswell, 2014) and epoch (Finlay, 2009) to see the phenomenon newly, so the true meaning of the experience can be discovered (Moustakas, 1994).

Epoch. The setting aside of the personal biases identified through bracketing is called epoch (Finlay, 2009):

> The researcher following a transcendental phenomenological approach engages in disciplined and systematic efforts to set aside prejudgments regarding the phenomenon being investigated (known as the Epoch process) in order to launch

> the study as far as possible free of preconceptions, beliefs, and knowledge of the phenomenon from prior experience and professional studies – to be completely open, receptive, and naïve in listening to and hearing research participants describe their experience of the phenomenon being investigated. (p. 21)

The researcher in this study employed reflective practices to continuously reevaluate and bracket her personal biases to set them aside through epoch to objectively approach and carry out this study.

***Statement of personal bias*.** All researchers carry with them beliefs and philosophical assumptions that influence and inform their research (Creswell, 2014). Therefore, the investigator in this study could be considered the instrument through which the data for the study were collected (Poggenpoel & Myburgh, 2003). Because this study utilized interviews, the investigator must be especially rigorous to manage bias due to fact that the study-specific interview questions were created by the investigator rather than employing pre-established survey instruments or questionnaires (Gubrium & Holstein, 2003).

> It is through the researcher's facilitative interaction that a context is created where respondents share rich data regarding their experience and life world. It is the researcher that facilitates the flow of communication, who identifies cues and it is the researcher that sets respondents at ease. (Poggenpoel & Myburgh, 2003, p. 418)

***Bracketing*.** The researcher in this study carried out bracketing, or the act of putting her biases aside (Creswell, 2014). In following the practice of bracketing, this researcher has identified four personal biases in relation to this research study:

1. A decade of experience working within the biological sciences in the discipline of human anatomy, which shapes the way she views pedagogical practice in this field.
2. Based on past experiences of taking general human anatomy through traditional instructional methods as an undergraduate student, has knowledge on the impact of instructionist methods on learning.
3. Based on past and current experience of teaching general human anatomy using student-centered and blended strategies, has knowledge of the impact of these approaches on learning.
4. Strong technological and pedagogical background from enrollment in the learning technologies doctoral program at Pepperdine University that has shaped the way she approaches technology adoption and use of technology in the classroom and across blended learning.

Transcendental phenomenological reduction. The process of transcendental phenomenological reduction includes bracketing to achieve epoch, horizontalizing data by identifying and organizing statements into irrelevant, repetitive, or overlapping data categories, clustering the horizontalized data into themes, and organizing the themes into a logical description of the phenomena (Creswell, 2014; Moustakas, 1994).

***Review of transcription considerations*.** It is critical that the transcripts precisely transcribe the interview recordings and that the researcher possesses a thorough knowledge and understanding of the content of the interview transcripts (Kuckartz, 2014). Therefore, before horizontalizing the data, the researcher reviewed the transcripts a minimum of two times to ensure their precision and to gain an in-depth

understanding of the themes and ideas that may emerge from the data. Prior to horizontalizing data, the participants were invited to review the final version of the transcript of their recorded interview and given the opportunity to suggest edits within 48 hours of their receiving of the transcripts. The edits suggested by participants within the 48-hour time period were included in the data analysis process.

Interrater reliability and validity. To establish the reliability of codes and because the coding process is subjective in nature, a committee of peer reviewers assisted in coding the data (Klenke, 2016). The peer review committee included two doctoral candidate students with experience in engaging in phenomenological qualitative research. After the principle researcher horizontalized the data and clusters those data into themes, the peer reviewers provided feedback about the coding. If consensus was reached between the peer reviewers and principle researcher, the principle researcher used the agreed-upon coding approach in the remaining interviews. If a consensus could not be reached between the peer reviewers and principal researcher, the principal researcher sought feedback from the dissertation committee on how to best approach the coding process.

Other coders. Because the use of multiple coders provides an additional check and external examination on the highly interpretive coding process (Creswell, 2014; Klenke, 2016), reliability was further obtained in this process of utilizing reviewers with significant expertise in phenomenological qualitative research. The principle researcher provided the peer reviewers with a table that organized the horizontalized data and indicated how those data were clustered into various themes so that feedback could be provided and consensus between the peer reviewers and principle researcher could be

reached. This study validated the coding process by the feedback provided and consensus reached by the peer reviewers and principal researcher.

Summary

This study utilized a qualitative transcendental phenomenological approach to discover the essence of the lived experience of anatomy faculty with regard to blended learning instruction. This chapter provided a comprehensive and extensive examination of the research design, methodology, and techniques for conducting valid and reliable qualitative research.

Chapter 4: Findings

The purpose of this study was to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course. This study aimed to explore blended learning instruction through the lived experiences of anatomy instructors to further understand their dilemmas and successes to inform current and future undergraduate anatomy education. To accomplish this purpose, this study examined the following research questions:

RQ1. What are the lived experiences of anatomy instructors with regard to blended learning instruction?

a) What methods are employed by anatomy educators to create meaningful learning experiences in this space?

b) What types of problem-based learning instruction techniques do anatomy educators use?

c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

RQ2. What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

An interview protocol composed of four open-ended questions was developed and utilized to answer the two research questions. The first three interview questions directly informed each of the three sub-categories within the first research question. The fourth interview question directly informed the second research question. The protocol

for the interview was validated through an interrater validity and reliability procedure that included prima-facie validity (concerning the face value of the interview questions) and peer-review validity (two doctoral candidate peers reviewed the interview protocol). The expert review validity process was not utilized in this study due to the peer reviewers reaching consensus regarding modifications to the interview protocol. Reliability of the instrument was achieved by conducting a pilot session (to trial the research questions and gain experience probing for rich responses), employing safe record keeping practices (storing all electronic data in a private password protected computer kept in the locked home office of the researcher), and review frequency (after completion of and transcription of each interview, the researcher reviewed the transcriptions at least two times to ensure they accurately reflected the participants' responses). Through these interrater validity and reliability procedures, the following four interview questions were confirmed and utilized to interview the participants of this study:

1. What methods do you use to create meaningful learning experiences for the students in your blended anatomy course?
2. What types of problem-based instructional techniques do you use to teach anatomy?
3. What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?
4. What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

The individuals that participated in this study were asked to respond to these four open-ended interview questions and to respond in as much detail as they wanted. Overall, the

total responses to the four interview questions presented rich and in-depth information surrounding the experiences of blended anatomy instructors including their successes, challenges, and recommendations. Chapter 4 provides a description of the individuals that participated in this study, the process in which the data were collected and analyzed, and an overview of the interrater review process. Finally, this chapter presents the findings from the data analysis acquired from the participants' responses to the four interview questions.

Participant

Six individuals participated in interviews for this study. All of the participants met the inclusion criteria at the time of their interview and were currently employed as a faculty member in higher education, had taught undergraduate general human anatomy for at least one semester, and use blended learning in their undergraduate general human anatomy course. Of the six participants, three (50%) identified as female and the other three (50%), identified as male. Out of the total six participants, two (33.33%) were employed at a 4-year higher education institution, two (33.33%) were employed at a 2-year community college, and the remaining two (33.33%) were employed at both a 4-year and 2-year institution at the time of the interview (see Figure 4). Experience teaching human anatomy ranged from four years to 45 years across the participant pool, and experience teaching blended courses ranged from four years to 25 years. Saturation was reached after the sixth interview (Swaney, 2018).

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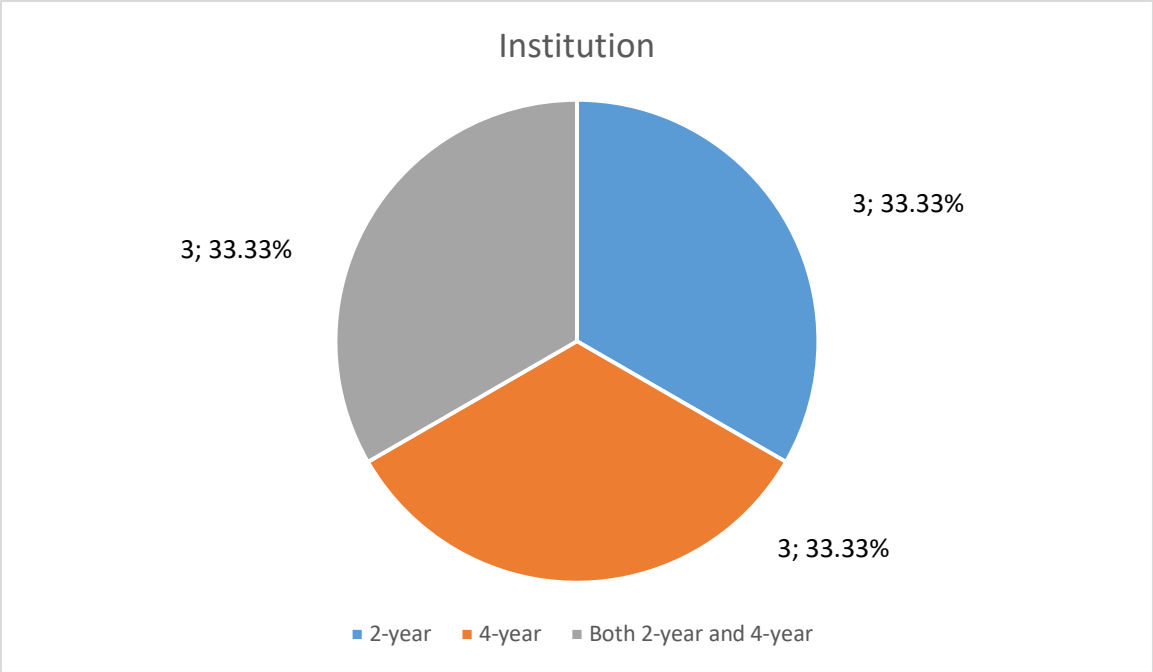

Figure 4. Institution details.

Data Collection

Purposeful sampling was utilized in the selection of participants for this study. The data collection process for the six interviews began with the posting of a standardized recruitment script to the HAPS "Teaching Portfolios" online discussion board. This script gave information on the researcher and served to measure the potential human anatomy faculty participants' interest in participating in the study. After contact had been established and interest shown, the potential participant was emailed the standardized recruitment letter with information on the objective of the study, the data collection process, the nature of the study, as well as informed the potential participant that if they choose to participate that they will take part in a 45-60 minute interview either by Zoom or phone and these sessions will be recorded. Next, the participants were contacted by email to schedule an interview date and time and to confirm that they met all of the criteria for inclusion. Criteria for inclusion was verified by

asking the participant to confirm that they were currently employed as a faculty member in higher education, that they have taught undergraduate general human anatomy for at least one semester, and that they use blended learning in their undergraduate general human anatomy course. The final list of six participants met all criteria for inclusion and maximum variation was met to ensure that a variation of gender, type of institution (2-year and 4-year), years of experience teaching human anatomy, and years of experience teaching with blended methods were included in the sample. Data collection began in early February 2019 after obtaining a full IRB approval in late January 2019 from Pepperdine University. The data collection process for this study was conducted during the month of February 2019 and utilized the approved IRB recruitment script.

During the month of February 2019, the standardized recruitment script was posted to the HAPS "Teaching Portfolios" discussion board. This posting yielded a total of six interviews that were obtained during the month of February 2019. The last of the six interviews took place at the end of February 2019.

Each participant that agreed to participate in an interview for this study was provided a copy of the purpose of the study, the four interview questions, and the informed consent form prior to the interview. All individuals that agreed to participate in the interview were informed that their information would remain confidential throughout the research process. Participants were also informed that all identifying information including any information that may potentially identify their institution would be redacted from the transcript, and that they would be referred to in the transcript with a pseudonym to protect their identity. Before the start of the interview, all participants

were informed that their participation in this study was voluntary and that they have the right to choose to not answer a question as well as the right to request to be removed from the study at any time. The participants were also informed that the interview would take between 45 minutes to 60 minutes. The shortest interview was 47 minutes and the longest interview was 99 minutes. All six of the participants consented to have their interview audio recorded (see Table 2).

Table 2

Participant Pseudonym, Interview Date, Interview Method, and Length of Recorded Interview

Participant (Pseudonym)	Interview Date (Month and Year)	Interview Method (Phone or Zoom)	Length of Recorded Interview (Minutes)
Kate	February 2019	Phone	99 minutes
Eric	February 2019	Phone	71 minutes
Kristen	February 2019	Phone	76 minutes
Richard	February 2019	Zoom	64 minutes
Brandon	February 2019	Phone	52 minutes
Tina	February 2019	Phone	47 minutes

Data Analysis

The collected data were analyzed through the transcendental phenomenological approach to uncover meaning and focus on the essence of the participant's experience (Creswell, 2014; Moustakas, 1994). The researcher set aside prejudgment by means of bracketing biases (Creswell, 2014) and achieving epoch (Finlay, 2009) to see the phenomenon newly, and in doing so, discover the true meaning of the participants' experiences (Moustakas, 1994). The process of transcendental phenomenological

reduction utilized in this study included bracketing to achieve epoch, horizontalizing the collected data in order to identify significant statements by organizing them into irrelevant, repetitive, or overlapping data categories, and then finally clustering the data into themes followed by organizing the themes into a logical description of the phenomena (Creswell, 2014; Moustakas, 1994). Prior to horizontalizing the data, the researcher reviewed the transcripts a minimum of two times to ensure their precision and to gain an in-depth understanding of the themes and ideas that may emerge from the data.

The data for this study were collected through individual recorded interviews with each participant. During the interview, the researcher manually hand-wrote notes regarding thought-provoking details and follow up questions to probe for rich and descriptive data. Upon completion of the interview, the researcher listened to the audio recording to transcribe the interview. To ensure the responses maintained their authenticity, descriptors were utilized to connect and clearly communicate breaks in participant responses that occurred due to the conversational nature of the interview (Fraizer, 2009). The epoch process was followed in which the researcher continuously reflected upon the four identified personal biases in relation to the study to manage those biases and set them aside, to ensure that they did not influence the data analysis process. The transcription process involved the researcher listening to the audio recordings to transcribe them into Microsoft word documents. After the audio recordings were transcribed, the researcher reviewed each transcript twice. Then a line-by-line analysis of the transcriptions took place in order to identify significant statements to make meaning of the data and identify themes. Next, all identifying information was

redacted and pseudonyms were used to identify each participant. Microsoft Excel was used to develop a grid that organized the responses by grouping significant statements by interview question number. The coding process utilized in this study allowed the researcher to develop structured themes from the interview data by grouping codes into common themes. The names for the themes were developed according to the descriptive wording included in the interview transcripts and according to the literature review carried out in chapter two of this study. An interrater validity and reliability process were then used to validate the data analysis process.

Interrater Review Process

In order to validate the data analysis utilized in this study, an interrater review process was conducted by two doctoral candidates enrolled at Pepperdine University in the Doctor of Education in Organizational Leadership program. Both of the doctoral candidates have experience in utilizing the phenomenological approached and have been trained in qualitative research methods and data analysis. Each of the two doctoral candidates acted as a reviewer for the coding process of this study and were given a copy of the Microsoft Excel spreadsheet that contained the grid of coded responses from the interview data and their associated themes. Each reviewer was also provided with a copy of the research questions and corresponding interview questions. The reviewers were each asked to:

1. Review the data in the Microsoft Excel spreadsheet and provide feedback on the significant statements, meaning behind the statements, and consider their thematic designation.

2. Review the data in the Microsoft Excel spreadsheet and provide feedback on the name designation for each theme.

The inter-rater review process resulted in a suggestion to further refine the clusters and narrow down the number of themes used in the data analysis process. The edits were discussed, and consensus was reached. The number of themes for each interview question was narrowed down to a maximum of five based on the feedback (see Table 3). No personal or identifying information about the participants was revealed or shared with the two raters during this interrater review process.

Table 3

Interrater Coding Table Edit Recommendations

Interview Question	**Items**	**Move From**	**Move To**
1	Diagnosing a disease with a group.	Group Work	Active Learning

Note. This table demonstrates the interrater reviewer suggestions regarding changes to the initial coding spreadsheet provided by the researcher.

Data Display

In the sections that follow, the analyzed data and findings will be displayed in numerical order of research question and corresponding interview questions. Details of the themes that emerged from the participants' responses will be further described. A summary will verify the 11 themes that emerged from the four interview questions presented in this study, through the use of supporting significant phrases, statements, or direct quotes by participants, as well as bar graphs to visualize the frequency in which participants responded in corroboration with a specific coded theme. In order to

continue to protect the identity of the participants, throughout this study each participant is referred to by their pseudonym (e.g. Kate, Eric, Kristen, etc.).

Research Question One

The first research question in this study asked, "What are the lived experiences of anatomy instructors with regard to blended learning instruction?" This research question had three subsections: RQ1a) What methods are employed by anatomy educators to create meaningful learning experiences in this space? RQ1b) What types of problem-based learning instruction techniques do anatomy educators use? RQ1c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses? During the interview, participants were asked to provide an answer to a total of three interview questions regarding research question number one. Each interview question corresponded directly with each subsection of research question number one. The three corresponding interview questions are:

- ***IQ1*:** What methods do you use to create meaningful learning experiences for the students in your blended anatomy course?
- ***IQ2*:** What types of problem-based instructional techniques do you use to teach anatomy?
- ***IQ3*:** What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?

The participants' responses to these three interview questions were coded and analyzed for common themes that inform the overall response to this first research question.

Interview question one. What methods do you use to create meaningful learning experiences for the students in your blended anatomy course? A total of four common themes emerged from the analysis of the participants' responses to interview question one. The four themes are: (a) Active learning, (b) Encouragement and support, (c) Technology, and (d) Guiding and facilitating (see Figure 5).

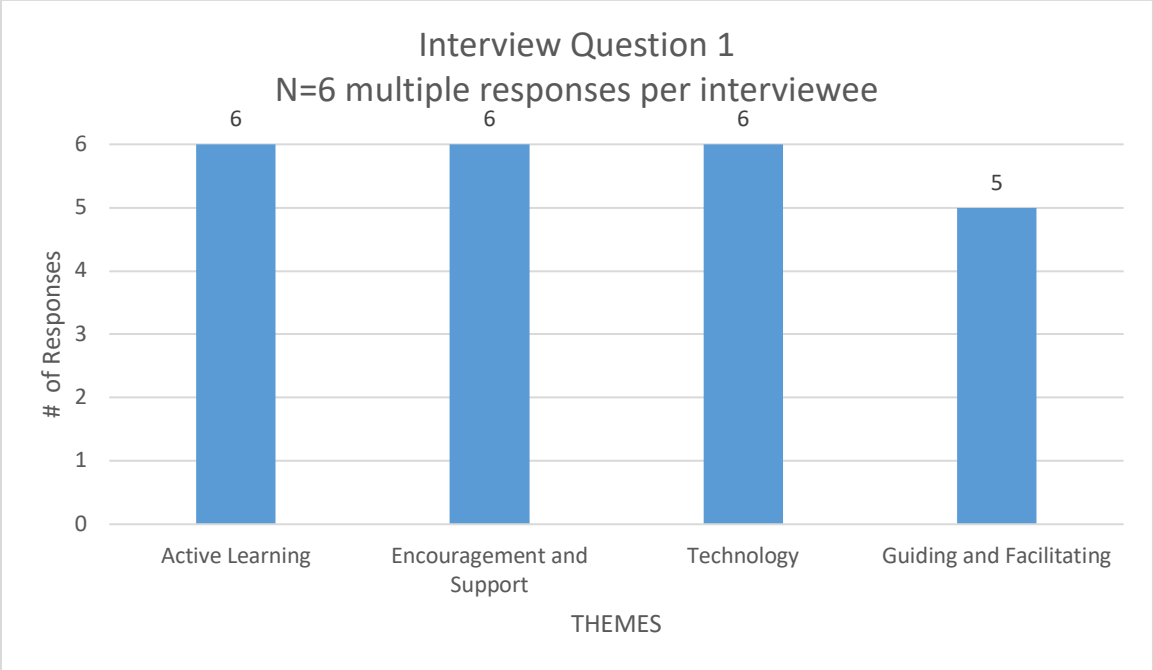

Figure 5. IQ 1: Themes that developed regarding creating meaningful learning experiences for students in blended anatomy courses.

***Active learning*.** Six out of the six participants (100%) indicated that active learning was a critical element in creating meaningful learning experiences for students in their blended anatomy course. Interview question one yielded various significant viewpoints, phrases, or responses that were directly related to creating meaningful learning experiences in blended anatomy higher education. Listed below are the active learning methods shared by participants:

- Encourage group work (Kate, Eric, Kristen, Richard, Brandon, Tina)
- Develop activities that go beyond identification and memorization (Kate, Eric, Kristen, Richard, Brandon, Tina)
- Carefully plan blended activities (Kate, Eric, Kristen, Richard, Brandon, Tina)

All six participants highlighted the importance of structured group work in their classes and developed intentional activities that took students beyond identification and memorization. Eric provided an example of such an activity:

> [The activity has student groups] look for positions and also landmarks on bones and then go in a logical sequence to find one structure and then the next. [The activity describes] the foramen magnum's position compared to the condyles that are at the ten and two position anteriorly. Then it asks what canal passes through the condyles. The station sheet tells students to put their fingers in a certain groove and then move medially until they reach a larger foramen, which is the jugular foramen... that sequence is a good way to interact with the bones and gets them to do more than point and memorize. (Eric, personal communication, February 2019)

Kristen explained how she encourages participation across group members by mixing her students up each period so that they would always work with a new group, by having them "just call off numbers and [then] they're put into groups randomly and then they just work through the activity together" (Kate, personal communication, February 2019). Tina encourages participation by utilizing group work for hands on dissections:

> We do our group work most often in our dissections. We do dissections throughout the whole course, so it actually works really well. It's probably the best

> model of group work because I'll lead everybody in a demonstration and then either take breaks in the demonstration and walk around and spend time with each group. Or I do the demonstration first and then when I've showed them everything, I walk around to make sure everyone's doing it right. Dissections are so hands on that usually everyone participates. (Tina, personal communication, February 2019)

The type of group work described by participants ranged from partner work to collaboration by the entire classroom. Brandon explained that he encourages active in-class partner work by doing "a lot of think-pair-share-activities" (Brandon, personal communication, February 2019) compared to Richard who, in addition to facilitating collaboration in small group sizes, also facilitates discussions across his entire classroom by forcing all of the smaller student groups to work together as one class to solve a common clinical problem that he poses at the start of the class:

> [After presenting the problem] I literally walk out of the room or would wander around the room if they had questions. Then, when we come back together, we would talk about the problem. For quite a while I wouldn’t tell them whether their answers were right or wrong. (Richard, personal communication, February 2019)

Richard further detailed his use of activities that go beyond pure identification and memorization and demonstrated this student-centered approach in his description of the clinical problem scenario he previously described:

> If at the end of the two hours they still don't know it, then the next class we would start where we left off and we would keep going... it was the students

who were really the ones that were keeping the pace of the class going. (Richard, personal communication, February 2019)

Although some imbalances with group member contributions were noted by all six participants, Eric noted that although "there will often be someone that knows more or who is more charismatic or just more talkative in general that may overshadow other students" that group work is still critical because it is "a skill that you need to learn in college - working in groups to some extent, so it [the flipped classroom model] gives them an environment to kind of foster that a little bit" (Eric, personal communication, February 2019).

Encouragement and support. All six of the participants (100%) also indicated that providing encouragement and support to their students significantly contributed to fostering meaningful learning experiences in their blended course. The following statements further elaborate this theme:

- Relate content to life and career goals (Kate, Eric, Richard, Brandon)
- Communicate with students about their progress (Kate, Eric, Kristen, Richard
- Create a positive and collaborative space (Eric, Kristen, Richard, Tina)

Four of the participants indicated that they constantly communicate with students about their progress, successes, and struggles in the course. Kate encourages her students to complete the preparatory activities for the flipped course by monitoring and communicating with students regarding their participation:

On my LMS I can see if they have [watched the video], and if they haven't, I can send them a little message like: hey, I can see you haven't watched this [video],

> make sure you do this before you come to class today. (Kate, personal communication, February 2019)

Richard identified struggling students with quizzes based on the preparatory activities in his flipped course and also provided personalized feedback to his students regarding their progress:

> I would get them [the quizzes] and read them and make notes on them. If a student didn't answer it well, I would just have to put a note on it saying, you didn't really watch the videos. You need to come to class prepared. Once in a while, we as a class would have what I would call a come to Jesus meeting where they would have to know that they're responsible for their own learning. (Richard, personal communication, February 2019)

Four of the participants reported that creating a positive space is essential to the student learning experience in such a rigorous course. Eric detailed how he provided this type of support:

> I try to be as supportive as possible. You kind of have to remind them [the students] that [blended anatomy] it will be difficult, and they see it very quickly. But you also have to be supportive in saying that they *can* do it. They *can* achieve this. They *can* figure things out. (Eric, personal communication, February 2019)

Kristen described how "students are terrified of anatomy and just come in so scared" and so she intentionally tries "to make them not scared to come to class and not scared to ask questions" (Kristen, personal communication, February, 2019). Eric indicated a similar approach to helping his students succeed in his rigorous course:

> There are definitely times where they get down on themselves or down on the class or just feel overwhelmed by the amount of information. But being like their rock, and not being antagonizing and not putting anyone down is important. (Eric, personal communication, February 2019)

Eric further continued to describe how at the end of the semester, he ties the course back to student career goals and encourages them to reflect on their experiences and accomplishments upon completion of the course:

> In the last lecture I give them an overall view of what they've done. I tell them the number of structures they've learned, which is like 1600 structures throughout the semester. It kind of gives them a perspective of what they can achieve and what they will need to do in the future for their nursing program, PT program, or whatever it is. (Eric, personal communication, February 2019)

***Technology*.** The third theme for interview question, one in which all six of the participants (100%) shared, indicated their use of various technologies both inside and outside of the classroom to create meaningful learning experiences in their blended course. The following statements detail the types of technology used by participants:

- Online video lectures (Kate, Eric, Kristen, Richard)
- Digital note taking and feedback (Kate, Kristen, Brandon, Tina)
- Virtual cadaver practice and homework (Kate, Eric, Kristen)

Four of the participants detailed the important role of online video lectures for students to prepare asynchronously for the F2F part of the class. Richard explained how providing the online videos increased his students' accessibility to the lecture content and allowed them to approach the lectures at their own pace:

> I would always tell them, download the videos, don't just listen to them online. That way they could listen to them anywhere and everywhere. They could go back and they could review the class anytime they wanted. They could stop the lecture, back it up, and double check their notes. (Richard, personal communication, February 2019)

Digital note taking and feedback was another prominent shared technology across four of the participants including the use of a learning management system, smartphones, laptops, and tablets by both students and instructor. Kristen described how she uses her iPad in class to create digital drawings as she lectures: "In the past I used the whiteboard, but then you would have to pull the screen up and down each time. I like using my iPad because I can draw directly on the slides" (Kristen, personal communication, February 2019). Kristen further provided an example of how she uses these digital drawings in her course:

> For the meninges, there's a slide that says what the pia mater is. So I use my iPad and draw the pia mater on my picture. Then I go to the next slide and do the same for arachnoid mater. Then the same for dura mater. I'm doing this on a tablet that's being projected during the classroom during my lecture. The students really like it because they can follow along. (Kristen, personal communication, February 2019)

***Guiding and facilitating*.** The final theme for interview question one was shared across five participants (83.33%) and indicates the significance of the instructor's role in guiding and facilitating the learning that takes place in the blended anatomy course. The following statements explain the importance of this role:

- Leading students instead of telling them (Kate, Eric, Kristen, Richard, Brandon)
- Scaffolding the students' experience (Kate, Eric, Kristen, Richard)

Five of the participants specifically described how critical their role as a facilitator and guide is to creating learning experiences where students are led to answers instead of being told them. Eric explained that his "role is to act kind of as a support" (Eric, personal communication, February 2019). When asked to elaborate on this statement, his response was as follows:

> I'm not really supposed to answer questions very directly, but I can help with guiding students to an answer. If they're having trouble finding a structure, I will lead them instead, from one structure to the next, to build up what they know and build up how they could figure something out. That's what I'm really there for. (Eric, personal communication, February 2019)

Four of the participants mentioned the use of scaffolding in their blended teaching. Eric emphasized the importance of scaffolding in his students' learning experience in the lab:

> I like to start at the most basic and build up from there. It's very crucial in my opinion to know the very basic terms, the very basic prefixes and suffixes, so you can apply them to many different things. (Eric, personal communication, February 2019)

When asked to provide an example, Eric provided the following explanation regarding scaffolding in his flipped lab:

> [Students are] expected to know some basic terms before they come to lab. They have a list of structures in their manual that they are supposed to look up definitions for. Those are the terms I usually will use throughout the semester.

> For example, if they know the word foramen, they'll know that is a hole, and that will apply itself to many other things like the foramen magnum, foramen ovale, and transverse foramina. In addition to that, they have other terms like directional terms that could apply as well, like transverse or other terms regarding position or size. That's how I try to approach learning or teaching, at least at this level. (Eric, personal communication, February 2019)

Kristen iterated the significance of the student's experience in being guided to the answers instead of being given them:

> I think that's really important because students tend to remember what they struggled with the most... if you just point to something for the student, they're not going to remember it, whereas if you work them through it, they tend to retain it better. (Kristen, personal communication, February 2019)

Interview question two. What types of problem-based instructional techniques do you use to teach anatomy? After analyzing all six participant responses to the second interview question, two common themes emerged. The two themes are: a) Clinical application and b) Group work (see Figure 6).

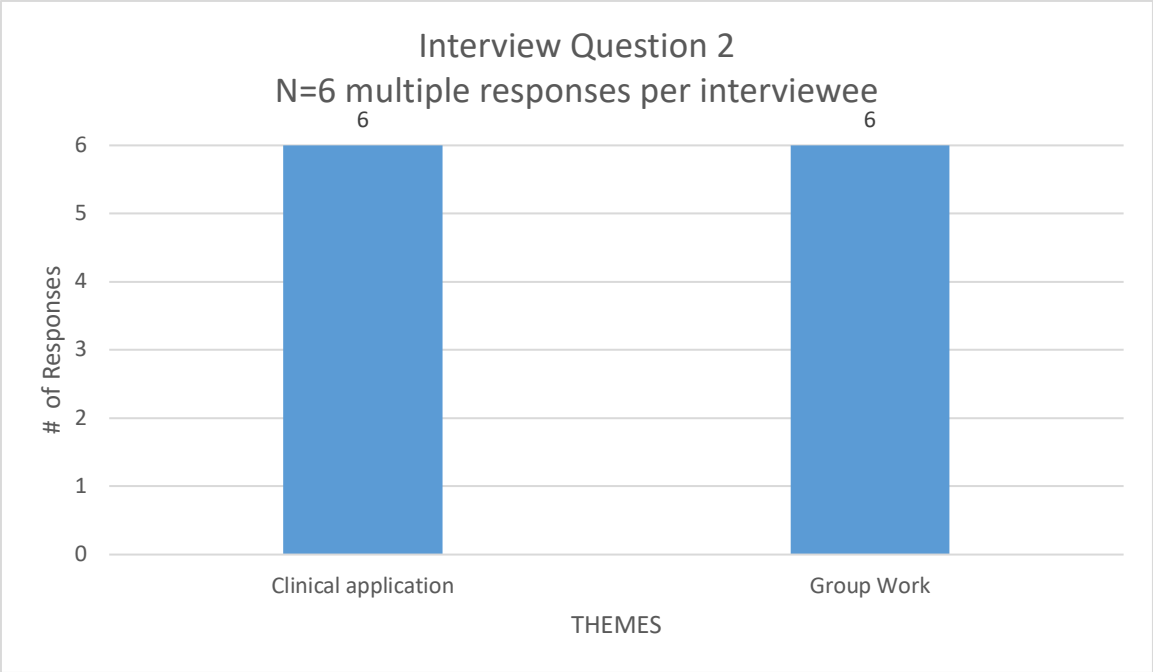

Figure 6. IQ 2: Themes that developed regarding the types of problem-based instructional techniques used to teach anatomy.

Clinical application. This first theme for interview question two was identified by all six participants (100%) as a strategy for incorporating problem-based instructional techniques in their blended anatomy courses. The following statements indicate the two major subdivisions of this theme:

- Clinical problem solving and diagnoses (Kate, Eric, Kristen, Richard, Brandon, Tina)
- Alternative views, planes, and cross sections (Eric, Kristen, Tina)

All six participants stated they utilize some form of clinical problem solving to incorporate inquiry activities in their course. Kate described the following problem-based activity:

> Someone has an injury to this area, what would you expect to be their symptoms, or vice versa, if a whole bunch of symptoms occur, what do you think

> is wrong or what did you learn about that might be causing this? It's a little bit of pathology, like look at these two things that are broken. What might you expect to occur or how might you expect this to work in a healthy human? What happens when it doesn't? (Kate, personal communication, February 2019)

Three of the six participants described their approach for fostering inquiry as one that, in addition to clinical problem solving and diagnoses, also encouraged students to consider alternative views of structures. Eric explained that the activities in his course encourage students to approach structures from "different perspectives, different angles, and with different views, as in having certain tissues removed with certain cross sections or across certain body planes" (Eric, personal communication, February 2019). Kristen iterated how the activities in her course force students to engage in alternate views and to helps students think deeply about the content:

> I find it really helpful to throw different models at them. It's really easy to know the brain from a midsagittal view, but then if you give them a transverse cute, they're completely lost. So I like to give them different models to really prove that they know it and that they didn't just memorize a list of structures from one viewpoint. (Kristen, personal communication, February 2019)

Brandon goes beyond purely clinical problems and specifically acknowledged problem-solving and inquiry in relation to the human experience:

> With all the information I provide, I always make sure I have a clinical application to it. So that's great, we just spent 10 or 15 minutes talking about some topic, but what does that *mean*? I always make sure to relate things to the human experience. Let's talk about a disease or some element or some behavior that

> represents what we just talked about. So you learn all this stuff about the cell or the bone, but lets' scale it up to what that means for the whole organism; the human individual. (Brandon, personal communication, February 2019)

***Group work*.** This next theme for interview question two was also identified by all six participants (100%) as a critical component to problem-based learning. The following statements shared by participants further explore these components to fostering successful group inquiry activities:

- Requiring a deliverable (Kate, Kristen, Richard, Brandon, Tina)
- Balance member participation (Eric, Richard, Tina)

Five participants specified that requiring a deliverable either prior to or upon completion of problem-based group activities positively contributed to students' learning. Kristen explained why she requires her students to prepare a manual prior to attending lab:

> I think it's really helpful [for groupwork] because every student has their lab manual filled out differently and hopefully at least one of them has something to help if they get stumped. (Kristen, personal communication, 2019)

Richard facilitated activities that require students to participate in groups and produce a deliverable upon completion of the problem-based activity:

> The students would turn in a preliminary diagnosis of the patient. That would be the first part of the problem. I would grade it, they would get it back ... the grading was not on the accuracy of the diagnosis, but on the scientific logic of the diagnosis... then when they got the preliminary diagnosis back, they would meet again in class [after gathering more information], with the additional information,

again, they would work as a group. (Richard, personal communication, February 2019)

Richard encouraged individual member participation by requiring the final diagnosis assignment to be an individual assignment, and asked students to "come up with their own individual diagnosis" (Richard, personal communication, February 2019) for submission.

Interview question three. What challenges have you faced in the preparation and implementation of blended learning in your anatomy course? After analyzing all six of the participant responses to the third interview question, two common themes emerged. The two themes are: a) Instructor's role in blended instruction and b) Student resistance to adoption (see Figure 7).

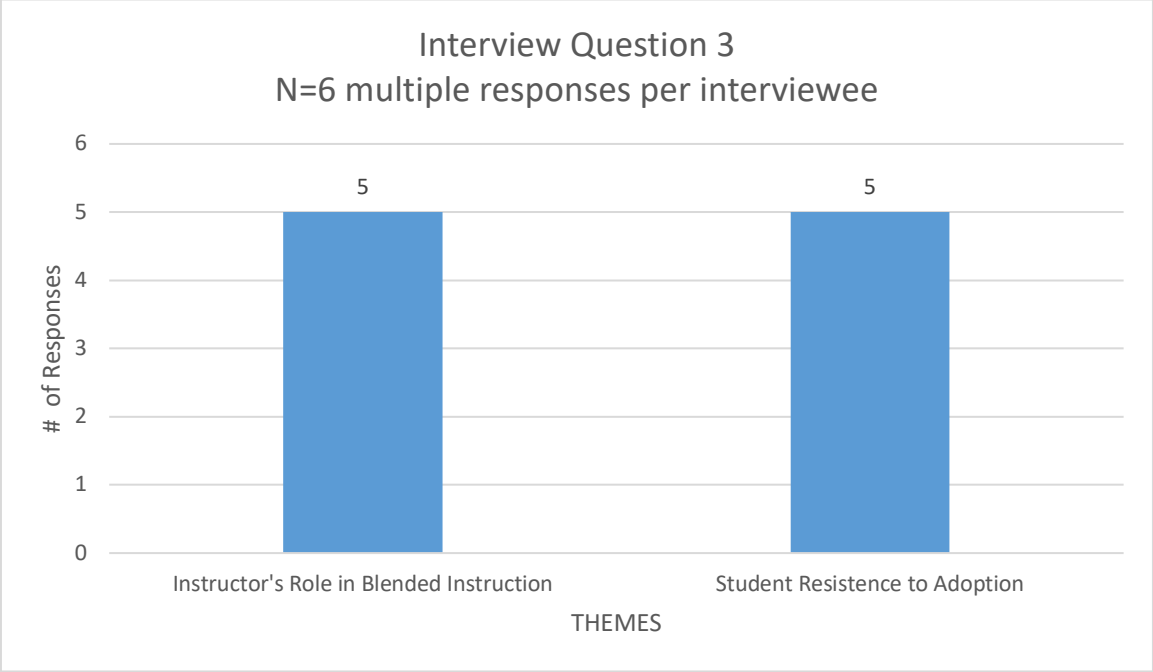

Figure 7. IQ 3: Themes that developed regarding the challenges anatomy instructors face in preparing and implementing a blended anatomy course.

***Instructor's role in blended instruction*.** The first major challenge faced by blended anatomy instructors is associated with their transition to a new role as a facilitator and guide of active learning. Five out of the six participants (83.33%) indicated the challenges associated with adapting to the requirements of their new role as a blended instructor. The following statements provide more depth to the challenges associated with the instructor's role in blended instruction:

- Instructors must learn to give up ownership of the class (Kate, Eric, Kristen, Richard, Brandon)
- It takes time and effort to prepare and implement blended activities (Kate, Eric, Kristen, Richard)

Five of the participants cited challenges they have experienced in adapting to their new role as a leader and guide. Richard explained that "We're all used to standing up in front being what I call the sage on stage and lecturing" (Richard, personal communication, February, 2019). Richard further described his initial fears of giving up ownership of his classroom:

> The most scary thing, at least for and in talking with other faculty members, is giving up ownership of the class. When you're standing up in front and lecturing, you know what they're going to be receiving. But when you're flipping the class and it's discussion based and they're having to listen to the videos on their own... I'm no longer in charge. The students are in charge because they're guiding the discussion. They're asking the questions. They're discussing amongst themselves with their classmates... so there's a little bit of, for lack of a better

> word, fear as far as is this going to work or not. (Richard, personal communication, February 2019)

The volume of work that it takes to create the asynchronous resources and associated F2F activities was another major challenge with regard to the participants settling into their role as a blended instructor. Four of the six participants voiced that the significant amount of time and effort that it took to create those resources was an obstacle. Kate noted the additional challenges associated with creating online video lectures that comply with student accessibility requirements:

> It's all about time for me. When I was first starting to do this, just to post videos, I had to get them close captioned. Getting them in on time and getting them sent back. Accessibility. When you have to do it for my college, there's one place where you're supposed to send your video and if you don't get it in within three or four business days, they just can't have it in time. (Kate, personal communication, February 2019)

Kristen compared blended instruction to traditional and explained that "when there's a blended course, there's a lot more resources that you have to manage" (Kristen, personal communication, February 2019). Richard echoed this thought in his description of his experiences creating the blended resources for his course:

> First of all, it [blended instruction] takes a hell of a lot more time. It takes a long, long time to put those videos together. All of a sudden you're sitting there and you're recording, and you find that you start to hem and haw and make mistakes and things along those lines ... producing the videos and then having to be able

> to produce the material that you're going to use for discussion. It takes an awful lot of amount of time. (Richard, personal communication, February 2019)

Kate reiterated these thoughts: "It always takes way more time than you think it does. Always. Always. Always." (Kate, personal communication, February 2019).

***Student resistance to adoption*.** The second major challenge faced by blended anatomy instructors is student resistance to the adoption of the blended approach. Five out of the six participants (83.33%) indicated that their students struggled to adopt this method of instruction and learning. The following statements further detail the shared ways in which participants experienced student resistance to adoption of blended methods:

- Poor participation in asynchronous activities (Kate, Eric, Kristen, Richard, Brandon)
- Lack of student readiness for the responsibilities of a blended course (Kate, Eric, Kristen, Richard, Brandon)
- Uneven group member participation (Eric, Kristen, Richard)

Five participants reported a lack of student readiness to undertake the responsibilities of a blended course. Eric elaborated on this obstacle:

> One thing that I have been seeing throughout my time teaching is that not everyone is ready for a flipped class. Sometimes they're freshmen, sometimes they're sophomores, and sometimes they could be seniors. So there is a variable amount of experience in being able to gather information independently and apply it. (Eric, personal communication, February 2019)

Brandon iterated this sentiment with regard to varying levels of student experience:

> There's quite a bit of range in terms of previous experience and trying to cater to the students who you don't want to bore to death ... but then you also don't want to leave anybody behind.

Five participants indicated that lack of student participation in the asynchronous preparatory activities created a significant challenge in implementing the blended approach. Kristen describes the consequences of this challenge:

> You'll always have a student that comes in with nothing filled out because they were too busy last night or they had work or something else comes up. Then they just get nothing out of the period whatsoever. It's always better if they prepare themselves. But if they don't, they now have a wasted period. (Kristen, personal communication, February 2019)

Kate detailed her experiences dealing with student readiness and the challenges regarding time commitment required for her students to successfully engage in the asynchronous part of her flipped course:

> I think at my community college, my students are doing other things. They've got 18 units, they've got two schools, they have families, they've got jobs. And when you tell them, hey it's flipped, you need to be spending X,Y, and Z hours outside of the classroom preparing, that doesn't really compute sometimes for them. 10-12 [hours] is a start per week. *Per week*. *Per week.* If we're being honest, it’s just a *start*. (Kate, personal communication, February 2019)

Three of the six participants cited uneven participation amongst groups as a result of students not participating in the asynchronous activities before coming to class.

> In the case of flipped or blended learning, sometimes there will be students that have not prepared at all, and then there will be the students that have really prepared, and it does give good results. But for those you don't prepare, sometimes it's really bad. (Eric, personal communication, Spring 2019)

Kristen elaborated on her experiences in dealing with underprepared students and their lack of contribution to group work:

> There's always at least one student that comes in that doesn't participate in the group or doesn't have their lab manual filled out. That kind of drags their group down at the beginning of the semester ... I don't call them out specifically but have a talk with them at the end of class and say: Now really think to yourself, did you have your lab manual filled out? Did you contribute to your group or did you hurt them? Where they carrying you around or did you actually have something beneficial (Kristen, personal communication, Spring 2019)

Kristen further explained the significance of this obstacle with regard to the skills required of those pursing health or medical careers:

> If someone who is taking anatomy is on the road to being a nurse or medical professional, some type of science-based career, they need to learn how to take responsibility for their own life. I don't think it's my responsibility to come by and tell them, have you studied this bone? How about this bone? What about this bone? *They* have to take the responsibility to use that time. (Kristen, personal communication, Spring 2019)

Research question one summary. Research question one asked, "What are the lived experiences of anatomy instructors with regard to blended learning instruction?" This research question was divided into three subsections: RQ1a) What methods are employed by anatomy educators to create meaningful learning experiences in this space? RQ1b) What types of problem-based learning instruction techniques do anatomy educators use? RQ1c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses? The three subsequent interview questions that were asked correspond directly with the three sub-sections of research question number one. The three corresponding interview questions are:

- ***IQ1*:** What methods do you use to create meaningful learning experiences for the students in your blended anatomy course?
- ***IQ2*:** What types of problem-based instructional techniques do you use to teach anatomy?
- ***IQ3*:** What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?

The three interview question asked in connection to research question number one revealed the best methods and strategies in which blended anatomy instructors can make learning more meaningful for the students in their class, illuminated the various methods in which blended anatomy instructors incorporate problem-based instruction in their course, and revealed the successes and challenges regarding the planning and implementation process of transitioning to the blended approach. The five top themes that were uncovered included Active learning, Encouragement and Support,

Technology, Clinical Application, and Group Work. All of these five themes were referenced by all six participants (100%), expressing the significance of these themes as critical components in fostering meaningful student learning experiences, incorporating problem-based instruction, and facing challenges within the undergraduate blended human anatomy course. The findings from the first research question support the three components of the theoretical framework outlined in the literature review in chapter two: a) Community of Inquiry elements of social presence, cognitive presence, and teaching presence were revealed. b) Cooperative Learning was supported by the structured and intentional group work that was described by participants, and c) Discovery learning was referenced in regard to various forms of clinical problem solving and application. Overall, eight themes emerged from research question number one, and a summary of these eight themes is provided in Table 4.

Table 4

Summary of Themes for Research Question One

IQI. Instructional Methods for Creating Meaningful Blended Learning Experiences	IQ2. Problem-based Instructional Techniques	IQ3. Challenges in Preparation and Implementation of Blended Learning
Active Learning Encouragement and Support Technology Guiding and Facilitating	Clinical Application Group Work	Instructor's role in blended instruction Student's resistance to adoption

Research Question Two

The second research question in this study asked, "What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?" During the interview, participants were asked to provide an answer to one interview question that corresponded directly to research question number two. The corresponding interview question is:

- ***IQ4*:** What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

The participants' responses to this interview question were coded and analyzed for common themes that inform the overall response to the second research question.

Interview question four. What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course? After analyzing all six participant responses to the fourth interview question, three common themes emerged. The three themes are: (a) Expect a challenge, (b) Show you care, and (c) Blended is better (see Figure 8).

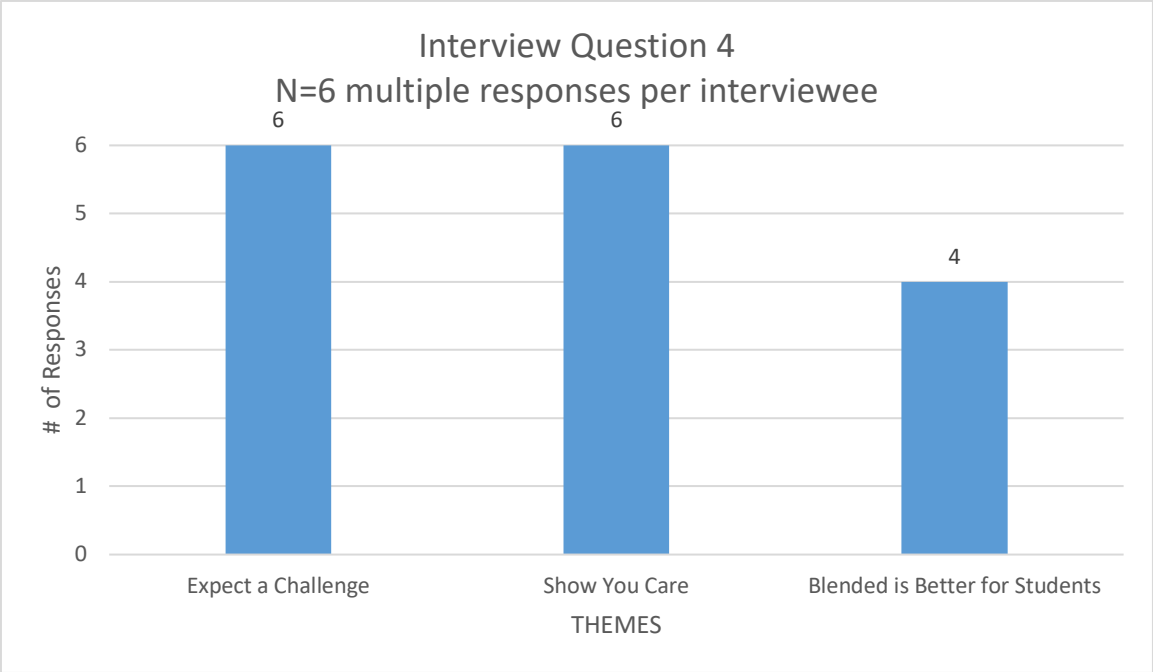

Figure 8. IQ 4: Themes that developed regarding the recommendations for other anatomy instructors that want to adopt blended learning in their anatomy course.

Expect a challenge. The first major recommendation for other anatomy instructors that want to transition to the blended approach is to expect a challenge. Six out of the six participants (100%) indicated that other anatomy faculty looking to make the transition from traditional to blended methods must understand that the process will be challenging. Richard explained this very plainly: "If a faculty member wants to flip a class or do a blended learning class because they think it's going to be easier. They are very sorely mistaken" (Richard, personal communication, February 2019). The following statements further explain the challenges that participants recommend that new blended anatomy faculty should expect regarding the transition from traditional instruction to the blended approach:

- Seek help (Eric, Kristen, Richard, Brandon)
- Expect initial student resistance (Kate, Eric, Kristen, Richard)

- Letting students lead will not be easy (Kristen, Richard, Tina)

Four participants shared ways in which seeking help was critical to their success when they first made the transition to blended methods. The ways in which the participants sought help varied widely. Richard recommended seeking help with the transition by networking:

> Find somebody who has a really, really good background. Be they on campus or through networking. There are a lot of professional organizations. The first one that comes to mind is HAPS, the Human Anatomy and Physiology Society. That is a society that is very much geared towards instructors, classroom pedagogy, and that type of stuff. Networking is probably the best way to do it. Finding somebody who has done it before so you don't have to reinvent the wheel. (Richard, personal communication, February 2019)

Eric described how he sought help by asking other blended instructors about their experiences:

> I asked for help from any of the instructors that did blended. They were very kind to help me out and tell me what they did and how they guided students to answers in contrast to explaining it to them. (Eric, personal communication, February 2019)

Kristen "observed a teacher to see how he did it" (Kristen, personal communication, February 2019). Brandon sought formal pedagogical training and explored literature:

> I took a couple of pedagogy courses where I actually got a certificate in teaching excellence and things like that where we went through many, many different styles of active learning. In reading the literature, we figured out what works, but

> also tested the various styles out in the classes we were teaching. (Brandon, persona communication, February 2019)

Four of the six participants recommended that new blended anatomy instructors prepare themselves to expect initial student resistance:

> With the flipped classroom, there was at first, a little bit of rebellion because they felt that they were putting twice as much time into the classroom. That they had to listen to the lectures online and then they had to come in and go to the regular amount of class at the same time. (Richard, personal communication, February 2019)

Kate explained how students asked her to revert back to traditional practices:

> I got a lot of, hey, could you lecture more? ... Or students saying that the class sucked. It was too hard. I shouldn't have to learn the material on my own. (Kate, personal communication, February 2019)

Eric reported similar experiences with students pushing back against his flipped course:

> There's definitely opposition to it [the flipped method] as well as where they think that we're not teaching them or they think that we're not doing our job or we're not being an instructor and are just expecting them to learn it on their own ... I would say that's the biggest initial challenge, students think that you're not doing your job. (Eric, personal communication, February 2019)

Richard explained that his students start out resisting the problem-based learning that took place in his flipped course, but eventually grew to enjoy it as they became more familiar with the process:

> With problem-based learning, students didn't like it at first because it was more work. It was work on top of what they were doing and they were not thrilled with having to put in the extra work. But then the more that they got into it, and a large percentage of my students in my classes were interested in health professions, the better they seemed to like it. Then as the reputation of the class got around campus, students actually started to look forward to it. (Richard, personal communication, February 2019)

Finally, three of the six participants revealed that letting students take lead in their own learning process will not be an easy transition for the new blended anatomy instructor:

> Blended courses are not easier. I feel like there's this thought that it is easier because now you don't have to teach, you just kind of watch them do it themselves. But you have so many more questions. You have so many more problems. You have to give them the tools ... You have to give them more. (Kristen, personal communication, February 2019)

Tina iterated that utilizing blended methods "requires more classroom management on our part" (Tina, personal communication, February 2019). Richard revealed that:

> There was quite a bit of consternation as to I'm no longer in charge, the students are in charge ... and so there's a little bit of, for lack of a better word, fear as is this going to work or not. (Richard, personal communication, February 2019)

***Show you care*.** The second major recommendation for other anatomy instructors that want to transition to the blended approach is to show that you care. Six out of the six participants (100%) indicated the critical importance of instructors caring about their students' learning experience: Richard laid this idea out very plainly:

"Nobody's going to give a damn what you know until they know you give a damn" (Richard, personal communication, February 2019).

The following statements further detail the recommendations of the participants with respect to caring about students in the course:

- Encourage participation and positive feedback (Kate, Eric, Kristen, Richard, Brandon, Tina)
- Build relationships and trust with students (Eric, Kristen, Richard, Brandon)

Four of the six participants emphasized the importance of building trust and relationships with their students in their blended course. Richard explained how his student-centered approach and teaching philosophy helped to build relationships and trust with the students in his flipped anatomy course:

> I also gave every student in my class my home phone number so that if something came up they could call me 24/7. It was not uncommon for me to get phone calls at two or three in the morning. That was just part of it, and so I think I developed a reputation of being a very student-centered faculty member, and so the students kind of knew by reputation that what was going on in my class was probably for their benefit. I think in the long run, it made the transition to problem-based learning in a totally flipped classroom that much easier... the students knew that I cared about them and that what I was doing was for their benefit. (Richard, personal communication, February 2019)

***Blended is better for students*.** The final major recommendation participants made for instructors looking to transition to the blended approach is to do it because blended is better for student learning in anatomy. Four out of the six participants

(66.66%) stated that blended is the better method for student learning in human anatomy. Below are the phrases that exhibit transitioning to blended learning as a recommendation for future anatomy faculty seeking to employ blended methods in their undergraduate general anatomy course:

- The blended approach teaches students to be responsible for their own learning (Kate, Kristen, Richard, Brandon)
- Go for it (Richard, Brandon)

Four out of the six participants advised future anatomy faculty that the blended approach will provide opportunities for students to learn to be responsible for their own learning. Kate highlighted the importance of this outcome in her course that is predominantly allied health students:

> I firmly believe in a flipped course. I've had students get through my course and then email me a couple of years later saying that, that is what the real world is like when you have to study for your NCLEX. That is what it is. You have to be responsible for it. My class had been the first time they were responsible for their own learning. (Kristen, personal communication, February 2019)

The final recommendation, shared by two of the six participants, stated that anatomy faculty should go for it and attempt the transition to blended anatomy instruction because it is better for student learning:

> Being what sometimes is called the sage on the stage is the Joe Friday form of teaching. What you're doing is you're just giving students facts and you're forcing them to learn how to apply and use those facts on their own. Students won't learn how to problem solve unless you show them how to problem solve. My advice to

> anybody, whether be they a seasoned teacher, or be they a newbie, is stop being the sage on the stage ... and dive in head first and give it one hell of a shot and you'll be amazed at how well it will work. (Richard, personal communication, February 2019)

Research question two summary. Research question two asked, "What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?" The three corresponding interview question asked was:

- ***IQ4*:** What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

The one interview question asked in connection to research question number two, revealed the recommendations that blended anatomy faculty had for other anatomy instructors looking to transition to the blended approach. The two top themes that were uncovered included Expect a Challenge and Show You Care. Both of these two themes were referenced by all six participants (100%), expressing the significance of these themes in the successful transition from traditional to blended anatomy instruction. The findings from the second research question support chapter 2 literature discoveries including the use of the constructivist approach to foster improved student learning experiences in anatomy. Overall, three themes emerged from research question number two, and a summary of these three themes is provided in Table 5.

Table 5

Summary of Themes for Research Question Two

IQ4. Recommendations for Anatomy Instructors that Want to Implement Blended Learning in Their Anatomy Course
Expect a Challenge
Show You Care
Blended is Better for Students

Summary

The purpose of this qualitative phenomenological study was to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course. This study aims to explore blended learning instruction through the lived experiences of anatomy instructors to further understand their dilemmas and successes to inform current and future undergraduate anatomy education. Four interview questions were formed to investigate the following two research questions:

RQ1. What are the lived experiences of anatomy instructors with regard to blended learning instruction?

a) What methods are employed by anatomy educators to create meaningful learning experiences in this space?

b) What types of problem-based learning instruction techniques do anatomy educators use?

c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

RQ2. What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

The data collection process of this study included four semi-structured interview questions. The data were coded and went through a rigorous interrater review process by two doctoral candidate reviewers at Pepperdine University. This interrater review process was utilized to validate the coding results developed by the researcher. The data analysis yielded a total of 11 themes. Four principle themes emerged for methods to create meaningful learning experiences in blended human anatomy including: Active Learning, Encouragement and Support, Technology, and Guiding and Facilitating. All responses except one (Guiding and Facilitating which received a response rate of five out of six participants) received a response rate of six out of six participants (100% participant response rate in RQ1a), the highest possible frequency of response. Two major themes surfaced regarding the use of problem-based learning instruction techniques including: Clinical Application and Group Work, which both received a response rate of six out of six participants (100% participant response rate in RQ1b), the highest possible frequency of response. Two themes regarding the challenges to preparing for and implementing blended anatomy courses were unveiled and included the following: Instructor's role in blended instruction and Student's resistance to adoption. Both received a response rate of five out six participants (83.33% response

rate in RQ1c) and were thus equally the most referenced themes within this subsection of the research question. Finally, three major themes were reveled concerning the recommendations anatomy faculty have for others looking to adopt a blended anatomy course and included: Expect a Challenge, Show You Care, and Blended is Better for Students. Expect a Challenge and Show You Care were the top two themes with a response rate of six out of six participants (100% response rate in RQ2) and were thus equally the most referenced themes within this research question. Table 6 below provides a summary of all of the themes that were revealed through the data analysis process of this study. Chapter five provides further information and details regarding the analysis and findings, implications, recommendations, and finally the conclusion of this study.

Table 6

Summary of Themes for Two Research Questions

RQ1a): Blended Learning Strategies	RQ1b):Problem-Solving Instructional Techniques	RQ1c): Challenges to Adoption	RQ2: Recommendations
Active Learning Encouragement and Support Technology Guiding and Facilitating	Clinical Application Group Work	Instructor's Role in Blended Instruction Student's Resistance to Adoption	Expect a Challenge Show You Care Blended is Better

Chapter 5: Conclusions and Recommendations

The last two decades have been marked by significant curricular reform across the higher education institution. Coupled with emerging technologies of the 21st century, this movement has led to considerable momentum behind the transition towards the adoption of the blended learning approach. Although literature suggest that this innovative approach to instruction and learning is the better suited strategy to meet the highly active student learning objectives of undergraduate human anatomy education, human anatomy as a discipline continues its long-standing didactic traditions. The continued reign of the traditional lecture as the dominant form of anatomy instruction has created a gap in surrounding the use of blended learning in human anatomy. Thus, there exists a danger of anatomy educators attempting the transition to blended learning without thoroughly understanding how it works within the scope of their discipline.

Although the significance of student-centered instruction is widely understood, the ability of educators to be successful in this transition, especially within a discipline where this innovative approach to instruction is not the norm, is questionable. Anatomy educators understand the importance of providing foundational coursework for the next generation of allied health practitioners and recognize the significance of students being able to transfer the knowledge gained in human anatomy to future courses, programs, and practice, yet the active learning and problem-solving experiences that are critical to this application of knowledge are absent from the traditional lecture format of instruction. As a result, some innovative anatomy educators have made the transition from traditional instruction to the blended approach. Although these leaders in blended

anatomy instruction have found significant success in creating more meaningful learning experiences for their students with this innovative and student-centered approach, they have been faced with significant challenges in this massive undertaking of leading the discipline of human anatomy out of the dark of the traditional 16th century anatomy lecture.

As such, the findings of this study sought to add to the existing literature by understanding the experiences of these innovative leaders in blended anatomy instruction by identifying the strategies that they use in their blended course to create meaningful learning experiences for their students, the types of problem-based learning instruction techniques that they apply, the challenges that they face in preparing for and implementing this transition, and finally the recommendations they have for other anatomy instructors that want to implement the same innovative blended approach in their own course. By understanding the experiences of leaders in blended anatomy education, this study was able to identify their dilemmas and successes to provide insight into how meaningful learning happens within that space.

Ultimately, this researched aimed to provide a model for creating meaningful learning experiences for students in blended anatomy education, that higher education anatomy instructors and other leaders in human anatomy education can employ to help them carry out the successful transition to the blended approach. As a result, a set of strategies were identified that aid in the development of this model, built upon the experiences of existing leaders in blended anatomy education, for the successful preparation and implementation of meaningful learning in the blended undergraduate general human anatomy course. Chapter 5introduces this model and its application for

anatomy faculty that desire to implement the blended approach in their own instruction. This chapter provides a summary of the study and findings, a discussion regarding key findings, the implications of the study, recommendations for future research, and the researcher's final thoughts.

Summary of the Study

The purpose of this study was to understand how anatomy faculty create meaningful learning spaces within their blended anatomy course. This qualitative study utilized the phenomenological approach to understand the lived experiences of leaders in blended anatomy education through the theoretical framework of community of inquiry, collaborative learning, and discovery learning to provide insight into how learning happens within that space. The literature review in chapter two guided the development of the two research questions and four open-ended semi-structured interview questions that inform this study. The two research questions restated below:

RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?

a) What methods are employed by anatomy educators to create meaningful learning experiences in this space?

b) What types of problem-based learning instruction techniques do anatomy educators use?

c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

RQ2: What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

Participants for this study were recruited through the posting of a recruitment script to a public HAPS (Human Anatomy and Physiology Society) discussion board to identify anatomy faculty that implement the blended approach in their undergraduate general anatomy courses. A purposeful sample of six participants was identified. Maximum variation was achieved by selecting a diverse group of participants. The length of experience teaching human anatomy with blended methods across the six participants ranged from four years to 25 years and at the time of the interview, included two faculty who were employed at two-year institutions, two faculty who were employed at four-year institutions, as well as two faculty serving at both. Overall teaching experience in the discipline of human anatomy ranged from four to 45 years. Half of the participants identified as male and the other half of the participants identified as female.

The data collection process of this study was carried out through individual interviews with all six participants and consisted of four semi-structured interview questions. Prior to the interviews, an interrater and validity process was utilized to validate the interview questions. The data collection instrument underwent a rigorous process in which the validity and reliability of the instrument was obtained through prima-facie validity, peer-review validity, and instrument reliability. Data collection from participant interviews was carried out through audio recordings of the interviews followed by transcription of the interviews into Microsoft Word documents. After careful review of the transcripts, the data were analyzed and coded to reveal common themes.

An interrater review process was utilized once more to validate the codes and themes that emerged from the data. Finally, the findings of the study were summarized and the frequency of emergent themes was displayed using bar charts to report shared experiences across each theme.

Summary of the Findings

The data analysis process was guided by the significant statements and findings collected from the six participant interviews. All six participants self-identified as blended anatomy instructors and reported experience using blended methods in their anatomy course between four and 25 years. At the time of the interview, four of the six participants were teaching a completely flipped anatomy course. The remaining two participants reported the use of blended methods in their partially flipped anatomy course. During the interview process, this diverse group of experts and leaders in blended human anatomy instruction described their experiences with the blended approach, after which eleven themes emerged from the coding and analysis process. The themes with the highest frequency for each interview question are outlined in the following subsections.

IQ1: Methods used to create meaningful learning experiences for the students in blended anatomy. The following themes received a response rate of six out of six participants (100%):

1. **Active learning**: Developing activities that intentionally facilitate interactive group work and encourage students to go beyond memorization and identification of structures.

2. **Encouragement and support**: Communicating with students to encourage accountability and progress in the course and relating the content to both life and career goals to inspire student success and create a positive and collaborative space for students to safely engage with one another and the instructor.

3. **Technology**: Increasing accessibility by utilizing online video lectures, providing personalized feedback using an LMS, the use of virtual cadaver software and applications, and digital note taking and drawing including the use of smartboards, iPads, and tablets.

IQ2: Types of problem-based instructional techniques used to teach blended anatomy. The following themes received a response rate of six out of six participants (100%):

4. **Clinical application**: Utilizing clinical problem solving and diagnoses type activities as well as presenting structures from alternative views, planes, and cross sections to encourage students to think deeply about the content and practice application in a relevant way.

5. **Group work**: Intentionally structuring group activities to include both individual and collective contributions to a group task or deliverable to facilitate and incentivize balanced member participation.

IQ3: Challenges faced in the preparation and implementation of blended learning in anatomy. The following themes received a response rate of five out of six participants (83.33%):

6. **Instructor's role in blended instruction**: Transitioning from a 'sage on stage' to a facilitator and guide of active learning requires instructors to have to learn to

give up ownership of the class. This new role requires a significant amount of time and effort on the instructor's part to prepare, connect, and implement the asynchronous content and student-centered F2F activities required of a successfully blended course.

7. **Student's resistance to adoption**: Students are generally unfamiliar or inexperienced with the blended approach and will initially struggle to carry out the asynchronous preparatory tasks, which can lead to uneven group member participation and overall unreadiness for the F2F part of the course.

IQ4: Recommendations for anatomy instructors that want to implement innovative blended learning in their anatomy course. The following themes received a response rate of six out of six participants (100%):

8. **Expect a challenge**: The transition to blended methods is not an easy one. Expect students to initially resist the approach. Seeking help is critical in planning and creating blended resources and implementing blended activities.

9. **Show you care**: Building relationships and trust with students and communicating with them and providing feedback about their progress will motivate and encourage them to trust the process of the blended approach.

Discussion of Key Findings

By directly asking leaders in blended anatomy education for their recommendations regarding the preparation and implementation of the blended approach, and by illuminating the strategies, practices, successes, and challenges of a successfully blended course, the findings of this study are intended to provide a greater understanding of how meaningful student learning happens in higher blended anatomy

education. These findings provide ultimately provide direction for anatomy educators looking to adopt the blended approach in their own undergraduate general human anatomy course. The discussion of key findings will provide a comparison between the findings of this study and the current body of literature as outlined in the literature review in chapter two as well, as present explanations of specific themes based on the response rate of the six participants.

RQ1: The lived experiences of leaders in blended anatomy instruction. In order to explore the lived experiences of leaders in blended anatomy instruction, a total of eight themes emerged and the following three questions were explored:

RQ1a) Methods used to create meaningful student learning experiences. A total of four themes emerged from the gathering of methods and strategies employed by leaders in blended anatomy education to create meaningful learning experiences for students in their blended anatomy course. The top three themes received the highest possible response rate of six out of six participants and included: Active Learning (100%), Encouragement and Support (100%), and Technology (100%).

All six participants indicated that a top strategy in creating meaningful learning experiences for students in blended anatomy is to employ active learning. Key findings of this study establish the development and use of activities that go beyond identification and memorization as critical to creating meaningful learning experiences for students in blended anatomy (Kate, Eric, Kristen, Richard, Brandon, Tina). The careful planning and intentional linking together of asynchronous activities to their respective active learning F2F counterparts is vital for deep learning to take place in that space (Kate, Eric, Kristen, Richard, Brandon, Tina). The use of group work of some kind

inside and/or outside of the blended anatomy classroom, and especial the deliberate construction of these group activities so that they hold the individual student accountable for the contributions while also involving all group members working towards a common goal, whether that be solving a problem or producing a deliverable, is critical to achieve maximum participation (Kate, Eric, Kristen, Richard, Brandon, Tina).

Research confirms the critical importance of constructivist activities in allowing for engagement and the application of knowledge so students can make sense of the subject matter, which will ultimately lead to deeper learning than traditional instruction alone (Cobern, 1993; Dewey, 1938; Piaget, 1963; Tobin, 1993; Yager, 1991). The importance of linking the asynchronous lecture to the F2F activities iterates the notions put forth by Gogalniceanu et al. (2010) and Lochner et al. (2016) in that inquiry based and collaborative learning approaches such as problem-based learning can only have a reflective role if students are already knowledgeable about the facts behind the problem in question, necessitating the careful connection between the two relevant formats of the blended approach. The results of this study support the thoughtful planning of F2F activities as essential to reaping the benefits of the blended approach (Cook, 2006; Gogalniceanu et al., 2010; Harden, 2008; Khogali et al., 2011; Lim & Morris, 2009; Williams et al., 2011). This study places the group work that takes place within the blended anatomy classroom within the spectrum of cooperative learning, an approach to collaboration that has been described as "the most carefully structured end of the collaborative learning continuum” (Smith & MacGregor, 1992, p. 15). The elements of group work in the successful blended anatomy classroom that were revealed in the

findings of this study closely paralleled the fundamental components to cooperative learning as outlined by Nelson (2010) who considered cooperative learning from the perspective of inquiry-based labs within the biological sciences.

All six participants also reported that being both encouraging and supportive of students is a critical component to achieving meaningful learning in blended anatomy courses. Communicating with students about their progress in the course including giving advice regarding strategies on how to asynchronously prepare for the F2F, managing student expectations by breaking down the required time commitment to prepare for F2F, and providing continuous opportunities for formative assessment and feedback are all vital elements to helping students navigate through what is likely their first ever blended course (Kate, Eric, Kristen, Richard). This communication lays a foundation for blended anatomy educations to relate content to their students goals in both their career and life (Kate, Eric, Richard, Brandon) and ultimately create a positive and collaborative space that excites students and empowers them to take control of their own learning (Eric, Kristen, Richard, Tina).

The merging of social presence, cognitive presence, and teaching presence as the three foundational elements of building a community of inquiry within blended learning environments (Garrison et al., 2001; Garrison & Kanuka, 2004) supports this study's findings that by shaping constructive exchange (teaching presence), fostering an environment that facilitates open and risk-free communication and learning (social presence), and encouraging students to apply their ideas and exchange information to explore relevant topics in their lives and future careers (cognitive presence), more

meaningful learning will take place in the blended anatomy classroom compared to traditional anatomy instruction.

All six participants also described the crucial role that technology plays in blended anatomy instruction and student learning. Digital note taking by both the instructor and student through the use of smartboards, iPads, tablets, and smartphones, as well as providing personal feedback to students immediately through the digital grading features of a learning management system (LMS), contribute to improved student engagement both inside and outside of the classroom (Kate, Kristen, Brandon, Tina). Online video lectures contribute to more meaningful learning experiences because they provide anatomy students with increased accessibility to lectures and allow students to take in and review the content at their own pace (Kate, Eric, Kristen, Richard). In addition to video lectures, virtual cadaver software is heavily relied upon by students both inside and outside of the classroom and is a relevant piece of technology for both anatomy programs that do and do not have wet-lab cadaver programs on campus (Kate, Eric, Kristen).

The use of these respective technologies within the findings of this study parallels the uses and capabilities surrounding these technologies in literature with regard to improved instruction, engagement, and accessibility. 21st century technologies available to the innovative anatomy educator include: (a) the increased ownership and use of mobile phones and other hand held devices due to their expanded capabilities (Franko & Trillel, 2011; Trelease, 2008), (b) the widespread popularity of virtual cadaver dissection programs and applications (Saltarelli et al., 2014) due to the increased accessibility and affordability compared to traditional wet-lab

dissection (Simpson, 2014), (c) the interactive capabilities of LMSs that allow educators to distribute course content to students online, communicate in discussion boards and emails, carry out assessments, post videos, and manage grades (Rhode et al., 2017), and (d) the use of online instructional videos as the dominant method of asynchronous pre-class content delivery in the flipped anatomy course (Bishop & Verleger, 2013; Jensen et al., 2018; O'Flaherty & Phillips, 2015).

RQ1b) Types of problem-based instructional techniques. A total of two themes emerged from the investigation of the various strategies and practices that leaders in blended anatomy education employ to facilitate discovery and inquiry through problem-based instruction in their blended anatomy course. Both of the two themes received the highest possible response rate of six out of six participants and included: Clinical Application (100%) and Groupwork (100%).

All six participants indicated that clinical application was the dominant form of instruction for incorporating problem-based learning in their blended anatomy course. Clinical problem solving in blended anatomy can take the form of (a) relating structure to function, (b) exploring functional pathways like skeletal muscle contraction, the pathway of sight and sound, or the digestive pathway, (c) diagnosing of disease states from a list of symptoms, and (d) the reverse diagnosis problem (presenting students with an injury so they can predict the symptoms) (Kate, Eric, Kristen, Richard, Brandon, and Tina). Other methods of problem solving outside of clinical problem solving in blended anatomy include approaching structures from alternative views including (a) identification and palpation of surface anatomy, (b) visualizing various planes including superficial and deep views, and (c) multiple and unexpected cross sections to force

students to think about the structure in 3 dimensions and its relationship to adjacent structures (Eric, Richard, Tina). Key findings of this study establish that the use of these problem-based instructional activities take the student beyond memorization and result in deeper and more transferable anatomy knowledge.

Discover learning is an inquiry-based approach to learning where the student utilizes their existing knowledge to interact with content, explore questions, discuss ideas, perform experiments, and discover relationships and facts for themselves (Bruner, 1961). Opportunities for discovery learning in anatomy include problem-based learning, simulation-based learning, case-based learning, and incidental learning, all of which invoke a strong cognitive presence, a critical element in the building of a community of inquiry. Although findings presented elements of all four of these outlets of discover learning, problem-based learning was the most frequently referenced and highest recommended form of incorporating critical thinking and problem solving amongst participants. These findings iterate the benefits of problem-based learning in that students learn best when knowledge is centered around a problem in a context that is relevant to the field of practice (Tawfik et al., 2013). Problem-based learning experiences allow students to engage in investigating ill-structured problems that have multiple solutions, and in doing so, learn both the concepts and the problem-solving skills relevant to their community of practice (Hmelo-Silver & Eberbach, 2012).

All six participants also indicated that group work was an essential part of problem-based instruction in their blended anatomy course. Structured group work that divided students into small groups and included elements of (a) the group having to achieve some sort of a goal, (b) the task being divided across all members, (c)

individual members being held accountable for contributions, and (d) a requirement for a collective group product, best managed group member participation during problem-solving activities (Eric, Richard, Tina). Requiring a deliverable is a substantial motivator to encourage participation and engagement in the problem-solving activities that take place within the blended anatomy course (Kate, Kristen, Richard, Brandon, Tina).

The structured group work discussed in the findings of this study support the use of cooperative learning in the blended classroom and correspond to Bishop & Verleger's (2013) summary of the three fundamental parts of cooperative learning as described by Foot and Howe (1998) including (a) students working together in teams to achieve a specific goal, (b) the labor is divided between the team members in a way that forces each individual to take responsibility for a different sub-goal, and (c) the individual contributions of members are finally pooled into a final product to provide a way of making sure the final goal is met.

RQ1c) Challenges in the preparation and implementation of this approach. A total of two themes emerged from the illumination of the various challenges that blended anatomy educators face in the preparation and implementation of the blended approach. Both of the two themes received a response rate of five out of six participants and included: Instructor's role in Blended Instruction (83.33%) and Student's Resistance to Adoption (83.33%).

Five of the six participants indicated that transitioning from their role as a traditional instructor into their new role as a blended instructor proved to be a significant challenge in both the preparation and implementation of the blended approach. A considerable challenge for new blended anatomy instructors is learning to give up

ownership of the class. This transition from a 'sage on stage' to a facilitator and guide of student-centered learning results in some initial level of uncertainty and sometimes fear regarding the pace of the class and the learning taking place (Kate, Eric, Kristen, Richard, Brandon). The development of the activities utilized by students in the F2F class as well as the creation of the asynchronous content (including online video lectures) present a sizable obstacle in the transition from traditional instruction to blended instruction due to the extensive amount of time and effort that it takes to prepare and implement these resources (Kate, Eric, Kristen, Richard).

Video lectures are the ideal method for delivery of asynchronous information due to evidence that they are as effective as in-person lectures when conveying fundamental information (Cohen, Ebeling, & Kulik, 1981; McNeil, 1989). The undertaking of creating a complete video library is a considerable task, as confirmed by the findings of this study. Due to asynchronous video instruction providing the fundamental information that the traditional lecture would normally deliver synchronously (Lage et al., 2000), the F2F time in a flipped course is left open for active group-based discussions and problem-solving activities where the student, rather than the instructor, is the center of focus (Lochner et al., 2016; Moreno & Mayer, 2007; Singh & Min, 2017; Wouters et al., 2007). The findings of this study reveal this 'flip' of synchronous and asynchronous activities and the transition away from a teacher-centered towards a student-centered classroom is initially challenging.

Five of the six participants also revealed that student resistance to the blended approach provided significant challenges, especially at the start of the course. There is an overall initial lack of student readiness for the responsibilities of a blended course

(Kate, Eric, Kristen, Richard, Brandon). For most blended anatomy instructors, their course will be their students' first experience with the blended approach. Poor time management, discipline, and consistency leads to poor participation in asynchronous activities (Kate, Eric, Kristen, Richard, Brandon). A lack of participation in the asynchronous activities leads to uneven group member participation (Eric, Kristen, Richard). This chain reaction effect is a serious challenge and obstacle to the success of the blended approach.

Student perceptions of blended learning differ based on achievement level (Owston et al., 2013). Owsten et al. (2013) found that high achievers gravitated towards the format of the blended courses, finding the blended approach to be more convenient and engaging compared to low achievers who struggled to cope with the blended format and did not have the same positive experience as their high achieving peers. The effect that the readiness of the student has on their success in blended anatomy learning as cited in the findings of this study, parallels this illustration of the meaningful impact that student achievement level has on student perspectives of the blended approach.

RQ2: Recommendations to implement the blended approach. In an aim to acquire an understanding of the recommendations that leaders in blended anatomy education had for other anatomy educators looking to also adopt the blended approach, a total of three themes emerged. The top two themes received the highest possible response rate of six out of six participants and included: Expect a Challenge (100%) and Show You Care (100%).

All six of the participants warn future blended anatomy instructors to expect a challenge. Initially, letting students lead the class will be challenging (Kristen, Richard,

Tina) and blended anatomy instructors should expect initial student resistance to the blended approach (Kate, Eric, Kristen, Richard). Seeking help through observations, colleagues, professional organizations and societies, and networking with other blended anatomy structures is critical to overcoming the initial challenges of transitioning to a blended model.

All six of the participants also recommend that future blended anatomy instructors simply show their students that they care. Encouraging students to participate in the asynchronous activities through ample communication and positive and encouraging feedback increases student accountability (Kate, Eric, Kristen, Richard, Brandon, Tina). By taking the time and effort to build relationships and trust with students through mutual respect, accessibility, kindness, and support, students will grow to trust the blended process as a result of trusting that their instructor cares and is using the blended model for their benefit (Eric, Kristen, Richard, Brandon).

The findings of this study illustrate the critical importance of actively encouraging student accountability. Technology-mediated instruction contributes to accountability in getting students to construct their own knowledge and improve their overall perception of and performance in the course (Bazelais & Doleck, 2018; Duffy & McDonald, 2008; Gopal et al., 2010; Okojie et al., 2006). Further, the findings of this study illuminate the necessity of simply caring about students and building trust so that they ultimately trust the blended process as a function of trusting the instructor. Due to *retention* and *transfer* being two of the most important educational goals (Mayer, 2009), onboarding students to positively view and adopt the blended approach is a powerful objective.

Implications of the Study

The objective of this study was to understand the experiences of innovative leaders in blended human anatomy instruction to identify (a) the various strategies that they use in their blended course to create meaningful learning experiences for their students, (b) the types of problem-based learning instruction techniques that they apply, (c) the challenges that they face in preparing for and implementing this transition, and (d) the recommendations they have for other anatomy instructors that want to implement the same innovative blended approach in their own course. By understanding the experiences of leaders in blended anatomy education, this study was able to identify their dilemmas and successes to provide insight into how meaningful learning happens within that space and inform current and future anatomy education. As such, the findings of this study can be used to develop best practices for preparing and implementing blended anatomy instruction at the higher education institution for both existing blended anatomy educators and those looking to transition to this innovative approach.

As a result of this study, a set of best practices for fostering meaningful learning experiences in blended anatomy education was identified. The findings of this study allowed for the construction of a pyramid for facilitating retention, transfer, and meaning with respect to student learning, built upon the experiences of leaders in blended anatomy education.

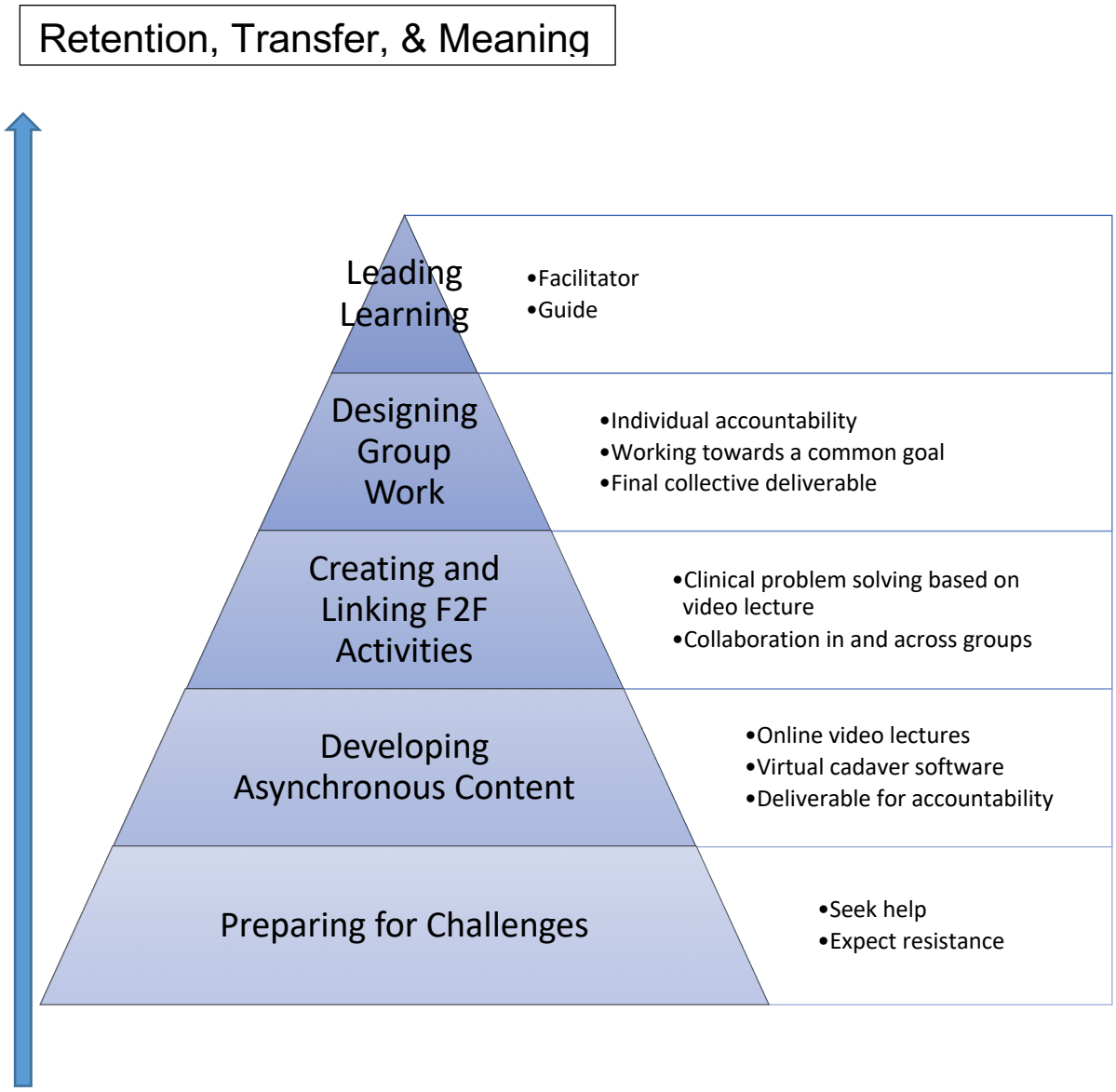

Figure 9. Nobles pyramid for retention, transfer, and meaning (RTAM). Copyright 2019 by Mia Nobles.

The pyramid has five primary components: (a) Preparing for Challenges, (b) Developing Asynchronous Content, (c) Creating and Linking F2F Activities, (d) Designing Group Work, and (e) Leading Learning (see Figure 9). The five components of the Nobles Pyramid for Retention, Transfer, and Meaning (NPRTAM; Nobles, 2019), provide an informed map to successfully preparing and implementing the blended approach in general undergraduate human anatomy education. Each component has

key elements that contribute to the success of each respective stage in the pyramid. Each component is designed to build upon the foundation of the pyramid and previous components, and with every step, the blended anatomy educator is closer to achieving the goal of retention, transfer, and meaning with respect to student learning in blended anatomy instruction. Once achieved, sustaining the goal of retention, transfer, and meaning requires blended anatomy educators to continuously assess new challenges in instruction as well as advancements in the field of anatomy. This dynamic process requires continuous updating of the asynchronous content and thus associated updates across the linked F2F activities, group work design, and the role that the instructor will play in leading learning for that activity. The progressive and dynamic nature managing educational resources and continuously adapting based on feedback and changes in the field makes the NPRTAM (Nobles, 2019) relevant to both current and future blended anatomy educators.

***Implications for diversity in STEM*.** Although diversity in the sciences is slowly improving (Lim et al., 2013), it is imperative that anatomy faculty make concerted efforts to support students who have been historically marginalized and are at-risk for dropping, withdrawing, or failing human anatomy, due to the critical position human anatomy has as a prerequisite course in the majority of allied health professional programs including nursing, physician's assistant, physical therapy, pathologists assistant, dental hygiene, and pharmacy school admissions (Ash, 2012; López-Pérez et al., 2011; Mattheis & Jensen, 2014; Owston et al., 2013; Pereira et al., 2007; Claire France Smith & Mathias, 2011). This outcome of student success and overall student experience in human anatomy has major implications for diversity in the sciences due to

anatomy's status as a critical prerequisite course to allied health programs across the United States (Bishop & Verleger, 2013; Mattheis & Jensen, 2014). Faculty who utilize the blended approach can support inclusion by helping their students not only pass the course and continue towards their allied health career goals, but also in providing students with a meaningful anatomy knowledge that will be transferable to their future allied health programs, while helping them build the skills that they need to grow into competent, confident, and independent learners (Weaver et al., 2016).

***Implications for nursing and allied health education*.** The need to provide pre-nursing students working and transferable knowledge of human anatomy is critical (Mitchell, 2003). As a foundational course requirement of nursing and a multitude of other allied health career paths (Brown et al., 2016; Brown et al., 2017; Sturges & Maurer, 2013), it is critical that anatomy educators recognize the great responsibility of introducing students to a subject that will be relevant in their not only their academic preparation, but also in their professional career and personal life (Breckler & Joun, 2009). Students must develop a foundational anatomy knowledge that is deep and flexible enough to be able to apply what they have learned (Smith & Mathias, 2011). This transfer of knowledge is critical to safe and competent patient care (Collins, 2009; Ellis, 2002; Farey et al., 2018). The retention, transfer, and meaning with respect to student learning as a result of the active student-centered learning that takes place within the blended approach is the better suited strategy for the training of future nurses and allied health professionals in the anatomical sciences.

***Implications for higher anatomy education*.** Before the blended approach can guarantee meaningful learning in the human anatomy classroom, it is critical to

understand the experiences of the people at the heart of the phenomenon (Buchanan et al., 2013; Kopcha, 2012; Rose, 2016; Scott, 2013). Best practices for blended instruction specifically in undergraduate general human anatomy is surprisingly absent from the literature (Porter & Graham, 2016). This study goes directly to the source and asks leaders in blended anatomy instruction about their experiences, strategies, successes, challenges, and recommendations to inform current and future anatomy education, and fills the gap regarding best practices for facilitating retention, transfer, and meaning with respect to student learning within that space.

Recommendations for Future Research

The intent of this study was to understand the lived experiences of leaders in blended anatomy education to explore their strategies for achieving meaningful learning, identify the problem-based instructional techniques that they utilize, uncover the challenges they faced in their adoption of the blended approach, and reveal their recommendations for other anatomy educations looking to also transition to blended instruction. These experiences were gathered from six participants who, at the time of the interview, were teaching at the following types of institutions: two participants (33.33%) were employed at 4-year institutions; two participants (33.33%) were employed at 2-year institutions; and two participants (33.33%) were employed at both 4 year and 2-year institutions at the same time. Although the implications of the differences between 2 year and 4-year institutions with respect to research scholarship and teaching scholarship were out of the scope of this study, the two participants who were employed at both 4 year and 2-year institutions at the time of the interview referenced the differences between their experiences with adopting blended learning at

their respective institutions. To continue to broaden the literature on blended learning in anatomy education, the following studies are recommended for future research:

1. A study that further explores the differences between the experiences of blended anatomy instructors at 2-year community colleges versus blended anatomy instructors at 4-year research institutions.
2. A study that considers the K-12 pedagogical background of students in regard to how their previous experiences with blended methods may influence their perspectives and adoption of blended learning in higher anatomy education. Conducting a study that considers the pedagogical background of K-12 students (and focusing specifically on their previous experiences with blended methods in their K-12 education) may shed light on additional factors that could influence the successful transition towards blended anatomy instruction.
3. A study that utilizes the RTAM (Nobles, 2019) model within the context of training teaching assistants as leaders in blended anatomy education (Nobles & Frazier, 2017).
4. A study that investigates the learning skills and successes of nursing students that have experienced blended anatomy education compared to those that have received their anatomy education through traditional instructionist methods.

Final Thoughts

Teaching is exhilarating. Every time I am in the classroom I cannot help but feel a combination of excitement and boundless energy. A large part of that feeling comes from recognizing how important that short time that I get with my students each week is; how that short period is filled with both tremendous possibility and responsibility and

how I have a chance to take part in shaping some part of my student's life. Of course, not every moment of teaching will feel like a victory and often, during the act of teaching, I feel like I am sometimes making a tiny dent in my student's life rather than inspiring major life changing moments, but I think that is where the magic of teaching happens. Blended anatomy instruction provides a remarkable ability for instructors to inspire and excite students about understanding their own bodies in a context that goes beyond the course. Perhaps, the most powerful aspect of the blended approach is that it teaches students to take responsibility for their own learning. I firmly believe that faculty can support inclusion by helping their students build the skills that they need to be competent, confident, and independent learners. I believe the anatomy instructor's role is about so much more than teaching content. By acting as a facilitator and a guide, blended anatomy faculty can help students discover and build their identity as an academic, practitioner, and professional. This requires a shift from traditional instructionist pedagogy to student-centered teaching where the instructor encourages students to actively learn from and with each other. By doing less telling, I believe that students can do more discovering.

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APPENDIX A

Recruitment Letter

Dear [Name],

My name is Mia Nobles, and I am a doctoral candidate in Educational Technologies at Pepperdine University's Graduate School of Education and Psychology. I am conducting a research study on human anatomy faculty that employ blended learning in their undergraduate anatomy course. The title of my dissertation is: Innovative Instruction: Learning in Blended Anatomy Education.

The purpose of this study is to determine: (a) the lived experiences of anatomy instructors with regard to blended learning instruction, (b) what methods are used by anatomy faculty to create meaningful learning experiences for students in their blended anatomy course, (c) what types of problem-based instructional techniques are used by anatomy faculty in their blended anatomy course, (d) what challenges anatomy faculty face in the preparation and implementation of blended learning in their blended anatomy course, and (e) what recommendations anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course.

If you agree, you are invited to participate in an interview that intends to explore the best strategies and practices of anatomy faculty that employ blended learning in their undergraduate anatomy course. The purpose will be achieved by identifying the challenges and successes that current anatomy faculty have experienced in the implementation of blended learning in their anatomy course. The interviews anticipated to take no more than 60 minutes to complete and the interview will be recorded with your consent. Participation in this study is voluntary. Your identity as a participant will remain confidential during and after the study. Your name, affiliated organization or any personal identifiable information will only be reported if you consent. If you do not consent, a pseudonym from a "generic organization" will be used to protect your confidentiality. Additionally, confidentiality and privacy of all participants will be fully protected through the reporting of data in aggregate form.

Participants selected for interviews and who complete the interviews will be compensated with a $50 USD Amazon electronic gift card. Should you have any questions, please contact me at mia.nobles@pepperdine.edu or Dr. Lani Fraizer at lani.fraizer@pepperdine.edu

Thank you for your participation,

Mia Nobles
Doctoral Candidate in Learning Technologies
Pepperdine University, Graduate School of Education and Psychology
Malibu, California, United States of America

APPENDIX B

Informed Consent

PEPPERDINE UNIVERSITY

(Graduate School of Education and Psychology)

INFORMED CONSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES

INNOVATIVE INSTRUCTION: LEARNING IN BLENDED HUMAN ANATOMY EDUCATION

You are invited to participate in a research study conducted by Mia Nobles, MS, and Dr. Lani Fraizer at Pepperdine University, because you:

1. Are currently serving as a faculty member at an institution of higher education;
2. Utilize blended learning techniques in your undergraduate general human anatomy course; and
3. Have taught a blended undergraduate human anatomy course for at least one academic semester.

Your participation is voluntary. You should read the information below and ask questions about anything that you do not understand, before deciding whether to participate. Please take as much time as you need to read the consent form. You may also decide to discuss participation with your family or friends. You will also be given a copy of this form for you records.

PURPOSE OF THE STUDY

The purpose of the study is to determine:

1. What are the lived experiences of anatomy instructors with regard to blended learning instruction?
2. What methods are employed by anatomy educators to create meaningful learning experiences in this space?

3. What types of problem-based learning instruction techniques do anatomy educators use?

4. What challenges do anatomy educators face in the preparation and implementation of blended learning courses?

5. What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

STUDY PROCEDURES

If you volunteer to participate in this study, you will be asked to:

1. Review the open-ended interview questions before the interview;
2. Review the informed consent form;
3. Respond to the 4 qualitative interview questions; and,
4. Review transcribed responses taken from the recording of the interview.

Note: Participant must agree to be audio recorded to participate in the study.

POTENTIAL RISKS AND DISCOMFORTS

There is no known risk to the participants in this study. If at any time the participant would like to choose to opt out of the study, they can for any reason. The participant may also choose to only answer those questions for which they feel comfortable during the time of the interview.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR TO SOCIETY

The potential benefit to the participant is the knowledge that their contribution and expertise contributed to the greater body of literature on use of blended learning in higher education anatomy education. A $50 USD electronic Amazon gift certificate will also be provided to participants who successfully complete the interview.

PAYMENT/COMPENSATION FOR PARTICIPATION

Participants who successfully complete the interview will be given a $50 USD Amazon gift certificate. The researcher will send the participants an email link to the gift certificate within 72 hours of the interview.

CONFIDENTIALITY

The records collected for this study will be confidential as far as permitted by law. However, if required to do so by law, it may be required to disclose information collected about you. Examples of the types of issues that would require me to break confidentiality are if you tell me about instances of child abuse and elder

abuse. Pepperdine's University's Human Subjects Protection Program (HSPP) may also access the data collected. The HSPP occasionally reviews and monitors research studies to protect the rights and welfare of research subjects.

The data will be stored on a password-protected computer in the principal investigators place of residence. The data will be stored for a minimum of three years. Any identifiable information obtained in the collection of information during the scope of the study will remain confidential. All interview recordings will be destroyed once transcribed.

PARTICIPATION AND WITHDRAWAL

Your participation is voluntary. Your refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study.

ALTERNATIVES TO FULL PARTICIPATION

The alternative to participation in the study is not participating or completing only the items which you feel comfortable.

EMERGENCY CARE AND COMPENSATION FOR INJURY

If you are injured as a direct result of research procedures you will receive medical treatment; however, you or your insurance will be responsible for the cost. Pepperdine University does not provide any monetary compensation for injury.

INVESTIGATOR'S CONTACT INFORMATION

You understand that the investigator is willing to answer any inquiries you may have concerning the research herein described. You understand that I may contact the following individuals if I have any other questions or concerns about this research.

Mia Nobles – Investigator (Mia.Nobles@pepperdine.edu)
Dr. Lani Fraizer – Dissertation Chairperson (Lani.Fraizer@pepperdine.edu)

RIGHTS OF RESEARCH PARTICIPANT – IRB CONTACT INFORMATION

If you have questions, concerns or complaints about your rights as a research participant or research in general please contact Dr. Judy Ho, Chairperson of the Graduate & Professional Schools Institutional Review Board at Pepperdine University 6100 Center Drive Suite 500 Los Angeles, CA 90045, 310-568-5753 or gpsirb@pepperdine.edu.

APPENDIX C

IRB Approval Notice

PEPPERDINE

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

NOTICE OF APPROVAL FOR HUMAN RESEARCH

Date: January 30, 2019

Protocol Investigator Name: Mia Nobles

Protocol #: 18-04-798

Project Title: Innovative Instruction: Learning in Blended Human Anatomy Education

School: Graduate School of Education and Psychology

Dear Mia Nobles:

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

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

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

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

Sincerely,

Judy Ho, Ph.D., IRB Chair

cc: Mrs. Katy Carr, Assistant Provost for Research

APPENDIX D

Final Interview Questions

Research Question	**Corresponding Interview Questions**
RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction? a) What methods are employed by anatomy educators to create meaningful learning experiences in this space? b) What types of problem-based learning instruction techniques do anatomy educators use? c) What challenges do anatomy educators face in the preparation and implementation of blended learning courses?	IQ1: What methods do you use to create meaningful learning experiences for the students in your blended anatomy course? IQ2: What types of problem-based instructional techniques do you use to teach anatomy? IQ3) What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?
RQ2: What recommendations do anatomy faculty have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?	IQ4) What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

APPENDIX E

Peer Reviewer Form

Dear Reviewer: Thank you for agreeing to participate in my research study. The table below is designed to ensure that many research questions for the study are properly addressed with corresponding interview questions. In the table below, please review each research question and the corresponding interview questions. For each interview question, consider how well the interview question addresses the research question. If the interview question is directly relevant to the research question, please mark "Keep as stated." If the interview question is irrelevant to the research question, please mark "Delete it." Finally, if the interview question can be modified to best fit with the research question, please suggest your modifications in the space provided. You may also recommend additional interview questions you deem necessary.

Once you have completed your analysis, please return the completed form to me via email to Mia.Nobles@pepperdine.edu. Thank you again for your participation.

Research Questions	**Corresponding Interview Questions**
RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?	
RQ 1a) What types of problem-based learning instruction techniques do educators use?	IQ1) What types of problem-based learning instruction techniques do educators use? Delete It Keep as stated

RQ 1b) What challenges do educators face in the preparation and implementation of blended learning courses?	Suggested modifications IQ2) What challenges do educators face in the preparation and implementation of blended learning courses?
RQ 1c) What recommendations do educators have for innovative implementation of blended learning courses?	Delete It Keep as stated Suggested modifications IQ3) What recommendations do educators have for innovative implementation of blended learning courses? Delete It Keep as stated Suggested modifications

APPENDIX F

Original Interview Questions

Research Questions	**Corresponding Interview Questions**
RQ1: What are the lived experiences of anatomy instructors with regard to blended learning instruction?	
RQ 1a) What types of problem-based learning instruction techniques do educators use?	IQ1) What types of problem-based learning instruction techniques do educators use?
RQ 1b) What challenges do educators face in the preparation and implementation of blended learning courses?	IQ2) What challenges do educators face in the preparation and implementation of blended learning courses? IQ3) What recommendations do educators have for innovative implementation of blended learning courses?
RQ 1c) What recommendations do educators have for innovative implementation of blended learning courses?	

APPENDIX G

Interview Questions Process Form

Participant Pseudonym: _____

Age: _____

Gender: _____

Institution: _____ 2yr / 4yr

Current role: _____

Highest level of education: _____

Length of time teaching undergraduate general human anatomy: _____

Length of time using blended learning strategies in instruction: _____

Interview Question One: What methods do you use to create meaningful learning experiences for the students in your blended anatomy course?

Notes:

Interview Question Two: What types of problem-based instructional techniques do you use to teach anatomy?

Notes:

Interview Question Three: What challenges have you faced in the preparation and implementation of blended learning in your anatomy course?

Notes:

Interview Question Four: What recommendations do you have for other anatomy instructors that want to implement innovative blended learning in their anatomy course?

Notes:

APPENDIX H

CITI Certification - Researcher

CITI PROGRAM

Completion Date 16-Apr-2017
Expiration Date 15-Apr-2022
Record ID 22900152

This is to certify that:

Mia Nobles

Has completed the following CITI Program course:

GSEP Education Division (Curriculum Group)
GSEP Education Division - Social-Behavioral-Educational (SBE) (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Pepperdine University

CITI

Verify at www.citiprogram.org/verify/?w071ed28f-3a5a-44e2-b421-5ea797bfc1d8-22900152

APPENDIX I

Permission to Reprint Figures

Figures 1, Figure 2, and Figure 3

Mia,
You have my permission to reprint the two CoI figures you noted.
Best wishes,
DRG

Mia,

Thank you for contacting us. Permission is granted for you to reuse this figure, provided that the figure is referenced appropriately in the caption of the figure, as outlined in your email.

I wish you the best of luck with your dissertation.

Regards,

Jacob Bishop, PhD
Department of Engineering and Technology
Southern Utah University