Comparing Lecture-Based and Flipped-Classroom Methods in the US Air Force's Officer Training School: An Analysis of Learners' Satisfaction and Achievement

by

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Abstract

The problem this study analyzed was if lecture-based or flipped-classroom methods resulted in significant differences in academic achievement scores and course satisfaction ratings. To analyze the problem, this study examined archival achievement and satisfaction data from a sample of 916 cadets attending the USAF's Officer Training School (OTS) Total Force Officer Training (TFOT) program. The purpose of this study was to determine if academic achievement (n = 916) and course satisfaction (n = 639) differed based on course teaching method for the cadets. Hierarchical linear regression (HLR) was used to analyze the effect of teaching method on achievement and satisfaction, and to investigate if the effect of teaching method varied across the de-identified demographic variables of cadet-career status and age. The results of the HLR analyses revealed that teaching method did significantly affect academic achievement [$R^2 = .037$, $R^2_{adj} = .033$, $F(1, 895) = 8.674$, $p < .001$] with cadets in the lecture courses scoring higher than cadets in the flipped courses, but that teaching method did not significantly affect course satisfaction in cadets [$R^2 = .005$, $R^2_{adj} = .000$, $F(1, 626) = 1.086$, $p = .354$]. The HLR analysis results also indicated that the test of the incremental R^2 for the interactions, above the main effects, was significant for academic achievement [$R^2 = .047$, $R^2_{adj} = .040$, $F(7, 892) = 6.303$, $p < .001$; Pedhazer, 1997]. A HLR analysis revealed no interaction for the effect of teaching method across cadet-career status when predicting course satisfaction [$R^2 = .006$, $R^2_{adj} = -.002$, $F(5, 624) = .753$, $p = .584$]. To interpret the contribution of each effect, separate simple effects analyses were conducted. The simple effects analyses for academic achievement indicated that the effect of teaching method did significantly vary across career status [$F(2, 894) = 4.569$, $p = .011$], but not for age [$F(17, 862) = .963$, $p = .499$]. The simple

effects analysis revealed active duty cadets in both the lecture and flipped classes scored significantly higher [$F(2, 894) = 4.569$, $p = .011$] than Reserve component [$t(894) = 3.49$, $p = .002$] and non-prior service cadets [$t(894) = 4.82$, $p < .001$] in academic achievement.

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Above all, Matthew 6:33, "But seek first his kingdom and his righteousness, and all these things will be given to you as well."

Disclaimer

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Chapter 1: Introduction to the Study

Introduction

The path toward sweeping changes in education and training for the United States Air Force (USAF) began in 2015 when senior leaders established a 30-year strategy for the force (Department of the Air Force, 2015). The series of decisions that led from the 30-year strategy to specific program changes made by the USAF's Officer Training School (OTS) permitted practitioners to transform the physically and mentally demanding 8-week course from a course that heavily relied on lecture-based instruction to a course that maximized use of learner-centered, active-learning, flipped-teaching methods (Strang, 2017). A form of blended learning, the flipped classroom, or flipped learning, represents an ongoing trend within all manner of education and training where practitioners seek to exchange traditional, teacher-centered approaches for engaging, learner-centered methods (Lee, Lim, & Kim, 2017; Thai, Wever, & Valcke, 2017). While the statistical significance of the flipped classroom has revealed mixed results, educators have expressed the practical significance of the learner-centered approach, where active-learning classrooms are producing learners who are more confident and skilled in course concepts, and have taken increased responsibility for their own learning (Hamdan, McKnight, McKnight, & Arfstrom, 2013; Larsen, 2015; Missildine, Fountain, Summers, & Gosselin, 2013; Wilson, 2013).

This study overviews the USAF's OTS educational transformation from teacher-centered learning to learner-centered learning by analyzing course satisfaction and academic achievement data to determine if differences existed between lecture-based and flipped-classroom teaching methods. The introduction briefly describes the origins of the USAF's force development initiative, the Continuum of Learning. Next, the introduction will describe OTS, the organization serving as the focus of this study, by providing an overview of the academic-program changes. Finally, the introduction will overview the theoretical background, problem statement, purpose statement, research questions, significance, limitations, assumptions, and study terminology.

Origins of the USAF's Continuum of Learning

In the USAF's 2015 Strategic Master Plan, then Secretary of the Air Force, Deborah Lee James, and Chief of Staff of the Air Force, General Mark A. Welsh, III, identified strategic priorities to guide investment decisions, institutional changes, and approaches to 21st-Century operations for the force (Department of the Air Force, 2015). To support the strategic priorities, the USAF command with primary responsibility for educating and training Airmen, Air Education and Training Command (AETC), formed a team to conduct an analysis and assessment of the Command's existing officer and enlisted force-development methods (Roberson & Stafford, 2017).

From the analysis and assessment of existing officer and enlisted development methods, the AETC team concluded that the current military education and learning model was one primarily based on a teacher-centered, industrial-age, pipeline-production system designed to mass produce specialists using lecture-based teaching in a traditional classroom or auditorium (Roberson & Stafford, 2017; Strang, 2017). This industrial-age model was deemed inadequate for force development of Airmen in an age where expert information is available on demand, and threats and technology change in an instant. The AETC team's new force-development model, known as the Continuum of Learning, provided a framework on how the Command would leverage innovative learning methods and the latest educational technologies (Roberson & Stafford, 2017). The Continuum of Learning was formally defined as a learning initiative "to better focus how Airmen learn by integrating education, training and experience in ways that allow them to learn anytime, anywhere throughout their careers," and where education and learning are transformed into a modern, learner-centered model (AETC, n.d.).

The Continuum-of-Learning concept formalized the innovation of blended learning, a form of learning combining the aspects of the face-to-face (F2F) classroom with technology-mediated learning, to transform force development within the USAF (Lee et al., 2017; Roberson & Stafford, 2017; Thai et al., 2017). Leaders throughout the Command embraced the modern, learner-centered model, and sought to forge Airmen who are "creative, intellectually agile, resilient, and competent (Roberson & Stafford, 2017, p. 6)," and capable of influencing the strategic environment (Air Education and Training Command, 2018). Approved for implementation, the Continuum of Learning offered the guidance and framework for subordinate education and training organizations to customize the model and implement learner-centered methods to shape a culture of self-directed, lifelong learners.

Use of the flexible Continuum-of-Learning model guided organizations to restructure existing courses in ways that connected formal education and training with Airmen's experiences and prior knowledge (AETC, n.d.). For OTS at Maxwell Air Force Base, Alabama, the Continuum of Learning offered the structure for a curriculum-design team to conduct a comprehensive re-evaluation of learning methods and instructional techniques based on the old model, and the opportunity to exchange inefficient and ineffective educational practices for methods that improved the OTS program and better educate future USAF officers (OTS, 2017).

Officer Training School

Officer Training School is an education and training program, and one of three commissioning sources (the other two are the US Air Force Academy in Colorado Springs, CO, and the Reserve Officer Training Course in the form of detachments located at civilian universities across the US), designed to produce officers for the Active Duty, Air Force Reserve, and Air National Guard service components (Department of the Air Force, 2008a). The mission of OTS is, "to produce leaders of moral character in an environment of mutual respect and dignity" (Air University, n.d.). Officer Training School has three courses to educate and train commissioned officers and prospective officer-candidates: Commissioned Officer Training, Reserve Commissioned Officer Training, and the focus of this study, Total Force Officer Training (TFOT; Department of the Air Force, 2008a). Once completing OTS TFOT, the learner, or cadet as each learner is called throughout this study, will receive an officer's commission as a second lieutenant in one of the three USAF service components.

For OTS, the curriculum-design team determined to better educate future officers meant that changes to the TFOT program's teaching methods, distribution of academic materials, and instructional activities were warranted (Welty, 2018). The decisions resulted in a substantial restructuring of 185 academic hours of the 451.25-hour TFOT course. As displayed in Table 1, Comparison of Old and New TFOT Courses by Hours, the team began by taking 70 hours of knowledge-level academics, condensing the material, and instituting a 30-hour, online prerequisite course for cadets to complete before arriving at the in-resident program (OTS, 2017). With the creation of the online prerequisite course, the team concentrated the remaining 115 hours of in-resident, classroom academics on active-learning, learner-centered methods like cases studies, guided discussions, exercises, and scenario-based lessons, and increased the time devoted to outside-the-class experiential-learning activities by 11.7% (Holm Center Academic Affairs, 2015; Holm Center Academic Affairs, 2017).

To distribute the hours available within the new TFOT course, the team used a series of calculations to guide development of the online prerequisite-course and experiential activities. First, each lesson in the online course was limited to a maximum of 20 minutes where online readings were estimated at 4 minutes per standard 8.5 x 11-inch page. Next, with the increase in available hours for outside-the-class experiential activities, cadets were to receive three additional formative assessments in field-leadership exercises before undergoing two summative assessments for graded evaluation by their OTS instructor. Some immediate advantages observed in the redistribution of hours and use of the online prerequisite course were from the TFOT cadets who possessed little-to-no military experience or Profession-of-Arms knowledge, the non-prior service cadets (OTS, 2017; Welty, 2018).

With increased exposure through the online material, the non-prior service cadets entered TFOT with the same level of academic prerequisite knowledge as their more experienced active-duty and Reserve classmates. Furthermore, three additional formative assessments presented the non-prior service cadets with more active-learning opportunities and allowed the cadets to apply lesson concepts and engage at higher levels of learning. Finally, with more active-learning opportunities, the non-prior service cadets received more individual attention from the experienced OTS TFOT faculty and active-duty classmates through immediate observation, feedback, collaboration, and mentoring (OTS, 2017; Welty, 2018).

Table 1

Comparison of Old and New TFOT Courses by Hours

Course area	Old course[a] Hours	Old course[a] % of course	New course[b] Hours	New course[b] % of course	% Difference
Academic assessments	7.00	1.5%	7.00	2.0%	.5%
In-resident academics	185.00	41.0%	115.00	30.0%	(11.0%)
Leadership experiential activities	128.00	28.3%	153.00	40.0%	11.7%
Online pre-requisite Course[c]	N/A	N/A	30.00	-	-
Non-academic military instruction[d]	131.25	29.0%	108.25	28.0%	(1.0%)
Total academic-only hours[e]	320.00	71.0%	275.00	72.0%	1.0%
Total course hours	451.25		383.25		(15.0%)

Note. Reproduced from Holm Center Academic Affairs (2015; 2017) OTS TFOT course syllabuses. [a]The Old Course is represented by Classes 17-01 and 17-02. The Old Course used lecture-based instruction as a primary teaching method. [b]The New Course in this study is represented by Classes 18-05 and 18-06. The New Course uses an online prerequisite course as the primary delivery method for knowledge-level course material. Academics for in-resident, face-to-face classes were raised to a minimum of the comprehension-level and the course increased use of experiential activities by 11.7%. [c]The TFOT online prerequisite course was activated in October 2016 and was not required for the Old Course. The online prerequisite course does not count toward the in-resident academic course hours. [d]Non-academic, military instruction includes items identified in the syllabuses as course administration, inspections, drill, ceremonies, academic orientation (i.e., GI Bill benefits briefing), and other military-related Profession of Arms events. [e]Total academics-only hours include only Academic assessments (i.e., time allotted for written tests), In-resident academics, and Leadership experiential activities.

As shown in Table 2, Comparison of TFOT Courses' Classroom Academic Hours by Teaching Method, the old and new courses' academic hours are broken down by teaching method and consist of active-learning activities, lecture, and self-paced reading. With the redistribution of knowledge-level material to the online prerequisite course, the curriculum team reduced course lectures by 44 hours, or 15%, creating more time within the course for instructors to prepare for events and mentor cadets. Simultaneously, the redistributed hours gave cadets time to practice, collaborate, reflect, and learn. While course hours devoted to in-class, active-learning activities remained the same, the restructured in-class activities comprised 68% of the academic focus and provided more emphasis on applying and exercising course concepts, participating in collaborative projects, and completing authentic tasks, like web-based research assignments to mimic leadership and supervisory challenges and daily responsibilities cadets could expect to experience as USAF officers (Strang, 2017; Welty, 2018).

Table 2

Comparison of TFOT Courses' Classroom Academic Hours by Teaching Method

	Old course		New course		
Teaching method	Hours	% of academic hours	Hours	% of academic hours	% Difference
Active-learning activities	78.0	41.0%	78.0	68.0%	27.0%
Lecture	72.0	39.0%	28.0	24.0%	(15.0%)
Self-paced	35.0	20.0%	9	8.0%	(12.0%)
Total	185.0	-	115.0	-	(38.0%)

Note. Reproduced from course information found in Holm Center Academic Affairs (2015; 2017) OTS TFOT course syllabuses.

The team's programmatic transformation of OTS, designed to produce better USAF officers, resulted in more time for application of course concepts through active-learning activities during the limited classroom hours. Outside of the classroom, the learner-centered approach presented more practice opportunities using authentically based, collaboratively structured exercises. Whether in or out of class, the flipped course design presented additional learning opportunities for cadets through cadet-to-cadet feedback, individual reflection, and observation, feedback, and mentoring by the OTS faculty (OTS, 2017).

Theoretical Background

As discussed in Chapter 2, the literature largely presents flipped-classroom designs as a form of blended learning and offers two general approaches for flipped designs: theoretically based approaches and practical, process-focused approaches. First, Thai, Wever, and Valcke (2017) and Lee, Lim, and Kim (2017) defined blended learning as a form of learning that combines the aspects of the F2F classroom with technology-mediated delivery. Flipped classrooms use the basis of blended learning to present lectures or knowledge-based readings through web-based media while reserving F2F class sessions for active-learning activities (Lee et al., 2017; Thai et al., 2017). Teachers touted the flipped classroom as a flexible method where learners can engage in learning activities and actively apply concepts instead of passively receiving declared information during in-class or auditorium lectures, and teachers can provide learners with immediate feedback (Berrett, 2012; Schlairet, Green, & Benton, 2014; Thai et al., 2017). As presented in Table 3, Characteristics of the Common Teaching Modalities, Thai et al. (2017) offer a conceptualization to distinguish the terms and general differences between three common teaching modalities: traditional, lecture-based learning; blended learning; and, the flipped classroom.

Table 3

Characteristics of the Common Teaching Modalities

Traditional lecture	Blended learning conditions	
	Blended learning	Flipped classroom
Reading (outside of class)	Reading (online)	Reading (online)
F2F lecture (classroom)	F2F lecture (classroom)	Lecture (online)
Questions (classroom)	Questions (online)	Activities / Questions (classroom)
Feedback (classroom)	Feedback (online)	Feedback (classroom)

Note. Modified and adapted from "The Impact of a Flipped Classroom Design on Learning Performance in Higher Education: Looking for the Best 'Blend' of Lectures and Guiding Questions with Feedback,' by Thai, Wever, and Valcke, 2017, *Computers & Education*, 107, p. 113-126. Copyright 2017 by Elsevier Ltd.

Second, the studies viewed for this work presented theoretically based or process-focused investigations rooted in specific research contexts. As expressed by O'Flaherty and Phillips (2015), it is within the confines of each specific educational context that makes generalization or application of an approach outside of the specific study difficult for others to replicate. However, where the literature lacks generalization and consensus on a universally accepted approach, theory, definition, or model for flipped-classroom designs, the andragogical process elements and stages of Kolb's Experiential Learning Model (ELM) serve as a flexible and customizable guide to link both theory and process for designing flipped classrooms in adult-learning environments.

The theoretical framework for this study is guided by the process elements of andragogy and stages of Kolb's ELM (Knowles, Holton, & Swanson, 2015). Discussed extensively in Chapter 2, the researcher sought to examine how the instructional methods and active-learning activities of a flipped-course structure aligned with the process elements of andragogy, as presented by theorist, Malcolm Knowles, and experiential learning theory as presented by David Kolb. This study and the investigation into relevant, learner-centered methods could inform military education and training programs and practices: Military courses offering increased exposure to course lectures or materials prior to a F2F class, followed by experiential-learning activities exercising course concepts versus passive absorption of concepts during finite, formal periods of F2F lecture.

First, andragogy informs this theoretical framework as a guiding process where educators and instructional designers can develop flexible educational programs suited to meet the needs and goals of adult learners. The eight andragogical-process elements offer a natural alignment with the planning and delivery of course instruction and active-learning activities of a flipped-classroom approach. For the flipped classroom, the andragogical-process elements offer a model for designing and developing courses that provide learners with procedures and resources for the self-directed acquisition of information, knowledge, and skills specific to an individual learner's needs and situation (Knowles et al., 2015). Concerned with enhancing the learning experience and equipping learners to self-direct, the eight andragogical-process elements guide educators to remake subject-centered learning by presenting subject-based concepts in a real-world context and adding a performance-based, problem-solving orientation (Knowles et al., 2015). Since activities for a flipped classroom are typically problem-centered, the stages of Kolb's ELM offer a model for the active-learning component of the theoretical framework.

Next, following Kolb's ELM, educators further shape the learning environment through experiences designed along Kolb's four stages: concrete experience, observation and reflection, abstract conceptualization, and active experimentation (Knowles et al., 2015). The stages of Kolb's ELM accentuate an adult's existing experience, or lack thereof, and provide a model for adults to cognitively process, actively use, and reflect on existing experience and new information or concepts. Using Kolb's ELM with the flipped-classroom method, educators create opportunities for learners to achieve higher-order levels of thinking, test class concepts using real-world problems, and increase awareness of their performance (Hoffman, 2014; Little, 2015). The four stages of Kolb's ELM allow educators and learners to observe firsthand what learning has taken place, gauge learners' level of understanding, and offer learners' peers and the instructor occasions for instant feedback and mentoring (Knowles et al., 2015; Little, 2015; McDonough, 2014).

Problem Statement

In the growing body of flipped-classroom literature, educators lamented the extensive time and enormous expense with transitioning from teacher-centered methods to learner-centered methods. Despite the immense effort creating an effective learner-centered environment, educators revealed mixed results when measuring changes in learning outcomes and learner improvements. Educators admittedly struggled to empirically determine if the changes from traditional-lecture methods to flipped-classroom methods resulted in improved outcomes such as increased course satisfaction and academic achievement among learners.

From the program and institutional-effectiveness perspectives, OTS leadership reviewed cadet-course satisfaction surveys and achievement scores, but desired more empirical evidence to determine if the program changes to TFOT created a program that produced better officers. The problem this study seeks to investigate is if traditional, lecture-based classes or the flipped-teaching model resulted in significantly different course-satisfaction ratings and academic-achievement scores for OTS TFOT cadets.

Purpose of the Study

The purpose of this nonexperimental, quantitative, correlational study was to determine if course satisfaction and academic achievement differ between the traditional, lecture-based course and flipped-teaching formats for OTS TFOT cadets. This study examined existing course-satisfaction ratings and academic-achievement scores based on course-teaching method and de-identified, cadet-demographic data. To accomplish the investigation, the researcher used de-identified academic-achievement scores from course multiple-choice exams to determine if differences in cadet-academic achievement existed between TFOT classes 17-01 and 17-02, which heavily relied on lecture-based methods, and TFOT classes 18-05 and 18-06, which added the online prerequisite course and primarily used flipped-teaching methods. The researcher also used de-identified surveys with Likert-scale scoring to determine if differences in cadet-course satisfaction existed between the same classes.

For this study, course satisfaction and academic achievement served as the dependent variables, and teaching method served as the independent variable. Additionally, the researcher investigated if an interaction existed among teaching method and the cadet-demographic data of age and career status (i.e., active duty, non-prior service, or Reserve component). The results of this research could inform and guide the design and implementation of future flipped education and training programs within the military. This study adds to the body of knowledge in adult education by following the recommendations of previous researchers who called for additional research on flipped-classroom designs with large sample sizes in multi-disciplined institutions (Njie-Carr, Ludeman, Lee, Dordunoo, Trucky, & Jenkins, 2017; Pierce & Fox, 2012).

Research Questions

To address the problem of this study, the researcher raised the following research questions:

Research Question 1: Does course teaching method affect academic achievement in OTS TFOT cadets?

Research Question 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

Research Question 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?

Research Question 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

Significance of the Study

The significance of this study for the military could inform course-structure changes, like moving lecture-based instruction or knowledge-level material to online modalities, which applies to a wide variety of education and technical training environments. Many military education and training practices call for delivery of large segments of knowledge and comprehension-level material through auditorium or classroom lecture as the most expedient instructional modality. With advances in educational technologies, educators can alter instructional practices and repackage knowledge and comprehension-level content for delivery to learners through an appropriate learning or content management system (i.e., Canvas, Moodle, BlackBoard, YouTube). Presentation of materials for learners can occur outside of a formal classroom environment or prior to a course start date. Benefits of such course changes include the increase of (a) learner-instructor and learner-learner in-class contact where observation, feedback, and mentoring are integral components of learner development; (b) learner-content interaction where the learners' targeted exposure and control of course content is based on individual need, learning style, or prior knowledge; and, (c) time available to conduct practical application of course concepts through active-learning activities and F2F discussions (Moore, 1989).

Additionally, this study seeks to investigate if course satisfaction and academic achievement vary based on cadet-career status (or experience) and age as presented by a previous researcher. As Griffith (2006) found in his analysis and comparison of veterans and traditional learners in a Navy ROTC program, cadet-career status and age are variables that resulted in significant differences in course academic achievement in the Navy education and training program. Griffith (2006) postulated that veterans (equivalent to the active-duty and Reserve-component cadets in this study) performed better due to their experience, prior knowledge, and maturity than non-prior service cadets.

Study Limitations

The limitations of this study describe certain parameters outside the researcher's control. The limitations presented below offer consideration or caution for the further application and interpretation of the results for future research designs and to contexts outside of formal military education and training environments.

1. Due to the nonexperimental research design, the results of this study may lack predictive power for learners with similar demographic variables and generalization of results to a wider population than OTS TFOT cadets or contexts outside of OTS TFOT (i.e., correlation does not equal causation; Cranton & Merriam, 2015).
2. The data available for analysis in this study were archived, anonymous satisfaction-survey ratings and de-identified academic-achievements scores. However, the anonymous surveys contain cadets' career status and the achievement scores contain cadet-career status and age. Course satisfaction surveys were de-linked to participants, thereby, eliminating the possibility of connecting satisfaction ratings with academic achievement scores thus excluding the possibility of multivariate analysis (Mertler & Vannatta, 2013).
3. The existing data represent the OTS TFOT course as a specific, finite period and include analysis only for the two classes from AY2017 and the two classes from AY2018 (Cranton & Merriam, 2015).
4. The course satisfaction surveys are self-report instruments. Participants' answers may contain biases that present themselves as ideal performers and as exhibiting behaviors that met or

exceeded course standards or outcomes (Dillman, Smyth, & Christian, 2014). For self-report instruments, learners may respond how they would like to think they behaved in a circumstance, but may have behaved differently in reality (Bannier, 2010).

Assumptions

For this study, the researcher made the follow assumptions

1. The cadets from OTS TFOT Classes AY17 and AY18 are representative of future OTS TFOT cadets.
2. The cadets of OTS TFOT Classes 18-05 and 18-06 possessed the ability to learn, engage in, or adapt to the self-directed learning behaviors required to learn the material presented in the online, prerequisite course and elsewhere in the TFOT course.
3. The achievement motivation and academic abilities of the OTS TFOT cadets will vary based on basic, individual differences, military time-in-service, career status, age, and education level.
4. The cadets from OTS TFOT Classes 17-01, 17-02, 18-05, and 18-06 answered course satisfaction surveys honestly, and performed to the best of their ability on course multiple-choice tests.

Definition of Terms

The following major terms are used throughout the study and unless otherwise noted, are taken from the Department of the Air Force's (2008a) *Air Force Instruction 36-2013*, *Officer Training School*:

Active Duty (AD): For this study, an individual serving in an enlisted paygrade as a full-time member in the Regular component of the US Armed Forces.

Air Force Reserve (AFR): for this study, a member of the federally recognized reserve component of the US Air Force who has completed basic military training and participates in sponsored-unit service as a "Citizen Airman" in the Selected Reserve in an enlisted paygrade and serves or trains one weekend per month and a two-week annual training period (USAFR Handbook, 2014, p. 16).

Air National Guard (ANG): for this study, a member of the federally recognized reserve component of the US Air Force who has completed basic military training and participates in sponsored-unit service as a traditional technician in an enlisted paygrade and serves or trains one weekend per month and a two-week annual training period (National Guard Bureau, 2012).

Blended learning: within the AETC Continuum of Learning Initiative, a course structure designed to meet program or course "learning objectives through multiple learning modalities (face-to-face meetings, facilitated, self-paced online, self-study, simulations, games, exercises, group projects, etc."; Roberson & Stafford, 2017, p. 6).

Cadet: A student, between the ages of 20 to 34, attending training in the OTS commissioning program.

Continuum of Learning (CoL): an AETC learning initiative designed to better focus US Air Force education and training programs on how Airmen learn by purposely integrating education, training, and experience throughout each Airman's career (AETC, n.d.).

Flipped-Classroom Teaching Method (FCM): For this study, a teaching method, also referred to as simply the flipped classroom or flipped learning, used in a range of educational programs where knowledge-level, lesson concepts are presented outside of class and face-to-face, in-class meetings are reserved for learner-learner interactions, learner-instructor interactions, or active-learning activities (Little, 2015).

Officer Training School (OTS): An intensive, prerequisite education and training program of the US Air Force open to college graduates with the required professional or academic background and who meet US Air Force standards.

Non-Prior Service (NPS): A service member having less than 6 months of military service in the Regular component of the US Armed Forces and not currently serving in the Regular Air Force.

Reserve Component (RC): for this study, referring to an OTS TFOT cadet's career status and if the cadet is a member of either the Air National Guard or Air Force Reserve component of the USAF.

Total Force Officer Training (TFOT): a mentally and physically demanding 8-week education and training course within OTS that is open to non-prior service civilians, active-duty Airmen, and members of the Reserve components (Air Force Reserve and Air National Guard) who were competitively selected to attend and pursue an opportunity to earn a commission as an officer in the US Air Force.

Organization of the Study

Chapter 1 served as the introduction to this study and presented the background, description of the organization serving as the study focus, theoretical background, problem statement, purpose, research questions, significance, limitations, assumptions, and definition of terms. Chapter 2 provides a review of the literature, discusses the theoretical framework guiding the study, and provides a synopsis of the flipped-classroom research. Chapter 2 will begin by offering an introduction into the USAF force-development changes that led to the restructured OTS TFOT course and an overview of blended and flipped-learning methods used in the military. Chapter 3 describes the methods used to conduct this study to include a description of the population and sample, instruments, data collection process, and data analysis procedures. Chapter 4 will present the study findings. Chapter 5 concludes this study with a summary, conclusion, study implications, and recommendations for future practice and further research.

Chapter 2: Literature Review

Overview

The literature on the flipped classroom, or flipped learning, presented the flipped method as a type or subarea of blended learning. The blended environment is thought to offer learners and teachers alike an interactive and satisfying learning experience where teaching method and education technologies offer opportunities to maximize flexibility (Wang, 2017b). Flipped learning carries the concept of blended learning further by swapping the traditionally passive, teacher-directed, face-to-face (F2F) lecture and homework (Pierce & Fox, 2012). This chapter will review the purpose of the study and research questions, discuss blended learning and the flipped classroom, and present the theoretical framework guiding this study.

Purpose of the Study

The purpose of this nonexperimental, quantitative, correlational study was to determine if course satisfaction and academic achievement differ between the traditional, lecture-based course and flipped-teaching formats for Officer Training School (OTS), Total Force Officer Training (TFOT) cadets. This study examined existing course-satisfaction ratings and academic-achievement scores based on course-teaching method and de-identified, cadet-demographic data. To accomplish the investigation, the researcher used de-identified academic-achievement scores from course multiple-choice exams to determine if differences in cadet-academic achievement existed between TFOT classes 17-01 and 17-02, which heavily relied on lecture-based methods, and TFOT classes 18-05 and 18-06, which added the online prerequisite course and primarily used flipped-teaching methods. The researcher also used de-identified surveys with Likert-scale scoring to determine if differences in cadet-course satisfaction existed between the same classes.

For this study, course satisfaction and academic achievement served as dependent variables, and teaching method served as the independent variable. Additionally, the researcher investigated if an interaction existed among teaching method and the cadet-demographic data of age and career status (i.e., active duty, non-prior service, or Reserve component). The results of this research could inform and guide the design and implementation of future flipped education and training programs within the military. This study adds to the body of knowledge in adult education by following the recommendations of previous researchers who called for additional research on flipped-classroom designs with large sample sizes in multi-disciplined institutions (Njie-Carr et al., 2017; Pierce & Fox, 2012).

Research Questions

To address the problem of this study, the researcher raised the following research questions:

Research Question 1: Does course teaching method affect academic achievement in OTS TFOT cadets?

Research Question 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

Research Question 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?

Research Question 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

Blended Learning and the Flipped Classroom

Blended learning and the flipped classroom are growing areas of research in the body of literature. Research revealed a wide interest from educational institutions around the world seeking to investigate both blended-learning and flipped-classroom methods, and empirically determine if enough evidence existed to either validate or refute blended or flipped methods over traditional lecture-based approaches (Cabi, 2018; Hao, 2016). This section will examine terminology, provide a brief history of the flipped classroom, discuss why the flipped classroom has increased in interest over the last 10 years, describe the search procedures used for this literature review, look at blended learning and flipped classroom methods in the military, and offer a discussion why the flipped classroom is increasingly seen as an innovative instructional method.

Terminology

For research studies prior to 2011, the literature consisted of varying terminology for instructional methods and classroom settings that combined use of online delivery and F2F instruction (Talbert, 2017). For studies dated after 2011, terms and definitions became more consistent for the pedagogical movement that reversed what was the traditional, in-class, teacher-led lecture and what was previously considered homework (Pierce & Fox, 2012; Talbert, 2017). The most common terms used to frame this learner-centered approach were flipped classroom, blended learning, flipped learning, inverted classroom, and hybrid learning (Logan, 2015; McGarry, Theobald, Lewis, & Coyer, 2015; Sun & Wu, 2016; Talbert, 2015; Thai et al., 2017). The object of comparison, the traditional classroom, also came with interchangeable, nonstandard terms like lecture-based instruction, teacher-centered approach, and F2F lecture (Logan, 2015; Sun & Wu, 2016; Talbert, 2015).

Seeking to match instructional design elements with an educationally sound conceptual framework, Thai et al. (2017) and Lee et al. (2017) presented extensive discussions to mark the distinctions between blended learning and the flipped classroom, as displayed in Table 3, Characteristics of the Common Teaching Modalities. First, blended learning is an approach to learning that combines traditional, in-class, lecture-based, F2F learning with supplementary activities most often presented out-of-class through a technology-mediated, online environment (Lee et al., 2017; Thai et al., 2017). Second, the flipped classroom, or flipped learning, is an approach to learning that swaps the in-class, F2F lecture and out-of-class activities (Lee et al., 2017; Thai et al., 2017). The research interests of many investigators were to gain insight on how to best inform instructional design decisions and what criteria or evidence would help determine the ideal, flipped blend most appropriate for the investigators' context-specific learning environment (Hoffman, 2014; Lee et al., 2017; Parker, Robinson, & Hannafin, 2008; Thai et al., 2017).

History

Over the last 5-to-10 years, the concepts of blended learning and the flipped classroom matured to more clearly denote the distinctions between terms, definitions, and environments. As education technologies have matured, the concept of blended learning offered educators a tangible means to understand and distinguish between modes where learners engaged in fully online learning and where learning environments could combine online and F2F environments (Peruso, 2012). By offering a mechanism to increase learner interaction and engagement out of class, blended learning was viewed as an improvement over the traditional, passive, in-class, teacher-centered environment (Peruso, 2012).

Even without advanced education technologies, the concept of the flipped classroom, or flipped learning, is a historically rooted teaching method (Berrett, 2012; Talbert, 2017). Described as a subarea of blended learning, the flipped classroom is most referenced in the literature where Bergmann and Sams (2012), high school chemistry teachers, used the flipped concept to teach struggling, traveling high school athletes (Logan, 2015). Bergmann and Sams (2012) offered the student-athletes lecture content and other supplemental materials to study out-of-class and as preparation for in-class activities. During the limited classroom time, Bergmann and Sams (2012) noted the benefits of the approach as the athletes brought focused, content-specific questions for difficult problems. As the approach gained in popularity, Talbert (2017) noted the intentional efforts of educators to increase the interaction and engagement of all students through creative, in-class, active-learning activities.

Why the Increased Focus on Flipped-Learning Methods

Over the last 15-to-20 years, education initiatives like No Child Left Behind and issues like soaring tuition costs in higher education have resulted in an increased focus on matters of school efficiency, student learning, and methods of evaluation (Bishop & Verleger, 2013; Boone, 2015; Talbert, 2017). The increased scrutiny on areas like evaluation moved many educators to investigate not only student performance in class, but also what students retained 1-to-3 months after the class concluded (Bishop & Verleger, 2013; Talbert, 2017). Many educators found some common occurrences: (a) teacher-centered, lecture-based environments reinforced passive behaviors in students; (b) students performed complex computations and memorized complex material during the course, but after class, students were unable to recall or apply even basic concepts from the course; and, (c) many students who performed well on class assessments and the class overall failed to recall the most basic course concepts or facts, or understand how the course possessed any relevance out of the class (Bishop & Verleger, 2013; Logan, 2015; Talbert, 2017). Based on such evidence, educators began looking for methods that promoted improved retention and mastery of class concepts over mere adequate performance on class assessments or simply passing the class (Earley, 2016; Talbert, 2017).

Educators researched the flipped classroom as a method to promote knowledge mastery where learners could apply course concepts in a real-world context and understand and use what they learned beyond the classroom (Berrett, 2012; Boone, 2015; Hao, 2016; Schlairet et al., 2014; Talbert, 2017). Educators focused on practical, problem-oriented activities and class discussions to push learners toward higher levels of learning (i.e., for Bloom's taxonomy, the application, analysis, synthesis, evaluation levels) within the subject or field of study (Hoffman, 2014; Schlairet et al., 2014; Talbert, 2017; Zainuddin & Halili, 2016). Educators found they could move beyond teacher-centered methods that primarily stopped at transmitting knowledge-level learning or superficial understanding or involvement with course concepts, and engage learners with active-learning activities to apply and synthesize basic concepts, exercise critical thinking, and solve problems typical of a discipline or field of study (McDonough, 2014; Schlairet et al., 2014; Talbert, 2017; Wilson, 2012).

Through the increased in-class contact, educators witnessed learners shift from memorization and mindless computation to understanding and thinking especially when the class structure allowed for use and discussion of "their work and their ideas" (Talbert, 2017, p. 22-23). Using knowledge-level material for out-of-class preparation and active-learning activities in class, educators saw the learning value of their flipped environment extend beyond the class because "The person doing the work does the learning," as the learners controlled what resources were used and how those resources were used (Talbert, 2017, p. 22). As unexpected benefits, educators observed how the learner-centered environment not only aided understanding and retention, but also increased learners' responsibility for their own learning and allowed more control over areas like out-of-class preparation and in-class discussions (Hoffman, 2014; Rui, Lian-rui, Rong-zheng, Jing, Xue-hong, & Chuan, 2017; Talbert, 2017).

Search Procedures and Results for the Literature Review

To investigate the literature on blended learning and the flipped classroom, the researcher used the following search procedures. First, the researcher focused on research studies that explored the flipped classroom for adult learners in higher education from 1998 to 2018 and searched through the ProQuest Dissertations and Theses, ERIC (Ebsco), and Education Research

Complete databases for qualitative, quantitative, and mixed-methods studies. The initial search produced 17 research articles relevant for this study. Next, the researcher broadened the search in the same databases and used the search sequence of flipped classroom, flipped teaching method, blended learning, flipped learning, inverted classroom, OR hybrid learning AND online pedagogies, for studies from 1998 to 2018. The second search produced 36 research articles relevant for this study. The last search conducted by the researcher sought qualitative, quantitative, and mixed-methods research studies and included the search sequence andragogy, adult education, learning theory, OR adult learners AND blended learning, flipped learning, OR flipped classroom, for studies from 1998 to 2018. The last search produced 37 research studies bringing the total to 90 peer-reviewed articles relevant for this study.

Table 4, Frequency Distribution of Studies by Research Design, Model, and Approach, provides a breakdown of the research articles selected for this study. The table displays the articles by research design and model, and whether the article was theoretically based on a learning theory or process focused centered on educator practice, a process-driven framework, or a set of researcher-defined instructional design principles.

Table 4

Frequency Distribution of Selected Studies by Research Design, Model, and Approach

Research design and model (*n* = 90)		
	n	%
Qualitative (total)	51	57
Action research	3	6
Case study	12	24
Content analysis	30	58
Correlational	1	2
Meta-synthesis	1	2
Mixed-exploratory	1	2
Phenomenological	3	6
Quantitative (total)	33	37
Action research	1	3
Cross-sectional-group comparison	3	9
Experimental	1	3
Longitudinal-cohort	2	6
Longitudinal-trend	1	3
Non-experimental-correlational	5	15
Non-experimental-descriptive	11	34
Quasi-experimental	9	27
Mixed methods (total)	6	6
Convergent parallel	1	17
Case study	2	33
Exploratory	3	50
Article approach		
Theory-based	65	72
Process-focused	25	28

Note. All errors are due to rounding.

Blended Learning and the Flipped Classroom in the Military

Peer-reviewed literature on blended learning and the flipped classroom in military settings is sparse. However, even though military education and training organizations are typically slow to adopt alternative pedagogies, the research reflected how more and more organizational leaders are recognizing that education has moved beyond a single, confined, isolated event to be viewed as an anytime, accessible, and collaborative endeavor with continuous interaction and engagement (Roberson & Stafford, 2017; Scoppio & Covell, 2016). From the studies conducted specifically within military contexts, researchers discussed how education technologies and blended and flipped approaches enabled learning opportunities that closely mimicked real-world military operations (Sonesson, Bofford, Lundberg, Rydmark, & Karlgren, 2018). For each study, researchers expressed how the flipped approach reinforced key learning benefits such as interaction, active learning, learner control, and learning through reflection (Comish & Copley, 2010; Sonesson et al., 2018).

Study #1

In a nonexperimental, qualitative case study, Sonesson et al. (2018) used surveys and interviews to investigate blended learning for a course in advanced military and civilian trauma care. The investigation found that blended learning supported learner interactions, active learning, learner control, and reflection during a preparation course for medical professionals (Sonesson et al., 2018). Despite a wide variation in levels of medical expertise, the medical professionals found that the online scenarios and cases allowed for questions, practice simulations, collaboration, and forum discussions in advanced trauma care. According to the data collected, the course participants expressed great satisfaction and confidence in solving and management of real trauma cases due to the out-of-class preparation and increased exposure prior to the in-class workshop (Sonesson et al., 2018). The online environment provided participants with virtual patients for a more life-like environment and access to knowledgeable classmates, realistic visual aids, and unlimited practice in reasoning and decision-making for scenarios involving complex, stressful, time-sensitive trauma cases and patient management (Sonesson et al., 2018).

Study #2

In a nonexperimental, qualitative case study, Comish and Copley (2010) described how the US Army's Recruiting and Retention School (RRS) prepared new recruiters for F2F instruction and kept experienced recruiters up-to-date on recurring education and training requirements. The RRS implemented a series of web-based learning sessions which included "virtual classrooms, self-paced distance learning, collaborative learning with and without an instructor, and streaming video, audio, and text" (Comish & Copley, 2010, p. 34). The RRS platform used blended learning to support learner interactions, active learning, learner control, and learning through reflection to prepare new students for in-residence, F2F instruction and as a means for experienced recruiters to maintain counseling skills (Comish & Copley, 2010). The researchers found that the pre-resident scenario-based recruiting sessions produced knowledgeable and proficient learners who could actively and productively participate in the virtual environment while waiting extended periods to either attend the Army Recruiter Course or report to their recruiting location (Comish & Copley, 2010).

Study #3

In a quantitative, quasi-experimental study, Giovengo (2014) investigated whether blended and traditional teaching methods, and use of metacognitive skills, affected trainee performance, course achievement, and training transfer in active-duty and Reserve-component participants attending US Coast Guard law-enforcement courses. Giovengo (2014) examined a convenience sample of US Coast Guard active-duty and Reserve personnel. Participants could choose 1) to attend a traditional, 5-week in-resident course, or 2) a blended-learning course with an asynchronous distance-learning component that served as classroom instruction and a 2-week follow-on in-resident component solely for practical exercises. While the blended course afforded students learner interactions, active-learning opportunities, learner control, and learning through reflection, the study found no significant differences in cognitive performance and course achievement between the fully in-residence and blended courses, but did find a significant difference in evaluations of practical-performance and training-transfer.

Analysis of the findings stated two conclusions. First, the learners' cognitive performance, course achievement, and use of metacognitive skills were attributed to the participants' existing law-enforcement experience and possession of already strong metacognitive skills. Second, learner differences in performance were attributed to structural differences in the in-residence course design and implementation which affected student-learning and training transfer to the job. Upon analysis of the two courses, Giovengo (2014) stated the 5-week in-residence course afforded learners more opportunities to engage peers, the instructors, and the material with four more practical and two more written evaluations than the blended course. The results of the study informed the review into the pedagogical structure of the courses, and guided practitioners to correct disparities in the two courses' structure, instructions, and evaluations.

The military-related studies mirrored the ongoing trends in higher education and the larger, international efforts to evaluate traditional teaching methods and blended and flipped-learning approaches. Each researcher continued with the ongoing trends of flexible and customized course designs, and trial-and-error implementation of their flipped classrooms (Cabi, 2018; Canhoto & Murphy, 2016; Larsen, 2015; Pang & Ling, 2012). The studies revealed efforts to create an increasingly effective learning environment that supported learner interactions, active-learning activities, learner control, and learning through reflection. The studies also met mixed results and included discovery of how extraneous, context-specific situational variables routinely impacted course designs and implementation (Cabi, 2018; Dennis, Bunkowski, &

Eskey, 2007; Jovanovic, Gasevic, Dawson, Pardo, & Mirriahi, 2017; Larsen, 2015; Missildine, Fountain, Summers, & Gosselin, 2013; Sun & Wu, 2016).

Flipped Classrooms in the Literature

As a growing body of literature, the flipped classroom, or flipped learning, has gained international attention in all manner of institutions, fields, and academic disciplines (Cabi, 2018; Earley, 2016; Hao, 2016; Schlairet et al., 2014; Wilson, 2013). Availability of instant, expert information or self-help video via most any Internet-capable device has changed the view of information, education, and training from something to impart to something anyone can easily access, process, and use (Summers, 2012, as cited in Grabau, 2015). This change in view of knowledge and information has driven changes in the classroom where learners can move from passive absorption of transmitted knowledge to active, self-directed behaviors for out-of-class preparation and in-class interaction and engagement (Hoffman, 2014; Logan, 2015; Szparagowski, 2014). This section will look at the literature discussion of learner-centered versus teacher-centered models, the benefits and challenges of a flipped classroom, and how researchers pursued their flipped approach.

Learner-centered versus teacher-centered models

Throughout the literature, researchers viewed the flipped classroom as a learner-centered model and the traditional, lecture-based classroom as a teacher-centered model where Bloom's taxonomy was often used to describe how and at what level of learning learners in either a flipped or traditional classroom engaged in the learning process (Cabi, 2018; Hao, 2016; Talbert, 2017; Zainuddin & Halili, 2016). In the learner-centered model, the role of the teacher shifts from one who imparts knowledge to one who facilitates and participates in the learning process (Hoffman, 2014; Logan, 2015). The role of the learner in the learner-centered model shifts from one who passively receives declared knowledge to one who exhibits self-directed learning behaviors, assumes responsibility for his or her own learning, and assists peers in collaborative learning (Hoffman, 2016; Logan, 2015; Schlairet et al., 2014; Szparagowski, 2014).

Informally defined by Talbert (2017), a learner-centered model describes a learning environment characterized by a patient "awareness of and responsiveness to student needs" (p. 173). As a learner-centered model, the flipped classroom was presented as a method for leading learners to the higher levels of Bloom's taxonomy (i.e., analysis, evaluation, creation) through active-learning activities (Hoffman, 2014; Zainuddin & Halili, 2016). The teacher increasingly involved learners by making knowledge and comprehension-level lectures or readings available out of class and used the limited in-class F2F time for learners to interact and engage in collaborative problem solving and discussions (Berrett, 2012; Hoffman, 2014; Rui et al., 2017; Zainuddin & Halili, 2016). The learner increased his or her personal involvement, autonomy, and sense of ownership in the learning process by controlling the pace, timing, and amount of out-of-class preparation; interacting, engaging, and learning via the in-class activities; and, reflecting on the personal or professional relevance of the course (Hoffman, 2014; Rui et al., 2017; Thai et al, 2017).

Described by Peruso (2012), the teacher-centered model exists in a formal F2F period of class where the instructor transmits information to learners usually through lecture. The research further expounded on the teacher-centered classroom as a model where learners passively receive knowledge- or comprehension-level information from a teacher and where learners are left to achieve higher levels of learning and interact and engage peers on their own (Logan, 2015; Rui et al., 2017). The traditional classroom pattern consisted of teacher-established, out-of-class reading requirements; a F2F lecture covering the out-of-class reading; feedback, hints, or elaboration, as requested by learners; and, some manner of out-of-class homework assignment (Berrett, 2012; Pierce & Fox, 2012; Schlairet et al., 2014). The traditional classroom pattern continued with learners following the directions and lead of the teacher; receiving the F2F lecture; asking clarifying questions, as needed; and, completing assigned in-class and out-of-class work (Berrett, 2012; Pierce & Fox, 2012; Schlairet et al., 2014; Zainuddin & Halili, 2016). Talbert (2017) viewed the standout, characteristic behaviors of learners in a traditional, teacher-centered classroom as actions that perpetuated dependent, passive, and shallow learning.

Benefits of the flipped approach

The literature reflected the benefits of the flipped approach in the form of four general themes: learner interactions (learner-content, learner-instructor, learner-learner, and learner-interface), active-learning activities, learner control in the online and F2F environments, and learning through reflection (Berrett, 2012; Cabi, 2018; Logan, 2015; Rui et al., 2017; Szparagowski, 2014; Talbert, 2015). Ascough (2002) noted the research of Glasser and Nicholl on what learning processes lead to knowledge and what people remember

> 10% of what they read;
> 20% of what they hear;
> 30% of what they see;
> 50% of what they see and hear;
> 70% of what they discuss with others;
> 80% of what they experience personally; and,
> 95% of what they teach to others (p. 22).

Researchers noted how the benefits of the flipped classroom affected learners' satisfaction, achievement, and knowledge or learning gains by the quality of the interactions, real-world relevance of the activities, amount of control permitted to the learners, and nature of the reflective assignments (Boone, 2015; Cabi, 2018; Logan, 2015; Rui et al., 2017; Talbert, 2015; Yilmaz, 2017).

Interactions.

Throughout the literature, researchers documented how the flipped approach led to an increase in the four fundamental types of interaction: learner-content, learner-instructor, learner-

learner, and learner-interface (Arbaugh, 2014; Berrett, 2012; Bouhnik & Carmi, 2012; Zainuddin & Halili, 2016). In his extensive examination of the literature, Moore (1989) sought to solidify the distinction of theories and ideas regarding terminology among the distance-education community by refining and defining the sub-concepts of interaction. Moore (1989) believed that the term interaction carried so many different meanings that the greater imperative was to clarify and define sub-terms and meanings the community could generally agree upon.

Noting the prominent online component to flipped designs, researchers remarked how theories once regarded as only applicable to distance education or solely online delivery, like the types of interaction, are increasingly useful to inform the perspectives and direction of blended and flipped-learning environments (Arbaugh, 2014; Bouhnik & Carmi, 2012). As discussed by Zainuddin and Halili (2017), learner-interface interaction, regarding the learners' interaction with education technology tools like learning or content management systems, was suggested and added by Hillman, Willis, and Gunawardena (1994) as the fourth interaction to complement Moore's (1989) foundational work. Researchers continue to use Moore's (1989) theory of interaction, with the addition of learner-interface interaction, to distinguish among the types of interaction taking place in both the online and F2F environments, and as measures in evaluating and analyzing instructional, learning, and course effectiveness (Yilmaz, 2017).

Learner-content interaction.

First, Moore (1989) described learner-content interaction which involves the learner and the content, subject, or concepts of a lesson, course, or field of study. Moore (1989) defined learner-content interaction as, "the process of intellectually interacting with content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind" (p. 1). In studies of adult learners in educational settings, Moore (1989) observed that most adults undertake self-directed study where the learner personally engages the content, subject, or concepts serving as the focus of study. As seen from the literature on flipped learning, researchers most often found mixed quantitative results for their overall study, but qualitative measures reflected increases in learner-content interaction over teacher-centered classrooms (Blackley & Sheffield, 2015; Parker et al., 2008).

Bishop and Verleger (2013) conducted a qualitative, document-based study on technology use and education ideology surrounding the content in flipped classrooms. The researchers collected evidence from studies based on type of in-class and out-of-class activities, evaluation measures, and research method (Bishop & Verleger, 2013). The findings revealed mixed achievement results from learners, but reflected learners' positive preferences for interactive activities in the classroom over the teacher-centered lectures (Bishop & Verleger, 2013). According to Bishop and Verleger (2013), the studies highlighted the advances in education technologies and changes to pedagogical practices for increasing learner-content interaction where learners reportedly preferred learning environments that used concise video lectures over in-class lectures to convey lesson content; online homework over "paper-and-pencil homework" (p. 2); and, problem-based discussions and active-learning activities to improve teachers' efforts to instill course concepts.

Learner-instructor interaction.

Next, Moore (1989) described the concept of learner-instructor interaction where the learner "comes under the influence of a professional instructor and is able to draw on the experience of the professional to interact with the content in the manner that is most effective for that particular individual learner" (p. 2). Regarding this highly desirable and essential element of learning programs, Moore (1989) highlighted the common components of learner-instructor interaction as instructor-guided organization (i.e., planned, yet flexible environment), instructor actions (i.e., application and practice activities), and instructor support (i.e., feedback, counsel, encouragement). The chief characteristic difference in this type of interaction and the others is the teacher's influence, varying in frequency and intensity, in the learning environment and on the learner (Moore, 1989). In studies of adult learners in educational settings, teachers scaffolded their influence and feedback to support the adult-learners' needs for autonomy and content mastery (Blackley & Sheffield, 2015; Diep, Cocquyt, Zhu, Vanwing, & de Greef, 2017; Larsen, 2015; Moore, 1989).

Earley (2016) conducted a cased study with 18 graduate students to observe if a flipped approach would result in increased student engagement and satisfaction in a qualitative research methods course. Early (2016) collected student feedback using end-of-term evaluations and evaluated course mastery using a standard, end-of-term product required of the entire class. Earley (2016) found that his students responded positively to the flipped-learning environment where his accessibility to each student during class ranked as among the best of the students' experiences. Recounting his actions and conduct of the course and study, Earley (2016) noted that pre-class organization, in-class actions, and support to students required purposeful forethought and real-time adjustments.

To successfully design and implement an effective flipped classroom, Earley (2016) remarked about the heavy workload and time demands to prepare and conduct the learning environment, especially if initiating the endeavor for the first time. First, to organize a planned yet flexible learning environment, Earley (2016) collected and prioritized content for direct instruction; created and curated out-of-class video content; prepared for in-class assessments and interaction; and, established the online, out-of-class active-learning components. Next, as instructor actions, Earley (2016) noted not only the importance of authentically relevant learning activities, but also the imperatives of flexibly differentiating and scaffolding instruction, and using a variety of assessments students could use to demonstrate and achieve content mastery.

Last, for instructor support, Earley (2016) found that chief among the students' preferences in the learning experience was the availability of the instructor to observe and then scaffold feedback to each student or group based on needs of the individual(s) and circumstances of the situation.

Learner-learner interaction.

Third, with advancements in education technologies, Moore (1989) described the dimension of increased interaction that was possible between learners both in class and out of class. With employers desiring the skills of communication and productively working in teams, learner-learner interaction in education programs adds the highly desirable elements of improved communication, collaboration, and social learning (Berrett, 2012; Canhoto & Murphy, 2016). Moore (1989) observed the importance of interaction between learners where encounters among classmates enhanced the quality of peer-to-peer communication and team productivity through learner-directed corrective and supportive feedback, and application and evaluation of course deliverables. In studies of adult learners in educational settings, learner-learner interaction supported learner autonomy and knowledge mastery through active-learning activities that used peer discussions, analysis, feedback, exercise of existing knowledge and skills, and application and evaluation of course concepts in assessments (Berrett, 2012; Blackley & Sheffield, 2015; Canhoto & Murphy, 2016; Hao, 2016; Moore, 1989; Parker et al., 2008).

Combining the flipped classroom with a cooperative-learning approach, Chen and Chuang (2016) used the case-study method to evaluate the combined pedagogies while teaching technical project management skills to would-be project managers. Chen and Chuang (2016) used student evaluation and final projects to analyze student learning and acquisition of technical skills with both individual-project and small-group, team-based project management. Using video lectures, online quizzes, and in-class discussions and projects, Chen and Chuang (2016) found the flipped approach as ideal to teach students the technical skills of project management while supporting a learner-learner, interactive encounter. Chen and Chuang (2016) concluded the flipped classroom and use of collaboratively based projects brought a practical, social interaction among learners and enhanced highly desired team-behavior skills through communication, discussion, and support over what was possible through traditional lecture and take-home projects.

Learner-interface interaction.

Where learner-learner interaction was the last type of interaction attributed to Moore (1989), the literature recognizes the addition of learner-interface interaction which refers to how learners interact with the technology environment (Zainuddin & Halili, 2017; Moore, 2011; Tuapawa, 2013). Reflecting the advancements and importance of technology-based tools like high-speed Internet and supporting education technologies like learning and content management systems (i.e., BlackBoard, Canvas, Moodle), learner-interface interaction considers the technology used in many of today's educational programs as a vital component which facilitates the other types of interaction (Arbaugh, 2014; Blackley & Sheffield, 2015; Hoffman, 2014; Little, 2015; Tuapawa, 2013; Zainuddin & Halili, 2017). As expressed by Little (2015), the recognition of learner-interface interaction as an accepted type of interaction is in response to the shifting education and learning contexts, and advances in technology that necessitated and drove "changes in teaching and learning practices and resources" (p. 271). In studies of adult learners in education settings, learner-interface interaction is credited with facilitating improvements in the other types of interaction, delivery of active-learning activities, learner control in the learning environment, and learning through reflection (Blackley & Sheffield, 2015; Little, 2015; Parker et al., 2008; Rui et al., 2017; Tuapawa, 2013; Wang, 2017a).

Everett (2015) conducted a qualitative content analysis to examine the themes surrounding engagement strategies and technologies that contributed to student learning.

Specifically, Everett (2015) studied student engagement, technology support in the online environment, teachers' use of content management tools to improve education programs, and the flipped-learning experience. While dependent upon such situational factors as institutional funding and teacher experience with technology tools, Everett (2015) found that use of modern learning management systems supported asynchronous and synchronous tools, and offered a variety of video and live communication options, discussion forums, chat options, and active-learning assignment features. Available through most any Internet-capable device, Everett (2015) concluded that while continued study and research on technology use in educational settings was warranted, learner-interface interaction was a valuable consideration for facilitating learner engagement and interactions with content, peers, and teachers.

Active learning.

The next benefit discussed in the flipped-classroom literature was the improved performance and learning that students achieved through activities deemed active learning (Pierce & Fox, 2012; Schlairet et al., 2014). Knowles, Holton, and Swanson (2015) described active learning as an approach where "learners take a participative role rather than a passive role" in instruction to develop mastery of course concepts or skills (p. 239). Knowles et al. (2015) believed that learning environments that used an active-learning approach allowed learners to integrate existing knowledge and experience with new information and that active-learning environments provided learners with ample opportunities "to practice all of their skills in one continuous procedure" (p. 239). Knowles et al. (2015) concluded that it was the dynamic production of transfer and practice that "facilitates both learning and retention" (p. 239).

Phillips and Trainor (2014) investigated a flipped approach with undergraduate accounting students. The researchers administered an originally designed survey to collect 125 accounting students' attitudes and experiences in a flipped classroom that used active-learning strategies (Phillips & Trainor, 2014). The researchers found 74% of the 125 students were open to using new techniques and expressed a desire to continue hands-on, practical activities that guided them to apply the content presented in the course (Phillips & Trainor, 2014). Phillips and Trainor (2014) concluded that based on the survey results, teachers using a flipped approach, along with meaningful active-learning activities, could meet students' desires to not only receive academic knowledge from a course, but also develop personal understanding of and application for course material.

Within the flipped-classroom literature, researchers listed common active-learning activities used in F2F meetings and online (O'Flaherty & Phillips, 2015; Phillips & Trainor, 2014; Ramnanan & Pound, 2017; Szparagowski, 2014). Some common activities teachers used to engage learners and impact student satisfaction, achievement, and learning were application activities using course concepts in case studies; in-class guided discussions; problem-solving exercises with realistic, hypothetical contexts or current events; online discussion forums; and, real-world, collaboratively structured projects (Boone, 2015; O'Flaherty & Phillips, 2015; Phillips & Trainor, 2014; Ramnanan & Pound, 2017; Szparagowski, 2014). Researchers found that use of active-learning methods greatly improved students' learning experiences as interactive, in-class and online sessions allowed learners to translate course academics and abstract concepts into personally relevant and understanding-driven practices (McDonough, 2014; Szparagowski, 2014).

Learner control.

The third major benefit of the flipped classroom in the literature was the aspect of learner control within the learning environment. While Knowles et al. (2015) described an in-depth process of learner control with four phases, the studies in the literature reflected the reality of limitations for adults in formal educational settings on taking complete control of their learning situation and decision-making. As described by Knowles et al. (2015), learner control of the learning process as an ideal consists of four phases

> *Need*. Determine what learning is needed so as to achieve goals.
> *Create*. Create a strategy and resources to achieve the learning goal(s).
> *Implement*. Implement the learning strategy and use the learning resources.
> *Evaluate*. Assess the attainment of the learning goal and the process of reaching it (emphasis in original; p. 157).

However, the literature reflected what Knowles et al (2015) acknowledged as the reality of learners in educational settings where at most, an amount of shared control exists, but primary authority remains with the teacher.

Studies on the flipped-classroom that reported high motivation, satisfaction, and achievement among learners highlighted aspects of a flipped classroom that offered varying degrees of learner control within the learning environment (Ausburn, 2004; Lo, Lie, & Hew, 2018; Peterson, 2016; Rui et al., 2017; Schlairet et al., 2014; Unal & Unal, 2017). Two of the most common areas of learner control involved out-of-class preparation and learner-selected projects to demonstrate mastery of course concepts (Blackley & Sheffield, 2015; McDonough, 2014; Rui et al., 2017). These two areas of control correspond to the phases described by Knowles et al. (2015) where learners "determine what learning is needed," and share aspects of control with the teacher to create a learning strategy, implement the strategy, and formatively assess learning (p. 157).

Researchers in the literature commonly expressed that their desire for pursing a flipped approach was to increase their learners' engagement and mastery of course material (Ausburn, 2004; Lo et al., 2018; Peterson, 2016; Rui et al., 2017; Schlairet et al., 2014; Unal & Unal, 2017). The transition from a passive classroom to an engaged, interactive class involved offering learners' control and responsibility of their own learning. The first most common area of learner control was out-of-class preparation. Consistent out-of-class preparation measures taken by learners included watching video lectures, taking notes, completing online activities, reading text-based materials, conducting supplementary research, and participating in online discussion forums (Lo, et al., 2018; Peterson, 2016; Rui et al., 2017; Schlairet et al., 2014; Unal & Unal, 2017). Each learner's preferred use of technology, and the timing, pace, and amount of preparation was entirely at the learner's discretion.

The second most common area of learner control was through use of learner-selected projects or methods to demonstrate mastery of course concepts. Teachers encouraged learners to accomplish assessments individually or in small groups, and supported learners' efforts to combine and incorporate existing knowledge and experiences with course concepts in open-ended discussions, student-led instruction, or professionally relevant authentic assessments (Ausburn, 2004; Blackley & Sheffield, 2015; Lo et al., 2018; Peterson, 2016; Rui et al., 2017; Unal & Unal, 2017). Researchers found that allowing learners to self-select demonstration of course mastery increased individual-learner buy-in, investment, and learning (Blackley & Sheffield, 2015; Lo et al., 2018; Peterson, 2016; Rui et al., 2017; Unal & Unal, 2017). Learner-selected, team-based assessments were also found to increase learner interactions, satisfaction, and achievement while creating a sense of community in the learning process (Lo et al., 2018; Peterson, 2016; Unal & Unal, 2017).

Learning through reflection.

The fourth major benefit of the flipped classroom in the literature was learning through reflection. Defined through context in Knowles et al. (2015), reflection is a technique that prompts learners to focus on existing experiences and knowledge, and purposely integrate new knowledge and skills as an exercise to aid retention, transfer, and learning. Commenting on acting and reflecting, Kolb and Kolb (2014), remarked that "many programs in higher education are much more focused on impressing information on the mind of the learner than on opportunities for the learners to express and test in action what they learned" (p. 208). Researchers who investigated assignments that promoted and stimulated reflection found improved learning outcomes, performance, and regulation of personal effort (Kaufman, 2003; Manwaring, Larsen, Graham, Henrie, & Halverson, 2017; Means, Toyama, Murphy, Bakia, & Jones, 2010; Sun et al., 2018; Yilmaz, 2017). Additionally, learners who described how learning activities were personally or professionally relevant, or how new material complemented existing knowledge, also reported increased cognitive and emotional engagement (Kaufman, 2003; Manwaring et al., 2017).

To promote learning through reflection and increased learner acceptance and engagement of complex material, Wilson (2013) flipped her undergraduate statistics course "to increase student interest, engagement, and retention of the types of statistical knowledge and skills needed for students to be successful in their academic and professional careers" (p. 193). Using a quasi-experimental design, Wilson (2013) compared pretests, posttests, overall course grades, and student evaluations from two traditional and two flipped classrooms to investigate "how helpful specific learning activities were in obtaining the learning objectives of the course" (p. 196). The learning activities Wilson (2013) required were practical statistics-skills application and reflection prompts focusing learners on the knowledge and skills learned in class, relevant use of statistics in their academic majors and eventual careers, and awareness and explanation of statistics-supported information found in any newspaper. Additionally, Wilson (2013) allowed class time for presentations and discussions of the learners' findings on the homework. Reporting on her study, Wilson (2013) found a significant difference between the traditional and flipped classrooms in overall course grades and posttest scores, and learners' attitudes toward the teacher and the course. Wilson (2013) concluded that the flipped approach and use of reflection activities not only enhanced learning, but also decreased learners' anxiety toward statistics.

Challenges of the Prerequisite Situational Variables

When designing a flipped classroom or altering an existing course to a flipped approach, researchers found that what transpired in the learning environment was ultimately dependent on a complex, interconnected system of prerequisite situational variables. Researchers identified the primary situational variables as the institution, faculty, instructional design, technology, and learners, which serve as the source of issues, barriers, or challenges when implementing a flipped classroom (Bouhnik & Carmi, 2012; Little, 2015; Ma'arop & Embi, 2016; Sun, Xie, & Anderman, 2018; Talbert, 2015; Wang, 2017b). Dennis, Bunkowski, and Eskey (2007) defined prerequisite situational variables as interconnected, internal and external, context-specific factors that exert a varying degree of influence on a learning environment.

As described by Wang, Han, and Yang (2015), the common, but context-specific situational variables reflected the complexity of the learning environment. Identification of the variables contributes to the practitioner's understanding of the intricate, often politically charged or sensitive, dynamic relationship between variables and how the variables interact and change without notice (Bouhnik & Carmi, 2012; Little, 2015). The situational variables formed an array of influences that determined what was achievable in the learning environment by acting as the driving forces behind why decisions were made, what program designs were undertaken, and how implementation occurred (Dennis et al., 2007; Talbert, 2015; Wang et al., 2015). The prerequisite situational variables ultimately determined what educational programs or aspects of programs would be sustained and what would be discontinued (Kim, Kim, Khera, & Getman, 2014; Wang et al., 2015). To address the range of complex, program-related planning tasks, Wang et al. (2015) described the importance of viewing the learning environment as a living system and applying local knowledge of the situational variables, beginning with the institution.

Institution.

Institutions comprised the first of the prerequisite situational variables. In the literature, institutions shaped the learning environment and educational programs as the primary force or constraint behind why decisions were made in the classroom. The institutional variable, by way of institutional leadership, determined the overall direction of the institution through decisions about priorities, policies, and procedures that affected major operations like the allocation of funds, research endeavors, major purchases/investments, outside partnerships, level of teacher autonomy, and collaboration efforts with external entities (Dennis et al., 2007; McGarry et al., 2015; Missildine et al., 2013; O'Flaherty & Phillips, 2015; Schlairet et al., 2014). Institutional priorities, policies, and procedures influenced behavior and guided decisions of the institution's leaders and subordinate faculty, and impacted the learning environment for years or decades into the future (Kim et al., 2014; Ma'arop & Embi, 2016; McGarry et al., 2015; Missildine et al., 2013; Schlairet et al., 2014).

Faculty.

Faculty comprised the second of the prerequisite situational variables and existed in the categories of the teaching faculty, administration officials, and technical-support personnel. In the literature, the teaching faculty affected educational programs and the learning environment through such personal traits as experience, creativity, attitude, initiative, and motivation (Dennis et al., 2007; Earley, 2016; O'Flaherty & Phillips, 2015; Rui et al., 2017; Schlairet et al., 2014; Yilmaz, 2017). The personal character and personality traits of the teachers translated directly into the learning experience and were revealed through pedagogical knowledge, subject matter expertise, approach to learning, readiness to collaborate, view of relationship with learners, inclination and ability to vary methods, technology prowess, and willingness to seek professional development or advanced training opportunities (Dennis et al., 2007; Kostaris et al., 2017;

Manwaring et al., 2016; McGee, 2014; McGee & Reis, 2012; McGee, Valdes, & Bullis, 2016; Missildine et al., 2013; Schlairet et al., 2014; Yilmaz, 2017). Administrative and technical-support personnel affected the learning environment and educational programs in a variety of areas, but most often served as the primary channel for assisting teachers and learners to resolve problems encountered with stubborn bureaucracy and a range of technology-related matters (Earley, 2016; Kim et al., 2014; O'Flaherty & Phillips, 2015; Schlairet et al., 2014).

Instructional design.

Instructional design formed the third component of the prerequisite situational variables. Described as an open system where the interactions are dependent on the external environment and internal subsystems (i.e., "system within the system"), instructional-design and the related entities were comprised of the designers, competencies, and processes within the institution and among the faculty (Rothwell, Benscoter, King, & King, 2016, p. 11; McGarry et al., 2018; O'Flaherty & Phillips, 2015). Rothwell et al. (2016) described the complexity of the instructional-design variable this way:

> Instructional systems design…is not about the mindless application of step-by-step schemes or new technology. Improving human performance is hard work. Both an art and science, instructional design requires a blend of intuitive and analytical thinking. And it requires a willingness to meet needs to solve organizational problems, which (in turn) may demand that instructional designers skip steps in traditional instructional design models, multitask to do several steps at once, rearrange steps, add steps (such as translation), or even reinvent design models to meet the unique needs of unique (learners) in unique situations. The growing desire for accelerated approaches that align with the fast-paced demands of new technology has prompted new interest in diverse models to guide instructional design. (p. xv)

From the literature, the instructional-design variable affected the learning environment by shaping the underlying structure of educational programs typically through accepted pedagogical frameworks, selection of activities for learning experiences, and how instructional designers operated with the capabilities and within the constraints of the institution, faculty, and technology (Hoffman, 2014; Lee, Lim, & Kim, 2017; Ma'arop & Embi, 2016; Manwaring et al., 2017; McGarry et al., 2018; O'Flaherty & Phillips, 2015).

Technology.

Technology made up a fourth of the prerequisite situational variables. The literature advocated for pedagogy before technology, but technology often determined what activities, programs, engagement, and interaction were possible. Technology most often impacted the learning environment by way of computer-mediated, enterprise-level solutions; available technological tools; and, capacity of the institution's technology infrastructure, like wireless, local area network, virtual-lab, and learning management system capabilities (Ascough, 2002; Cabi, 2018; Ma'arop & Embi, 2016; Manwaring et al., 2017; Missildine et al., 2013; Moraros, Islam, Yu, Banow, & Schindelka, 2015; Yilmaz, 2017). To effectively design and implement programs for learning, the technology variable was most often viewed as not only the determinant of what an educational program could pedagogically achieve, but also what institutions and faculty could sustain (Ma'arop & Embi, 2016; McGarry et al., 2015; Yilmaz, 2017).

Learners.

Learners made up the fifth of the prerequisite situational variables. A common concern within the literature on flipped-classroom studies was if learners possessed the readiness, skills, and maturity for assuming ownership of their learning and willingness to emotionally and cognitively engage in the learning environment (Lee et al., 2017; Ma'arop & Embi, 2016; Manwaring et al., 2017; McGarry et al., 2015; O'Flaherty & Phillips, 2015; Talbert, 2015). Researchers sought to examine numerous learner-related factors within the learning environment to better understand why some flipped interventions were successful while other interventions yielded the same outcome as traditional methods, but without the extra work (Yilmaz, 2017).

Common research into learner characteristics analyzed factors such as goal orientation, motivation, self-regulation, metacognition, self-efficacy, personality, prior knowledge, use of learning strategies, and individual demographics (Hao, 2016; Jovanovic et al., 2017; Larsen, 2015; McDonough, 2014; Shivetts, 2011; Sun et al., 2018; Yilmaz, 2017). Despite the learner-factors measured, studies often reported mixed results (Cabi, 2018; Jovanovic et al., 2017; Larsen, 2015; Missildine et al., 2013; Sun & Wu, 2016).

Acknowledging the presence of near-infinite situational effects and individual-learner differences, Knowles et al. (2015) discussed the merits of investigating the situational variables from multiple perspectives. Discussing the matter from the researcher's dilemma of prediction versus explanation in behavioral-science research, Pedhazur (1997) advised, "theory is the best guide in selecting criteria and predictors, as well as in developing measures of such variables" (p. 197). Knowles et al. (2015) concluded that only prior analysis of the academic context and situational variables, along with planned learning experiences and flexible application, would guide a practitioner through the considerable intricacies in and complexity of the learning environment.

Effect of Teaching Method on Achievement and Satisfaction

The effect of teaching method on the learner and in learning environment was often measured in terms of learners' achievement and satisfaction. In blended and flipped classrooms, researchers investigated the effects with a variety of researcher-defined terms such as learner success, perception, attitude, utility, performance, and knowledge, skills, or learning gains, and equated the terms as a measure of achievement or satisfaction (Flores, Del-Arco, & Silva, 2016; Garrison & Cleveland-Innes, 2005; Hao, 2016; Kostaris, Sergis, Sampson, Giannakos, & Pelliccione, 2017; Mason, Shuman, & Cook, 2013; Moraros et al., 2015; Pierce & Fox, 2012; Rui et al., 2017; Sergis, Sampson, & Pelliccione, 2018; Sohrabi & Iraj, 2016; Sun & Wu, 2016;

Talbert, 2015; Tosta, 2012; Turan & Goktas, 2016). However, regardless of the variable, term, or instrument chosen to measure the effect, the results of the measured areas, typically the learners, environment, and teaching method, varied per study (Flores et al., 2016; Jovanovic et al., 2017; Kostaris et al., 2017; Mason et al., 2013; Moraros et al., 2015; Sergis et al., 2018; Sohrabi & Iraj, 2016; Sun & Wu, 2016; Tosta, 2012; Turan & Goktas, 2016).

Achievement.

Learners' academic achievement was a common measure of effectiveness for teaching methods. Best defined by Kanadli (2016), academic achievement is "the level of acquisition of the course attainments as a result of learning experiences that the students undergo in any discipline" (p. 2,062). Researchers used a variety of quantitative measures such as exam scores, quizzes, grade point average, pre- and post-test comparisons, and final grades, and qualitative measures such as performance and knowledge or learning gains as indicators or predictors of learners' achievement (Cabi, 2018; Little, 2015; Mason et al., 2013; Moraros et al., 2015; Parker et al., 2008; Pierce & Fox, 2012; Sohrabi & Iraj, 2016; Turan & Goktas, 2016). The literature revealed mixed results on quantitative measures of learner achievement based on teaching method (Cabi, 2018; Jovanovic et al., 2017; Larsen, 2015; Missildine et al., 2013; Moraros et al., 2015; Tosta, 2012).

For qualitative studies measuring achievement, researchers using self-report instruments stated achievement was higher on learners' preferences and perceived knowledge, skill, or learning gains in favor of flipped classrooms over the traditional, lecture-based method (Flores et al., 2016; Garrison & Cleveland-Innes, 2005; Jovanovic et al., 2017; Mason et al., 2013; Sun & Wu, 2016). Learners' qualitative, self-reported achievement gains in flipped classrooms were reportedly due to aspects of the learning environment such as enhanced quality of the interactions, active-learning activities, learner control, and assignments prompting learners to reflect on and discuss knowledge or learning gains (Blackley & Sheffield, 2015; Flores et al., 2016; Garrison & Cleveland-Innes, 2005; Hao, 2016; Mason et al., 2013; Sun & Wu, 2016).

Satisfaction.

Learners' satisfaction was another common measure of effectiveness for teaching methods. While never formally defined, learner satisfaction can be defined through context as the fulfillment or perception of fulfillment of a need, desire, goal, or expectation (Peterson, 2016; Ramnanan & Pound, 2017). Researchers used both quantitative and qualitative measures (i.e., Likert-scale, open-ended comment) and methods (i.e., surveys, questionnaires, focus groups, interviews, observation) to collect learners' self-reported motivation, regulation, strategy use, perception, attitude, confidence, self-efficacy, engagement, desire, improvement, or preference as measures of satisfaction with a course and teaching method (Cabi, 2018; Flores et al., 2016; Hao, 2016; Jovanovic et al., 2017; Kostaris et al., 2017; Mason et al., 2013; Moraros et al., 2015; O'Flaherty & Phillips, 2015; Pierce & Fox, 2012; Rui et al., 2017; Sergis et al, 2018; Sun et al., 2018; Tosta, 2012; Zhai, Gu, Liu, Liang, & Tsai, 2017).

Learners' satisfaction with flipped classrooms was also reportedly due to aspects of the learning environment such as enhanced quality of the interactions, active-learning activities, learner control, and assignments prompting learners to reflect on and discuss knowledge or learning gains (Blackley & Sheffield, 2015; Cabi, 2018; Flores et al., 2016; Kostaris et al., 2017; Mason et al., 2013; Moraros et al., 2015; Sergis et al, 2018; Yilmaz, 2017; Zhai et al., 2017). Researchers often concluded quantitative or qualitative measures of learners' self-reported satisfaction (i.e., Likert scale or open-ended comment on end-of-course surveys or questionnaires) were sufficient to evaluate the effectiveness of teaching method and overall learner satisfaction with the learning environment, and knowledge, skill, or learning gains (Cabi, 2018; Flores et al., 2016; Hao, 2016; Kostaris et al., 2017; Mason et al., 2013; Moraros et al., 2015; Pierce & Fox, 2012; Sergis et al, 2018; Tosta, 2012; Yilmaz, 2017; Zhai et al., 2017).

Effect of Teaching Method by Career-Status and Age

While numerous studies were concerned with the effects of teaching method on achievement and satisfaction, some researchers sought to measure the moderating effects of age and career status (i.e., for the military, active duty, non-prior service, Reserve component) with teaching method. For the moderating effects of age and career status in non-military populations, researchers investigated learners in secondary, undergraduate, or graduate education; and, examined learners' self-efficacy, prior-domain knowledge, and use of cognitive and learning strategies (Cabi, 2018; Jovanovic et al., 2017; Pierce & Fox, 2012; Sohrabi & Iraj, 2016; Sun et al., 2018; Turan & Goktas, 2016).

For quantitative studies investigating the effects of teaching method on learner populations, the studies revealed mixed results when accounting for age, experience, skill, or prior knowledge (Errey & Wood, 2011; Missildine et al., 2013; Pierce & Fox, 2012). In qualitative studies, researchers found learners' self-reported preferences and perceptions of knowledge, skills, and learning gains favored flipped classrooms over the traditional, in-class, lecture-based teaching method regardless of learner population, age, existing experience, skill level, or prior knowledge (Cabi, 2018; Larsen, 2015; Sohrabi & Iraj, 2016). In the few studies that found learners' self-reported negative attitudes or perceptions regarding the flipped-teaching method, learners revealed their dissatisfaction with the perceived increase in out-of-class workload, and the unwillingness to or resistance toward taking ownership of one's own learning or actively participating in the learning environment (Berrett, 2012; Cabi, 2018; Missildine et al., 2013; Rui et al., 2017; Talbert, 2015; Yilmaz, 2017).

Researchers concluded that passive learners, extrinsically motivated learners, or learners who lacked skills in use of cognitive or learning strategies preferred teacher-centered learning environments (Berrett, 2012; Cabi, 2018; Cook, Gelula, Dupras, & Schwartz, 2007; Horii, 2007, p. 370; Mason et al., 2013; Sohrabi & Iraj, 2016; Sun & Wu, 2016; Sun et al., 2018; Talbert, 2015; Talbert, 2017). However, researchers also concluded that active learners, disciplinary experts, learners with prior-domain knowledge, or learners who use cognitive strategies would perform well regardless of teaching method, age, or experience due to learner traits like intrinsic motivation, internal locus of control, or high self-efficacy (Berrett, 2012; Cabi, 2018; Cook et al., 2007; Hao, 2016; Horii, 2007; Jovanovic et al., 2017; Larsen, 2015; Mason et al., 2013; Sohrabi & Iraj, 2016; Sun & Wu, 2016; Sun et al., 2018; Talbert, 2017).

How Researchers Developed Their Flipped Classroom

Detailing the complexity of the combined online and F2F learning environments and associated instructional-design tasks, the literature reflected how more researchers from 2012 to 2018 began to increasingly design their studies from an educationally sound, theoretically based position before focusing on practical, instructional application and classroom practice. Supporting this observation, Lo, Lie, and Hew (2018) found that researchers in many studies of the flipped classroom before 2015 used a process- or principles-focused framework for their flipped-classroom model or pedagogical design. McGee (2014) observed the same pattern of theory-based versus process-focused studies from 2006 to 2011 by reporting how many studies primarily concentrated on aspects of the learning environment like learner satisfaction, achievement, and learning styles, or integrating technology tools.

Of the articles selected for this study, and as documented in Table 4, Frequency Distribution of Studies by Research Design, Model, and Approach, the researcher discovered 65 theoretically based studies, and 25 studies solely focused on educator practice, a process-focused framework, or a set of researcher-defined instructional design principles to guide implementation or describe a flipped-classroom approach. Overall, the growing body of flipped-classroom research reflected assorted theory-based and process-focused approaches where researchers chose some manner of informed, yet flexible trial-and-error model, and recommended assembling a team of experts for the instructional-design process.

Theory-based versus process-focused approach.

As observed by Lee, Lim, and Kim (2017) and Lo, Lie, and Hew (2018), much of the literature on designing flipped classrooms reflected studies developed from a theoretically based synthesis of research or a practical, process-focused approach. The process-focused studies investigated teaching methods based on researcher or teacher experience; a customized instructional-design process; or, list of researcher-defined design principles (Baldwin & Trespalacios, 2017; McGarry et al., 2015; Schlairet et al., 2014; Talbert, 2015). Without a singularly accepted theoretical framework or instructional-design approach for the flipped-learning model, educators contended with the designer's dilemma that "design requires specificity but specificity is incompatible with reusability and general application" (Larsen, 2015; Lee et al., 2017, p. 449). This designer's dilemma presented the issue of balance for theorists who sought a theoretically based and "wide-reaching model with general and flexible guidelines," and practitioners, typically as discipline subject matter experts, who sought "a useful model with specific and practical guidelines" (Lee et al., 2017, p. 449).

Ertmer and Newby (2013) approached the designer's dilemma by articulating the instructional-design goal as one of balancing theory and process where educators can practically translate "principles of learning and instruction into specifications for instructional materials and activities" (p. 43). Ertmer and Newby (2013) added that how one defined learning and what one believed about the ways learning occurs would drive "instructional strategies and techniques for facilitating learning" (p. 43). However, the researchers acknowledged that the complexity and labor of the instructional-design process produced the tendency to generate solutions to practical learning issues where solutions often lacked a clear connection to a sound, contributing learning theory (Ertmer & Newby, 2013).

To translate a theory of learning into practice and effectively prescribe a solution to an instructional problem, Ertmer and Newby (2013) emphasized core knowledge and skills to balance the designer's dilemma and link application and research (i.e., theories of learning). First, Ertmer and Newby (2013) addressed learning theories as a source to inform instructional strategies and methods. Knowledge of learning theories served as "an effective prescription for overcoming a given instructional problem" (Ertmer & Newby, 2013, p. 44).

Second, an instructional strategy or method selected for the demands of an instructional task comes from understanding learning theories (Ertmer & Newby, 2013). Knowledge of when, why, and how to connect learning theories to a repertoire of instructional strategies leads one to match educationally sound theory and instructional demands (Ertmer & Newby, 2013). Third, Ertmer and Newby (2013) advised that given an instructional context, "learning theories and research often provide information about relationships among instructional components and the design of instruction" (p. 44). Awareness of the relationship dynamics, including the context-specific situational variables, offer insight into specific techniques and strategies for integrating theory, instructional design, and instructional content for a specific subject matter and group of learners (Garrison & Cleveland-Innes, 2005).

Last, Ertmer and Newby (2013) reminded researchers that the role of theory is to offer an avenue for reliable prediction. Through use of core knowledge and skills to bridge application and research, Ertmer and Newby (2013) derived seven questions to facilitate an intentional approach for understanding and balancing the designer's dilemma

1. How does learning occur?
2. Which factors influence learning?
3. What is the role of memory?
4. How does transfer occur?
5. What types of learning are best explained by the theory?
6. What assumptions/principles of the theory are relevant to instructional design? and,
7. How should instruction be structured to facilitate learning (p. 46)?

Deliberately selecting a sound, theoretically based strategy for the context and instructional demands offers a more reliable, even predictable, approach for instructional design instead of arbitrarily implementing material and activities as de-linked solutions to instructional tasks (Hoffman, 2014; McGee, 2014).

To meet the demands of flipped learning, Ertmer and Newby (2013) addressed how technology has transformed learning in today's learning environments. Ertmer and Newby (2013) described how the concept of learning as a process has witnessed three notable changes: (a) technology has allowed immediate, reliable access to expert information; (b) learners use learning experiences for "high levels of interaction and activity" (p. 67); and, (c) employers expect communication skills and technological competence in their workforce. These changes have driven an increased interest in theoretical perspectives that can align teaching methods and instructional strategies to these changes in instructional demands and the needs of learners (Bouhnik & Carmi, 2012; Ertmer & Newby, 2013). As presented in the literature, the needs of today's learners require instructional designs that afford the advantages of technology and embrace learner control, learner interactions, active-learning using authentic and collaboratively structured assessments, and learning through reflection (Blackley & Sheffield, 2015; Bouhnik & Carmi, 2012; Ertmer & Newby, 2013; Rui et al., 2017).

Using informed, flexible, trial-and-error guidelines for instructional design.

Throughout the literature, researchers who categorized themselves as first-time flippers offered both anecdotal reflections and researched analyses of the learning environments and on their instructional-design process. While discussing flipped learning and the big-picture instructional design process known as ADDIE (analyze, design, development, implementation, evaluation), Hoffman (2014) acknowledged, "the stumbling block has often been the detail needed by a designer to create the actual learning tasks and select appropriate teaching strategies and resources" (p. 54). Other researchers posited that any instructional design for a flipped-classroom endeavor should come from informed, yet flexible guidelines that generously accommodate trial and error; account for the constraints of the existing context-specific situational variables (i.e., institution, faculty, instructional design, technology, learners); and, cover the major flipped-classroom components of in-class and out-of-class activities, and the online and F2F environments (i.e., often phrased, "deciding the right blend"; Canhoto & Murphy, 2016; Foster & Stagl, 2018; Korr, Derwin, Greene, & Sokoloff, 2012; Lee et al., 2017; Ma'arop & Embi, 2016, p. 48; McGarry et al., 2015; Pang & Ling, 2012). However, without a universally accepted theory, framework, model, or process for the flipped classroom, researchers endorsed even novice attempts and approaches if changes for the classroom swapped passive learning environments for methods that actively engaged learners and pushed ownership of learning to the learner (Albert & Beatty, 2014; Hoa, 2016; Hoffman, 2014; Kaufman, 2003; Larsen, 2015; Wilson, 2013).

Informed, flexible instructional design.

To guide instructional design for a flipped-classroom approach, the literature offered researched examples of theoretically based frameworks accompanied by flexible, overarching guidelines, often referred to as characteristics, principles, or themes, that researchers used to inform and guide the trial-and-error implementation of their study-specific, instructional-design activities (Al-Azawei, Parslow, & Lundqvist, 2017; Albert & Beatty, 2014; Canhoto & Murphy, 2016; Hoffman, 2014; Kaufman, 2003; Kim et al., 2014; Lo et al., 2018; McGee, 2014; Pang &

Ling, 2012; Parker et al., 2008). First, Albert and Beatty (2014) researched, identified, and listed what they defined as the five characteristics shared by flipped classrooms

> (a) the education process transforms students from passive to active learners;
> (b) technology facilitates the approach;
> (c) class time and traditional homework are inverted so that homework is done first;
> (d) content is given real-world context; and,
> (e) class activities engage students in higher orders of critical thinking and problem solving or help them grasp particularly challenging concepts (p. 421).

From their meta-analysis, Albert and Beatty (2014) further acknowledged that despite the shared characteristics, each research study revealed a different implementation of a flipped classroom which included the authors' application of the shared characteristics in their own, researcher-defined flipped classroom for an undergraduate management course.

Next, Lo et al. (2018) conducted a study using the flipped-classroom approach guided by Merrill's (2002) First Principles of Instruction: (a) problem-centered; (b) activation; (c) demonstration; (d) application; and, (e) integration. Lo et al. (2018) used Merrill's (2002) principles to inform and guide their design and conduct of out-of-class and in-class, problem-centered activities. While Lo et al. (2018) touted the guidance offered by Merrill's principles, the authors concluded that their first attempt (i.e., one of trial and mostly error) resulted in an initial study greatly hindered by their context-specific situational variables of institution, faculty, and learners.

Last, McGee (2014) investigated pedagogical strategies in research studies of blended courses from 2001 to 2012. McGee's (2014) meta-analysis sought to identify patterns to discover instructional-design priorities and extracted the following themes from the literature: definitions of blended design, meetings for the learner, online priority, technology with a purpose, focused e-interactions, active learning, distribution of time, pedagogical chunking, and outliers and omissions. McGee's (2014) declared purpose was to offer successful strategies by way of the identified themes to inform blended instructional design. As an informed, flexible set of guidelines, McGee's (2014) themes offer insight into planning and balancing instructional-design considerations such as what students will do in and out of class, what learning and teaching should take place, and how to structure online and F2F interactions.

Understand and design within the context-specific situational variables.

In her meta-analysis on themes of blended course designs, McGee (2014) remarked, "Questions remain about what is not reported in the literature that may impact on the potential success of blended courses" (p. 49). Research from around the world and in a diverse array of disciplines and levels of institution (i.e., secondary, undergraduate, graduate) reflected attempts at blended and flipped learning (Cabi, 2018). Many researchers remarked how many decisions that impacted their instructional design were outside of their control and due primarily to internally and externally driven factors such as learners' preparedness, faculty experience, university support, instructional policies, content or discipline requirements, and available technology (Albert & Beatty, 2014; Lo et al., 2018; McGee, 2014; Schlairet et al., 2014). Directly warning about matters that can impact the instructional design and ultimately the learning environment, Korr et al. (2012) remarked that understanding and designing within one's context-specific situational variables of the institution, faculty, instructional design, technology, and learners requires more knowledge and skills than good teaching alone.

The major flipped-classroom components.

Studies that described the complexity of the learning environment and instructional-design process presented the major components for consideration of a flipped classroom and reported not only how the components existed in isolation, but also how the components function together (Wang et al., 2015). First, the major components of a flipped classroom presented in the literature covered the out-of-class and in-class activities, and the online and F2F environments. The overall researched consensus on the flipped-classroom components reflected that researchers experienced a demanding design endeavor which required taking individual components of disparate pedagogies and harmonizing activities and environments (Lee et al., 2017; Little, 2015; Lo et al., 2018; Ma'arop & Embi, 2016; Talbert, 2015).

Second, the major components in isolation were presented as individual considerations and where each component moved lecture out of class and investigated how to more actively, efficiently, and effectively use the limited classroom time (Little, 2015; Lo et al., 2018). The general breakdown of the flipped-classroom components consisted of

> Out-of-class - Usually video lectures and readings to prepare for in-class learning.
> In-class - Interactive, active-learning activities (i.e., problem-solving, real-world focused) where learners "do" the subject.
> Online - Follow-up exercises, discussions, and reflection where learners share ideas, apply knowledge-level concepts, and use opportunities to engage peers, discuss issues, and solve problems.
> F2F - Review of out-of-class material, and participate in collaborative exercises with immediate access to feedback from the instructor (created from the discussion presented by Lo et al., 2018, p. 152-155).

As noted by Little (2015), the educator must plan the design and implementation of each component for every lesson or session in his or her course for an effective flipped-learning experience.

Last, how the flipped-classroom components functioned together was key to an effective and congruent learning environment, but the exact design and implementation of the components differed for each study. The results researchers described about flipped-components that effectively functioned together were blends that enabled learner control during the out-of-class periods; offered a variety of interaction opportunities during in-class sessions; provided online questions, exercises, and discussions to promote learning through reflection; and, used active-learning instruction to guide learners through real-world, problem-centered activities to instill concept mastery (Boone, 2015; Little, 2015; Lo et al., 2018; Ma'arop & Embi, 2016; Rui et al., 2017). While studies reported mixed results on measured areas like learners' satisfaction and achievement, researchers, like Wilson (2013), qualitatively reported their flipped-learning experience as successful and with "great (personal) satisfaction out of seeing students' anxiety and tension be replaced by confidence and skill" (p. 198).

The team approach.

The complexity of designing an effective learning environment requires balancing the dynamic interplay of context-specific situational variables. To achieve such a balance, the literature contained an increasing number of researchers advocating for the best practice of a team approach to the instructional-design process (Pang & Ling, 2012; Talbert, 2015). Where Little (2015) described the design and implementation of his flipped-classroom experience as "particularly labour-intensive (sic)" (p. 272); and, Ma'arop and Embi (2016) found many instructors surprised by "issues like increased workload, increased time devotion, lack of skills to conduct" the blended or flipped components (p. 48); Korr et al. (2012) simply asserted the transition and instructional-design process as "exhausting to all parties" (p. 10). To overcome issues such as a lack of familiarity and understanding of online pedagogies, facilitation versus lecture skills, technology, the instructional-design process, and active-learning strategies, Korr et al. (2012) aptly advised assembling a team of skilled experts. While transitioning their courses to a blended approach, Korr et al. (2012) found that "regardless of the specific model chosen, all course instructors and developers will not be innately talented in all aspects, and may not be strong in some aspects even after training" (p. 9).

As noted in the literature, the "lone-wolf approach" to instructional design lacks the effective and efficient investment and use of resources (Herron, Holsombach-Ebner, Shomate, & Szathmary, 2012, p. 26). As a common perspective presented in the literature, one practitioner, acting as the lone educator and program designer, seldom possessed the internal expertise and physical energy required to design, develop, implement, and then evaluate the pedagogical effectiveness of a program (Arbaugh, 2014; Pang & Ling, 2012; Peterson, 2016). According to Herron et al. (2012), a multi-faceted, multi-disciplined, collaboratively structured production team for instructional design offered such notable benefits as a clear division of labor, checks and balances, constructive review process, responsive maintenance and support, and increased opportunities for the highest quality learning environment and experience for faculty and the learners (Herron et al., 2012). Overall, the team approach was found to provide the best advantages through support from subject matter, design, and technology experts to synchronize and integrate faculty resources and instructional, subject, pedagogical, and technical knowledge (Herron et al., 2012).

Theoretical Framework

The theoretical framework for this study was guided by the process elements of andragogy and stages of Kolb's Experiential Learning Model (ELM). When researchers used Knowles' andragogy as theoretical guidance for adult-learning environments, the focus primarily concerned what Knowles regarded as the principles or assumptions of how adults learn (Bear, 2012; Blackley & Sheffield, 2015; Halpern & Tucker, 2015; Kaufman, 2003). What was often omitted as a research area in the literature was the andragogical process elements. Whereas Kolb's ELM served as a prominent theoretical perspective in the literature for adult learners and flipped classrooms, both the process elements and Kolb's ELM offer a theory-based framework to align flipped-classroom methods and active-learning strategies to meet instructional demands and needs of adult learners.

The andragogical process elements and stages of Kolb's ELM were derived from decades of research conducted by Knowles et al. (2015) and Kolb (2015). The andragogical process elements serve as a systematic guide for designing a learner-centered, active-learning environment; and, link to the assumptions of how adults learn and the benefits of a flipped classroom (i.e., learner interactions, active learning, learner control, learning through reflection; Bear, 2012; Kaufman, 2003). As more educators turn to learner-centered methods, the andragogical process elements and Kolb's ELM inform the instructional-design process and support learning environments of educators who desire to move their learners from passive bystanders to active participants in the learning process (Kaufman, 2003).

The Eight Andragogical Process Elements

The eight andragogical process elements inform this theoretical framework as both a theoretical base and practically focused guide educators and instructional designers can use to develop flexible educational programs suited for adult learners, naturally align the delivery of course materials, and integrate active-learning activities in a flipped classroom. As displayed in Table 5, The Process Elements of Andragogy, the process elements serve as a guide for designing and developing courses that provide learners with procedures and resources for the self-directed acquisition of information or skills specific to each individual learner's needs and situation (Clayton, 2017; Kaufman, 2003; Knowles et al., 2015). Concerned with enhancing the learning experience and equipping learners to self-direct, the eight andragogical process elements guide educators to remake subject- and teacher-centered learning by involving learners in planning aspects of the course, presenting subject-based concepts in a real-world context, and adding a performance-based, problem-solving orientation (Boone, 2015; Clayton, 2017; Kaufman, 2003; Knowles et al., 2015).

Preparing the learner.

To encourage self-directed learning behaviors, Knowles et al. (2015) introduced the first step of preparing learners for an education program. Knowles et al. (2015) found many learners were conditioned to exhibit dependence on a teacher to teach the content or subject. To promote self-directed learning and ownership of the learning process, Knowles et al. (2015) introduced a flexible “learning-how-to-learn activity” which varied based on the needs of the learners and intensity of the education program (p. 53). The opening encounter consisted of

> 1. A brief explanation of the difference between proactive and reactive learning.
> 2. A short experience in identifying the resources of the participants (who knows what, or who, has had experience doing what) and establishing collaborative, I-Thou (rather than It-It) relationships with one another as human beings. For this exercise, groups of four or five participants are recommended.
> 3. A mini-project in using the skills of proactive learning, such as reading a book proactively or using a supervisor proactively (Knowles et al., 2015, p. 53).

The opening, experiential encounter prepared learners for accepting responsibility to self-direct in the learning environment and encourage learners to feel secure in their skills for active learning.

Establishing a climate conducive to learning.

The second process element is to establish a climate conducive to learning (Knowles et al., 2015). While Knowles et al. (2015) discussed the quality of the environment primarily from the organizational and human resource development perspectives, the climate process element directly transfers to the role of the educator, and the view and approach the educator takes in the learning experience. Knowles et al. (2015) believed if the educator viewed the learning encounter as one of merely managing a learning experience or transmitting knowledge, he or she would exert little influence. To create a quality learning experience for the learner and educator, Knowles et al. (2015) viewed climate setting as the “most crucial element in the whole process,” and the educator could establish a quality climate that is relaxed, trusting, respectful, collaborative, supportive, open, and authentic by involving learners and supporting each learner’s needs, goals, and education (p. 57).

Creating a mechanism for mutual planning.

The third process element of mutual planning is a practice that encourages the educator to move from only teaching to facilitating learning. Mutual planning brings into account the role of the learner, the learner's need to self-direct, and the learner's desire to achieve specific goals from the learning encounter. Based on research findings, Knowles et al. (2015) stated that a learner's involvement in mutual planning during the learning encounter leads to the tendency of the learner "to feel committed to a decision or activity in direct proportion to their participation in or influence on its planning and decision-making" (p. 58). Without the opportunity to influence the learning environment, learners tend to exhibit reduced feelings of commitment or investment toward teacher-imposed decisions or activities.

Diagnosing the needs for learning.

In the fourth process element of diagnosing the needs for learning, Knowles et al. (2015) constructed a path from the learner's current perceptions to what the individual learner wanted to become or accomplish, and what level of performance to attain. Two key outcomes of this element are from the diagnostic process where the educator and learner mutually identify desired competencies and misconceptions about competence, and assess discrepancies. However, as effective as the researchers found the model, Knowles et al. (2015) admitted, "The most critical factor is what it does to the mindset of the learner" (p. 60). In the diagnostic process, Knowles et al. (2015) refer to their research findings where learners begin to experience how attaining knowledge and skills are within their ability, understand how to autonomously improve performance, and accept learning as a more personal endeavor. The culmination of the diagnostic process "converts course-takers and seminar participants into competency developers (p. 60)," where learners exhibit ownership and control of their learning.

Formulating objectives.

In the fifth element of developing objectives, Knowles et al. (2015) acknowledged the enormous range of viewpoints and controversies on the perceptions, components, and uses of objectives from multiple, varied, historical and theoretical perspectives. Knowles et al. (2015)

combined a “terminal behavior-oriented” training perspective and an “inquiry-process-oriented” education perspective to balance the treatment of the establishing objectives process (p. 64). Regardless of the method used to establish specific objectives, Knowles et al. (2015) held to the view that learners would resist full commitment to the endeavor under teacher-imposed decisions and absent options of choice and mutual-diagnosis.

Designing a learning experience.

In the sixth process element of designing a learning experience, Knowles et al. (2015) discuss the process of learning and acknowledge the utility and pattern of learning experiences informed by such learning theories as behaviorism, cognitivism, and experiential learning. As a general rule, educators and instructional designers build instructional models and education programs around the aspects of the theoretical orientation in which they prescribe most (Knowles et al. 2015; Lee et al., 2017). Regardless of theoretical orientation, Knowles et al. (2015) concluded that the learner and educator must proactively engage in diagnosis, planning, and designing a learning experience through mutual identification and selection of a relevant problem area.

Operating the program.

In the seventh process element of operating the program learning activities, Knowles et al. (2015) discussed the element with primary consideration given to the situational variables of the faculty and institutional resources. This consideration is consistent with the findings in the literature regarding the flipped classroom and active-learning activities. The quality of the learning experience is 1) directly related to the abilities and preparation of the teacher or faculty for facilitating relevant, problem-centered, authentically focused learning activities; and, 2) the quality and availability of institutional resources needed to support faculty, learners, and instructional designers (Earley, 2016; O’Flaherty & Phillips, 2015). For the function of real-world, active-learning activities and how to develop and implement andragogically consistent, adult-relevant activities, the literature presented Kolb's ELM, discussed below, as a relevant experiential-learning model.

Evaluating the program.

For the last process element of evaluation, Knowles et al. (2015) acknowledged the controversy surround the definition, concept, and process of evaluation within education and training programs. Knowles et al. (2015) approached the evaluation discussion by covering the purpose of the evaluation process as desiring to assess and measure pre- and post-instruction knowledge gains and behaviors. For adult education and training programs, Knowles et al. (2015) concluded evaluation is a "re-diagnosis of learning needs," and a means of reflection for both the educator and learner on the learning experience to get the entire picture of the real-world effects of a learning program (p. 68).

Table 5

Process Elements of Andragogy

Process elements		
Element	Pedagogical approach	Andragogical approach
1. Prepare learners	Minimal	Provide information Prepare for participation Help develop expectations Begin thinking about content
2. Climate	Authority-oriented Formal Competitive	Relaxed, trusting Mutually respectful Informal, warm Collaborative, supportive Openness and authenticity Humanness
3. Planning	By instructor	Mechanism for mutual planning by learners and facilitator
4. Diagnose needs	By instructor	By mutual assessment
5. Set objectives	By instructor	By mutual negotiation
6. Design learning plans	Logic of subject matter Content units	Sequenced by readiness Problem units
7. Learning activities	Transmittal techniques	Experiential techniques (inquiry)
8. Evaluation	By instructor	Mutual re-diagnosis of needs Mutual measurement of program

Note. Reproduced from "The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development (8th ed.)," by M. Knowles, E. Holton, and R. Swanson, 2015, New York, NY. Copyright 2015 by Routledge.

Kolb's Experiential Learning Model

The role of experiential learning is rooted in debate and tension in educational and philosophical works. Theorists like Dewey, James, Follett, Lewin, Piaget, and others struggled between the objective views of empirical knowledge and scientific investigation, and the subjective views that regarded the presence and impact of personal biases, individual reality, and socially or culturally bound contexts (Kolb, 2015). Dedicating his life to the inquiry into experiential learning, Kolb (2015) sought to establish "a theory that helps explain how experience is transforming learning and reliable knowledge" (p. xxi). Kolb (2015) desired to describe a perspective and approach to individual education, training, and the process of learning applicable to all situations, areas of life, and disciplines or fields of study.

Through his own iterations of reading, research, and reflection, Kolb (2015) defined the theory of experiential learning as a "view of learning based on a learning cycle driven by the resolution of the dual dialectics of action/reflection and experience/abstraction" (p. 50-51). As a natural complement to andragogy, where adults' experiences provide the backdrop for learning, Kolb (2015) articulated how knowledge comes from the interaction of grasping and transforming experiences (Knowles et al., 2015). This process of absorbing information, and interpreting and acting on the information, is what Kolb (2015) believed led to the learning cycle with distinct learning modes.

Since many active-learning activities are authentically based problems intended to promote practical application of course concepts, the stages that Kolb fashioned into his own experiential learning model offer a theoretical framework and structure to organize and link an activity with the interactive, active-learning, learner-controlled, and learning-through-reflection benefits of a flipped classroom (Grover, 2014). Following Kolb's ELM, educators can further shape the learning environment through experiences designed along Kolb's four stages: concrete experience, observation and reflection, abstract conceptualization, and active experimentation (Grover, 2014; Knowles et al., 2015; Kolb, 2015). The stages of Kolb's ELM accentuate an adult's existing experience, or lack thereof, and provide a model for adults to cognitively process, actively use, and reflect on new information or concepts (Grover, 2014). Using Kolb's stages and flipped-classroom methods, educators can create opportunities for learners to achieve higher levels of thinking, test class concepts using real-world problems, and increase personal awareness of their performance (Grover, 2014; Hoffman, 2014; Little, 2015). The four stages of Kolb's ELM allow educators and learners to observe firsthand what learning has taken place, gauge learners' level of understanding, and offer learners' peers and the instructor occasions for instant feedback and mentoring (Grover, 2014; Knowles et al., 2015; Little, 2015; Meretsky & Woods, 2013).

As shown in Figure 1, The Experiential Learning Cycle, Kolb's ELM is a cyclical process where a concrete experience serves as the focal point for observation and reflection (Grover, 2014; Knowles et al., 2015; Kolb, 2015; Little, 2015). The individual learner's observation and reflection are mentally assimilated and broken down into abstract concepts which the learner can later draw on and apply to new experiences (Grover, 2014; Knowles et al., 2015; Kolb, 2015; Little, 2015). As new experiences are encountered, the learner can actively test the abstract concepts which serve as a guide to the learner through the new experience (Grover, 2014; Knowles et al., 2015; Kolb, 2015; Little, 2015). As advocated by Knowles et al. (2015), Kolb's (2015) four-stage ELM provides "an invaluable framework for designing learning experiences for adults" (p. 182). As he reflected on experiential learning theory and his model, Kolb (2015) acknowledged that the value of education is in how it aids learners to exceed the limits of their finite experiences, but in the healthy debate regarding the philosophies on the role of experience in learning, Kolb held to the viewpoint that learners could trust their experiences and master their own learning.

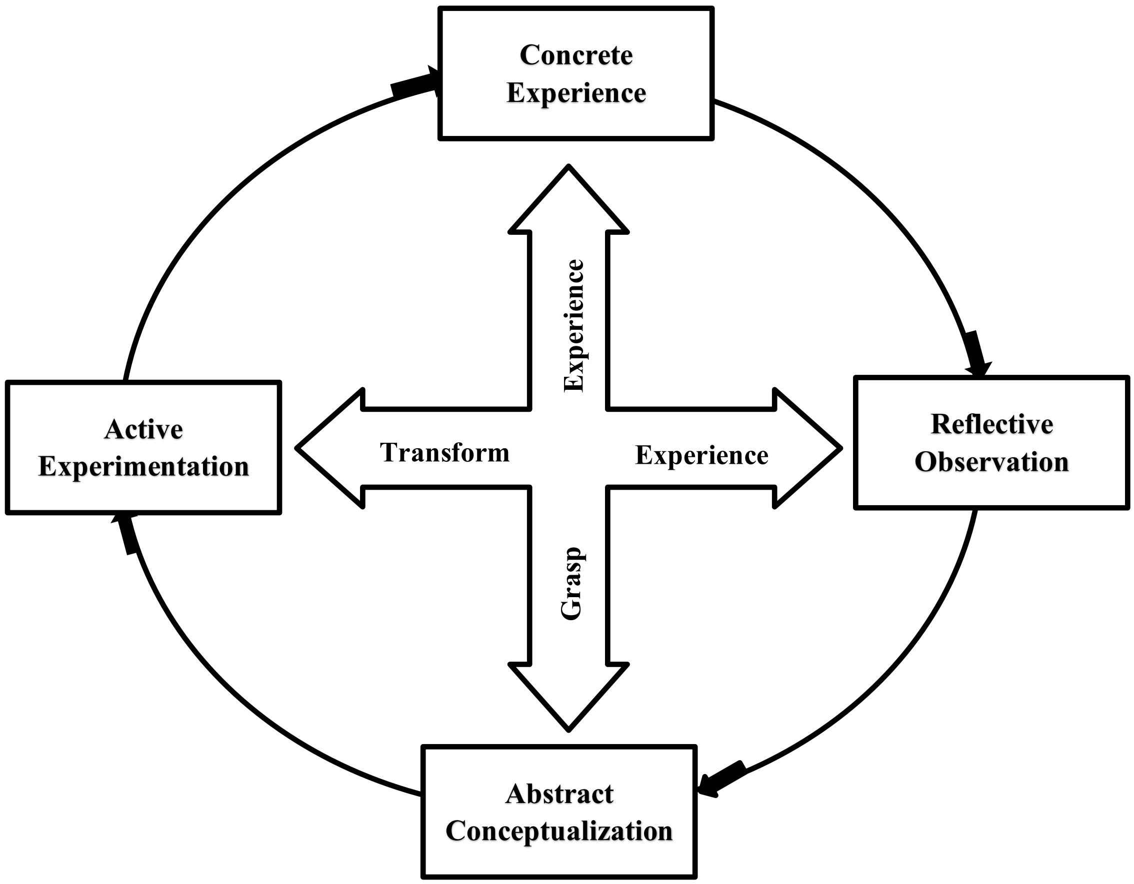

Figure 1. The experiential learning cycle (reproduced from Kolb, 2015, p. 51).

Linking Andragogy, Kolb's ELM, and the Benefits of the Flipped Classroom

The andragogical process elements and Kolb's ELM form a natural connection to the adult learning principles or assumptions, and benefits of the flipped classroom (Knowles et al., 2015; Kolb, 2015). While the research is clear that all adult learners fail to fit all six adult-learning assumptions, the andragogical principles do offer an initial instructional-design perspective of adult-learning behaviors useful when designing and implementing education programs for adults (Kaufman, 2003; Knowles et al., 2015). The debate regarding the assumptions was expounded on by Knowles et al. (2015) where the authors explained how all adults differ and ultimately exhibit a level of knowledge and performance based on a range of variables categorized generally as individual and situational differences. As a framework, the combination of process elements, experiential-learning process, adult-learning principles, and benefits of a flipped classroom (learner interactions, active-learning, learner control, learning through reflection) inform instructional design and teaching perspectives on constructs in the learning environment that learners need to move from passive attendees to self-directing owners and active participants (Canhoto & Murphy, 2016).

The adult-learning principles or assumptions present a perspective on common adult-learning behaviors useful for teachers and instructional designers when designing and implementing adult-education programs (Bear, 2012). As displayed in Figure 2, Andragogy in Practice Model, Knowles et al. (2015) presented the six adult-learning principles as

1. learners need to know what, how, and why;
2. learners possess a self-concept of independence;
3. prior experience of the learner is a valuable resource in the learning process;
4. learners possess a readiness to learn knowledge and skills personally or professionally relevant;
5. learners possess a problem-centered, context-specific orientation to learning; and,
6. learners possess an intrinsic motivation to learn. (p. 169)

While the individual needs, goals, and purposes of each adult learner in a learning environment will differ, the strengths of the principles lie in their flexible and customizable application for all adults in all learning situations (Bear, 2012; Kaufman, 2003; Knowles et al., 2015).

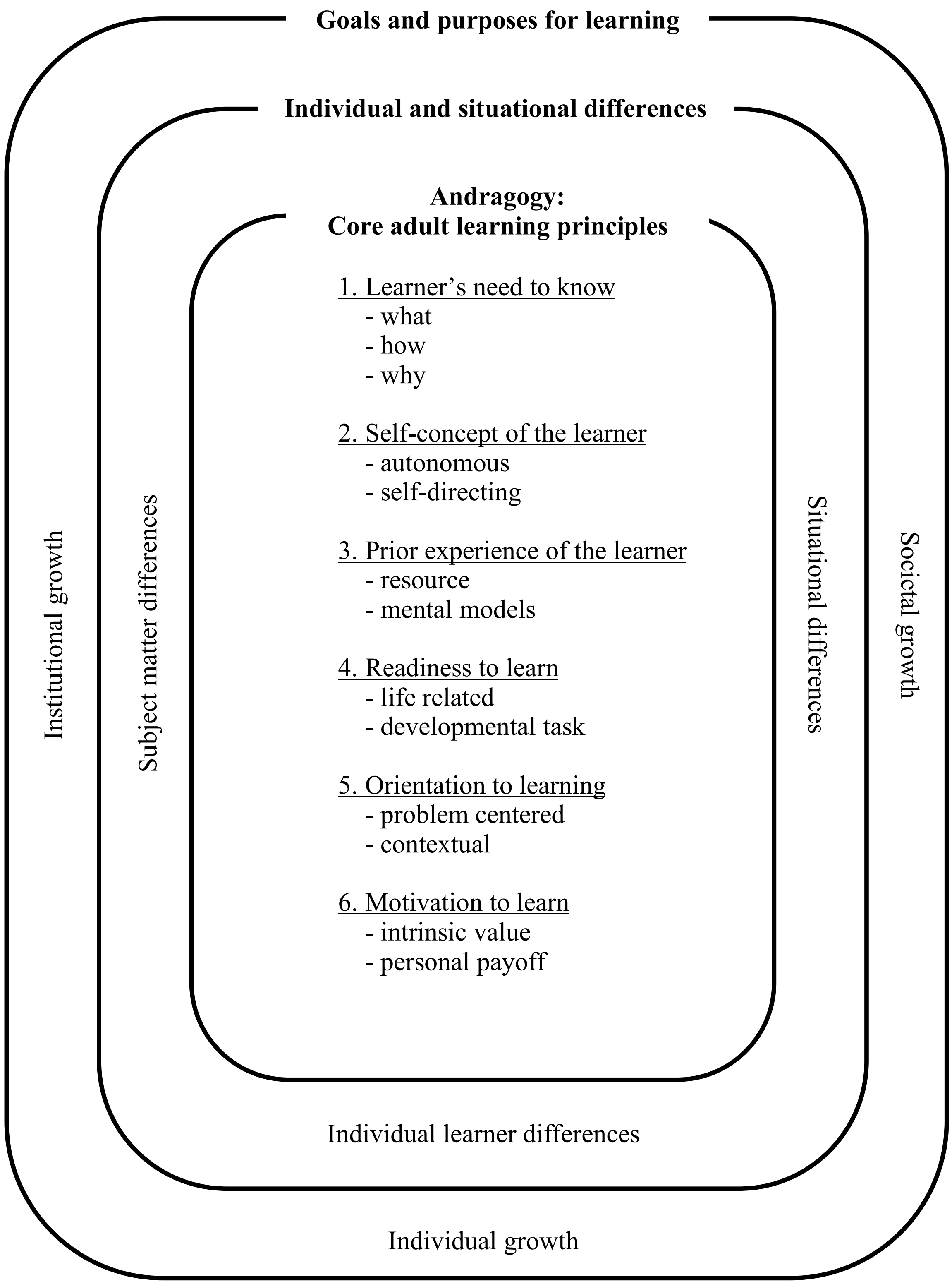

Figure 2. Andragogy in practice model (adapted from Knowles et al, 2015, p. 80).

Connecting the andragogical process elements and Kolb's ELM to the adult-learning principles and benefits of the flipped classroom offer a practical, yet theoretically grounded, means of methodically and consistently designing and implementing flexible and customizable programs for learners in a flipped-learning environment. The synthesis of learning theories, aligned with the flipped-classroom research findings, comprise an effective structure for designing flipped-learning environments. Table 6, Synthesis of Andragogical Process Elements, Kolb's ELM, Adult-Learning Principles, and Flipped-Classroom Benefits, presents the process within a process as a flexible and customizable approach on possible connections among the theories and key practices within the learning environment.

The first process element, prepare the learner, and Kolb's ELM connect to the adult-learning principle of need to know and flipped-learning benefits of learner-instructor interaction and active learning. The mutual preparation aspect is a learner-instructor interaction where the "learning-how-to-learn" activity uses an active-learning strategy guided by Kolb's ELM (Bear, 2012; Knowles et al., 2015, p. 53; Schlairet et al., 2014). The mutual-planning approach, learner-instructor interaction, and preparation activity fulfill the adult's need to know regarding what learning is expected, how learning is conducted, and why the learning is relevant and important (Bear, 2012; Blackley & Sheffield, 2015; Hao, 2016; Kaufman, 2003; Knowles et al., 2015; Larsen, 2015; McDonough, 2014). Additionally, the active and participative preparatory activity establishes the role of the educator as facilitator and the role of learner as primary owner and beneficiary in the learning process, and prepares the learner to accept control by offering the learner choices and inputs into learning activities and decisions most relevant to the learner (Blackley & Sheffield, 2015; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Rui et al., 2017; Schlairet et al., 2014).

The second process element, climate setting, and Kolb's ELM connect to the adult-learning principle of independent self-concept and flipped-classroom benefit of learner-instructor interaction. The collaborative and supportive climate and preparation efforts act as an extension of the concrete experience that prepares learners to self-direct, and extends the learner-instructor interaction. Since some adults lack autonomy and self-directing behaviors and learning skills, the open, informal setting provides an opportunity for the teacher to identify notable knowledge and skill gaps, and prepare learners by collaboratively selecting realistic, achievable, authentically focused learning goals for the course (Blackley & Sheffield, 2015; Kaufman, 2003; McDonough, 2014; Schlairet et al., 2014).

The third process element, mutual planning, and Kolb's ELM connect to the adult-learning principles of independent self-concept and motivation, and the flipped-classroom benefits of learner-instructor interaction, learner control, and active learning. Mutual planning is a continuation of the concrete experience and active-learning experience which provides the learner with an opportunity to influence the learning environment (Blackley & Sheffield, 2015; Hao, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014). The learner-instructor interaction in planning course decisions and setting course goals provides the learner with some degree of control in the learning process. Knowles et al. (2015) found that where the learner is allowed to exert a degree of control and influence, the learner exhibits an increase in motivation, autonomy, and self-directing behaviors to achieve the specified goals (Kaufman, 2003; Larsen, 2015).

The fourth process element, diagnosing learning needs, and Kolb's ELM connect to the adult-learning principles of role of learner's experience and readiness to learn, and flipped-classroom benefits of learner-instructor interaction and learner control. Diagnosing learning needs extends the mutually planned concrete experience and offers the learner a focal point which to reflect on his or her existing experience in relation to course and individual goals (Blackley & Sheffield, 2015; Hao, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014). As the learner-instructor interaction continues, the learner can use the encounter to control a degree of diagnosis as he or she determines the relevance of existing experience in relation to the new goals and what learning from the encounter is personally or professionally significant (Blackley & Sheffield, 2015; Kaufman, 2003; Larsen, 2015; Rui et al., 2017; Schlairet et al., 2014).

The fifth process element, setting objectives, and Kolb's ELM connect to the adult-learning principle of orientation to learning, and flipped-classroom benefits of learner-instructor interaction and learner control. Through the mutual process of setting objectives, the learner is faced with the abstract lessons from the mutual-planning and diagnosing-learning needs experiences which reinforces that he or she is the owner and primary beneficiary of the learning process, and where responsibility for learning ultimately resides (Hao, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014). With continued learner-instructor interaction and a degree of control in setting objectives, the learner is allowed to orient his or her learning toward the desired context or problem most relevant to a personal or professional perspective (Blackley & Sheffield, 2015; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Rui et al., 2017; Schlairet et al., 2014).

The sixth process element, designing the learning plan, and Kolb's ELM connect to the adult-learning principle of readiness to learn, and flipped-classroom benefits of learner control and active learning. Designing a learning plan presents the learner with an opportunity, or active-learning experience, to exercise the previously learned lessons of ownership of and responsibility for learning by co-designing a customized, authentic-learning activity (Blackley & Sheffield, 2015; Hao, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014).

Before entering into the formal, experiential-learning process and the evaluative portion of the learning experience, the learner has already received relevant learning experiences of interaction, control, active learning, and learning through reflection (Canhoto & Murphy, 2016). From this active, flexible process of planning, diagnosing, setting objectives, and designing a plan, the learner has completed a valuable, informal learning experience with activities that have helped establish ownership, responsibility, and self-directing behaviors (Canhoto & Murphy, 2016; Hao, 2016: Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014). Designing a learning plan extends the learner's readiness to learn as he or she prepares to engage in a personally or professionally relevant learning experience (Blackley & Sheffield, 2015; Kaufman, 2003; McDonough, 2014).

The seventh process element, operating the learning activity, and Kolb's ELM connect to the adult-learning principle of learner's experience, and flipped-classroom benefits of learner control and active learning. Here, all four stages of Kolb's ELM are used to structure the primary, formal, course-focused learning activity. During the practical exercise of completing the course learning activity, the learner not only uses his or her existing knowledge, skills, and experience, but also adds the new knowledge, skills, and experiences gained from course concepts, the learner-instructor interactions, and increased control over the learning-planning process (Blackley & Sheffield, 2015; Canhoto & Murphy, 2016; Hao, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Rui et al., 2017; Schlairet et al., 2014). While the existing abilities of the learner are tested in the course learning activity, the learner's commitment and new abilities as owner of the learning process are tested within the one course activity (Blackley & Sheffield, 2015; Canhoto & Murphy, 2016; Kaufman, 2003; McDonough, 2014; Schlairet et al., 2014).

The eighth process element, evaluation, and Kolb's ELM connect to the adult-learning principle of motivation, and flipped-classroom benefits of learner-instructor interaction and learning through reflection. The learner-instructor interaction and the mutual "re-diagnosis of learning needs" through the evaluation process offer the learner opportunities to learn from immediate instructor feedback, through reflection on the entire planning process, and from the real-world implications of the gains in knowledge, skills, and experience (Boone, 2015; Blackley & Sheffield, 2015; Canhoto & Murphy, 2016; Garrison & Cleveland-Innes, 2005; Hao, 2016; Kaufman, 2003; Knowles et al., 2015, p. 68; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014). As Knowles et al. (2015) found from their research with adult learners, adults possess intrinsic motivation to learn knowledge and skills with real-world relevance. The process of evaluation offers the learner a mechanism to measure and reflect on learning gains, and not only recognize the fulfillment of, or discrepancies in, learning needs or goals related to the course, but also his or her needs and goals for autonomy and self-direction that extend beyond the course (Blackley & Sheffield, 2015; Canhoto & Murphy, 2016; Kaufman, 2003; Larsen, 2015; McDonough, 2014; Schlairet et al., 2014).

Table 6

Synthesis of Andragogical Process Elements, Kolb's ELM, Adult-Learning Principles, and Flipped-Classroom Benefits

Process elements		Kolb's ELM	
Element	Andragogical approach	Stage	Link to ALP[a] and FCB[b]
1. Prepare learners	Provide information Prepare for participation Develop expectations Thinking about content	Concrete experience	Need to know Learner-instructor interaction Active learning
2. Climate	Relaxed, trusting Mutually respectful Informal, warm Collaborative, supportive Open and authentic Humanness	Extension of concrete experience	Independent self-concept Learner-instructor interaction
3. Planning	Mutual planning by learners and facilitator	Extension of concrete experience	Independent self-concept Motivation Learner-instructor interaction Learner control Active learning
4. Diagnose needs	By mutual assessment	Reflective observation	Role of learner's experience Readiness to learn Learner-instructor interaction Learner control
5. Set objectives	By mutual negotiation	Abstract conceptualization	Orientation to learning Learner-instructor interaction Learner control
6. Design learning plans	Sequenced by readiness Problem units	Active experimentation	Readiness to learn Learner control Active learning
7. Learning activities	Experiential techniques (inquiry)	All 4 stages	Role of learner's experience Learner control Active learning
8. Evaluation	Mutual re-diagnosis of needs Mutual measurement of program	Reflective observation Abstract conceptualization	Motivation Learner-instructor interaction Learning through reflection

Note. Adapted based on an analysis and synthesis of "The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development (8th ed.)," by M. Knowles, E. Holton, and R. Swanson, 2015; "Experiential Learning: Experience as the Source of Learning and Development (2d ed.)," by D. Kolb, 2015; and, research studies on the flipped classroom.
[a]ALP - adult-learning principle(s). [b]FCB - flipped-classroom benefit(s).

Summary

The literature on the flipped classroom presented the flipped method as a type or subarea of blended learning. The blended environment is thought to offer learners and teachers alike an interactive and satisfying learning experience where teaching method and education technologies offer opportunities to maximize flexibility (Wang, 2017b). Flipped learning carries the concept of blended learning further by swapping the traditionally passive, instructor-led, face-to-face (F2F) lecture and homework (Pierce & Fox, 2012). However, the flipped classroom is without a singularly accepted theoretical framework or instructional-design approach. Recognizing the absence of a universal approach, the growing body of flipped-classroom research reflected assorted theory-based and process-focused approaches where researchers chose some manner of informed, yet flexible trial-and-error model, and recommended assembling a team of experts for the instructional-design process.

Chapter 1 served as the introduction to this study and presented the background, description of the organization serving as the study focus, theoretical background, problem statement, purpose, research questions, significance, limitations, assumptions, and definition of terms. Chapter 2 provided a discussion of the research findings from the literature on the flipped classroom and discussed the theoretical framework guiding the study, and offered a conceptual model combining the theoretical framework and flipped-classroom research to inform and guide the instructional-design process. Chapter 3 will describe the methods used to conduct this study to include a description of the population and sample; instrumentation; data collection process; and, data analysis procedures. Chapter 4 will present the study results. Chapter 5 concludes this study with a summary, conclusion, study implications, and recommendations for future practice and further research.

Chapter 3: Methods

Overview

This chapter focuses on the research methods used for this study and describes the nonexperimental quantitative approach used for analysis of the population-demographic data, and the archival achievement and satisfaction data. This chapter will review the study's problem statement, purpose of the study, and research questions. Next, the chapter will describe the research design, participants, instruments, data collection process, and the techniques used in the data analysis. In accordance with ethical standards regarding human-subjects study, measures were taken with the archival data to guard the personal identity of the OTS TFOT cadets whose demographic data, course-satisfaction ratings, and academic-achievement scores served as the focus of the analysis.

Problem Statement

In the growing body of flipped-classroom literature, educators lamented the extensive time and enormous expense with transitioning from teacher-centered methods to learner-centered methods. Despite the immense effort creating an effective learner-centered environment, educators revealed mixed results when measuring changes in learning outcomes and learner improvements. Educators admittedly struggled to empirically determine if the changes from traditional-lecture methods to flipped-classroom methods resulted in improved outcomes such as increased course satisfaction and academic achievement among learners.

From the program and institutional-effectiveness perspectives, OTS leadership reviewed cadet-course satisfaction surveys and achievement scores, but desired more empirical evidence to determine if the program changes to TFOT created a program that produced better officers. The problem this study seeks to investigate is if traditional, lecture-based classes or the flipped-teaching model resulted in significantly different course-satisfaction ratings and academic-achievement scores for OTS TFOT cadets.

Purpose of the Study

The purpose of this nonexperimental, quantitative, correlational study was to determine if course satisfaction and academic achievement differ between the traditional, lecture-based course and flipped-teaching formats for Officer Training School (OTS), Total Force Officer Training (TFOT) cadets. This study examined existing course-satisfaction ratings and academic-achievement scores based on course-teaching method and de-identified, cadet-demographic data. To accomplish the investigation, the researcher used de-identified academic-achievement scores from course multiple-choice exams to determine if differences in cadet-academic achievement existed between TFOT classes 17-01 and 17-02, which heavily relied on lecture-based methods, and TFOT classes 18-05 and 18-06, which added the online prerequisite course and primarily used flipped-teaching methods. The researcher also used de-identified surveys with Likert-scale scoring to determine if differences in cadet-course satisfaction existed between the same classes.

For this study, course satisfaction and academic achievement served as dependent variables; teaching method served as the independent variable; and, cadet-career status and age served as covariates. Additionally, the researcher investigated if an interaction existed among teaching method and the cadet demographics of age and career status (i.e., active duty, non-prior service, or Reserve component). The results of this research could inform and guide the design and implementation of future flipped education and training programs within the military. This study adds to the body of knowledge in adult education by following the recommendations of previous researchers who called for additional research on flipped-classroom designs with large sample sizes in multi-disciplined institutions (Njie-Carr et al., 2017; Pierce & Fox, 2012).

Research Questions

To address the problem of this study, the researcher raised the following research questions:

Research Question 1: Does course teaching method affect academic achievement in OTS TFOT cadets?

Research Question 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

Research Question 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?

Research Question 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

Research Design

This study used a quantitative nonexperimental design. A nonexperimental research design was selected for this study since the researcher lacked access to manipulate the independent variable or assign participants to a condition. According to Gravetter and Wallnau (2017), nonexperimental designs preclude the possibility of establishing cause-effect relationships, but do permit examination of relationships among variables by comparing groups and the accompanying quantitative techniques are best suited to analyze the large data sets. Nonexperimental designs are common in educational settings and education-related research especially when random assignment and variable manipulation are deemed impractical or unethical (Cranton & Merriam, 2015; Fraenkel, Wallen, & Hyun, 2015; Joyner, Rouse, & Glatthorn, 2013).

As nonexperimental research, this study used a correlational design to investigate relationships among the variables without any attempts to influence the variables (Fraenkel et al., 2015). As is common in a correlational design, the researcher sought to predict performance and attitude (i.e., academic achievement and course satisfaction) based on knowledge gained from the relationships (Fraenkel et al., 2015; Gravetter & Wallnau, 2017). Examining the sample, the researcher sought to uncover the nature of the relationships among the variables.

The researcher chose hierarchical linear regression (HLR) as the statistical test to analyze the effect of the independent variable on the dependent variables while controlling for other variables (Pedhazer, 1997). The researcher chose the order of entry for the demographic variables (i.e., cadet-career status and age) to isolate the independent variable (i.e., teaching method) on the dependent variable of academic achievement, while conducting a separate HLR for isolating the independent variable on the dependent variable of course satisfaction (Pedhazer, 1997). For the archival data collected, achievement scores were predicted by the de-identified cadet demographic variables of career status (i.e., active duty, non-prior service, and Reserve component) and age, while course satisfaction was predicted by the de-identified cadet demographic of career status.

Participants

The population of OTS TFOT cadets for the study are cadets from Academic Year (AY) 2017 (AY17) and AY 2018 (AY18), where OTS class sizes for each AY, or officer corps accession targets, are established by the Force Management Division, Headquarters Air Force (Department of the Air Force, 2008a). The population of cadets (N = 3,621) for this study are US citizens between the ages of 20 and 42, who seek to earn a commission as a second lieutenant in the US Air Force. The OTS TFOT population is comprised of Air-Force personnel from the active-duty and Reserve components (Air National Guard or USAF Reserve); civilians with prior military service; and, non-prior service civilians who are entering the active-duty or Reserve component for the first time. Each cadet in OTS TFOT has been confirmed to meet the following eligibility requirements for the TFOT pre-commissioning course: a citizen of the US; deemed of good moral character; physically qualified for military service with medical qualifications validated by the staff of a Military Entrance Processing Station; earned a baccalaureate degree or higher; and, meets minimum scores on the Air Force Officer Qualification Test (Department of the Air Force, 2008a).

The AY17 and AY18 OTS TFOT population and sample demographics are displayed in Table 10, Descriptive Statistics of the OTS TFOT Population Demographics, and Table 11, Descriptive Statistics of the OTS TFOT Sample Demographics. The population is the combined number of AY17 and AY18 cadets and comprise a total population of 3,621 cadets. The sample is comprised of AY17 cadets who attended OTS TFOT when the teaching method was primarily lecture-based and AY18 cadets who attended OTS TFOT when the teaching method was primarily flipped classroom. For the AY17 classes, the study used achievement scores and satisfaction results from Class 17-01 with 228 cadets and Class 17-02 with 234 cadets, totaling 462 cadets. For AY18, the study used achievement scores and satisfaction results from Class 18-05 with 251 cadets and Class 18-06 with 203 cadets, totaling 454 cadets. The total sample size for the study is 916 cadets, or 25% of the 3,621-cadet population.

The archival data available for analysis were separated by achievement scores and satisfaction results, where each data set was aggregated to obtain the average scores used for the analyses. The cadets' achievement scores and satisfaction results were kept in separate information systems and since course satisfaction surveys were voluntary and anonymous, the achievement scores and satisfaction results were not linked. This separation of data necessitated univariate statistical analyses. The data used to calculate achievement scores were from 916 cadets since cadets cannot graduate OTS TFOT without a passing test average. Since satisfaction surveys were voluntary and anonymous, the data available to calculate satisfaction results were from the 639 (Class 17-01 with 126 completed; Class 17-02 with 227 completed; Class 18-05 with 149 completed; and, 18-06 with 137 completed) cadets, or 18% of the population, who completed the end-of-course survey.

Instruments

The instruments used to collect the archival data for the analyses included multiple-choice tests and course-satisfaction surveys, with both instruments containing limited de-identified cadet demographic information. First, the researcher used archival scores from course multiple-choice tests to calculate an aggregated academic achievement score for each cadet. Air Force Instruction 36-2605, Air Force Military Personnel Testing System, establishes regulations against test compromise and therefore prohibits public release and disclosure of the actual OTS TFOT course tests for review by the Institutional Review Board (IRB) and inclusion as an appendix in this study (Department of the Air Force, 2008b). However, as displayed in Table 12, Descriptive Statistics for Academic Achievement by Teaching Method and Career Status, the researcher provided descriptive statistics of achievement scores.

The academic achievement scores were aggregated from OTS TFOT course multiple-choice tests. Course tests were developed by subject matter experts (SME) within the curriculum-design departments of the USAF's Holm Center Academic Affairs. Use of SMEs to develop and evaluate the tests served to establish construct validity (Martella, Nelson, & Marchand-Martella, 1999). Content validity was assured through test questions that measured cadet competencies and knowledge of the academic curriculum (Martella et al., 1999).

Next, the two surveys used by OTS were locally (i.e., USAF's Holm Center Academic Affairs) devised instruments and contained items collecting quantitative course-satisfaction ratings from the cadets. The AY17 and AY18 surveys contained minor differences where the AY18 survey restricted the number and type of questions to focus primarily on the curriculum. Both surveys consisted of self-report items using a 6-point Likert-type scale where higher scores indicated greater feelings of satisfaction toward the OTS TFOT course. Cadets could choose from 6-Strongly Agree, 5-Agree, 4-Slightly Agree, 3-Slightly Disagree, 2-Disagree, or 1-Strongly Disagree for each item.

For the analysis of overall course satisfaction, the researcher isolated the courses' academic and curriculum items, and excluded the administrative and support-service related survey items (i.e., questions asking about the condition of the dormitory, quality of the food in the dining facility, utility of the athletic facility, availability of the chaplain, and helpfulness of the Army-Air Force Exchange Service staff) before performing a calculation of aggregated course-satisfaction ratings (i.e., AY17 survey, omitted questions were #16-29; and, AY18 survey, omitted questions were #16-21). Appendices A and B contain the complete surveys without omissions.

The course satisfaction surveys were validated by SMEs within the Holm Center's Academic Affairs branch to ensure construct validity (Martella et al., 1999). The researcher performed the Cronbach's alpha reliability test for the AY17 survey and the AY18 survey. Cronbach's alphas were .94 for the AY17 and .92 for the AY18 surveys. According to Martella et al. (1999), "Reliability coefficients of .70 or above are usually considered respectable regardless of the type of reliability calculated" (p. 69). Completion of the end-of-course satisfaction surveys were anonymous and voluntary, and as such, 70% of the sample, or 639 of the 916 cadets, completed the surveys. See Appendices A and B for the complete surveys.

Data Collection Procedures

Data were collected to measure the constructs of academic achievement and course satisfaction, and to describe and compare the OTS TFOT sample and population using the de-identified demographic variables of career status, military time in service, gender, age, and race. Following the ethical guidelines for research, the researcher obtained approval for the conditional release of OTS documentation (i.e., AY17 and AY18 satisfaction surveys) needed for Auburn University's IRB. After receiving IRB approval from Auburn University, the researcher obtained permission for the study and release of the archival data used for the analyses from the USAF's Air University Institutional Analytics and Effectiveness department, and the USAF Surgeon General's Division of Research Oversight and Compliance. See Appendices C-F for all associated approval documentation for this study.

Data Analysis

All analyses for the data screening and research questions (RQ) were conducted using the Statistical Package for the Social Sciences (SPSS) software, version 25, and are as follows. First, the researcher conducted the data screening procedures as outlined by Mertler and Vannatta (2013) to look for data accuracy, missing values, and outliers, and test assumptions. Following the initial data screening, the researcher used descriptive statistics to compute means and percentages for a description and comparison of the study's OTS TFOT population and sample with six previous OTS classes. Additionally, the researcher used descriptive statistics to compare the means and standard deviations of cadets' academic achievement scores and course satisfaction results by item, teaching method, and career status. For a display of mean cadet academic achievement scores by teaching method and career status, and mean course satisfaction ratings by item, teaching method, and career status, see Table 12, Descriptive Statistics for Academic Achievement by Teaching Method and Career Status; Table 13, Sample Satisfaction Descriptive Statistics by Item, Teaching Method, and Career Status; and, Table 14, Sample Course Satisfaction Descriptive Statistics by Item and Teaching Method.

Next, for RQ1 and RQ2, the researcher used hierarchical linear regression (HLR) analyses as outlined by Pedhazer (1997) to investigate the effect of teaching method first on cadets' achievement scores and then on satisfaction ratings while controlling for the cadets' de-identified demographics of career status and age. Last, for RQ3 and RQ4, the researcher investigated the uniqueness of the relationships between teaching method and the covariates of cadet-career status and age. The uniqueness of the relationships was explored by testing for interactions using HLR analyses as outlined by Pedhazer (1997). The test for interactions was followed up with simple effects analyses as outlined by Pituch and Stevens (2016) to interpret the contribution of the effect by level of the categorical variable.

Cadet-career status and age were chosen as the most important demographic variables of interest since both variables represent an indication of adult status and experience. For this study, a determinant that a learner is an adult is associated with 1) age (i.e., the four definitions of an adult include biological, legal, social, and psychological where all definitions are associated with the learner's age) and 2) cadet-career status, or experience, which represents prior military (domain) knowledge (Knowles et al., 2015). As discussed by Knowles et al. (2015), an adult learner's greatest resource is the quality of their life experience.

Summary

This chapter focused on the research methods used for this study. This chapter described the quantitative approach used for analyses of the population-demographic data, and the archival achievement and satisfaction data. This chapter reviewed the study's problem statement, purpose of the study, and research questions. Next, the chapter described the research design, participants, instruments, data collection process, and the techniques used in the data analyses. The researcher used SPSS version 25 to perform preliminary data screening according to procedures outlined by Mertler and Vannatta (2013), and to calculate descriptive statistics for the population, sample, achievement scores, and satisfaction results. Last, for the study RQs, the researcher used HLR analyses to investigate the effect of the independent variable on the dependent variables, and tested if interactions existed between the independent variable and the two covariates. Simple effects analyses were used to interpret the interactions. In accordance with ethical standards regarding human-subjects study, measures were taken with the archival data to guard the personal identity of the OTS TFOT cadets whose de-identified demographic data, course-satisfaction ratings, and academic-achievement scores served as the focus of the analysis.

Chapter 1 served as the introduction to this study and presented the background, description of the organization serving as the study focus, theoretical background, problem statement, purpose, research questions, significance, limitations, assumptions, and definition of terms. Chapter 2 provided a discussion of the research findings from the literature on the flipped classroom and discussed the theoretical framework guiding the study, and offered a conceptual model combining the theoretical framework and flipped-classroom research to inform and guide the instructional-design process. Chapter 3 described the methods used to conduct this study to include a description of the population and sample; instrumentation; data collection process; and, data analysis procedures. Chapter 4 will present the study results. Chapter 5 concludes this study with a summary, conclusion, study implications, and recommendations for future practice and further research.

Chapter 4 Results

Overview

This chapter presents the organization of the statistical analyses used on the independent and dependent variables and covariates. This chapter also focuses on the results of the analyses performed for this study. First, this chapter will review the study's problem statement, purpose of the study, and research questions. Next, the chapter will present the organization of the data analysis and provide the results of the data screening, descriptive statistics, and hierarchical linear regression (HLR) used to analyze the data sets related to the research questions. Last, the chapter will summarize the analyses and results.

Problem Statement

In the growing body of flipped-classroom literature, educators lamented the extensive time and enormous expense with transitioning from teacher-centered methods to learner-centered methods. Despite the immense effort creating an effective learner-centered environment, educators revealed mixed results when measuring changes in learning outcomes and learner improvements. Educators admittedly struggled to empirically determine if the changes from traditional-lecture methods to flipped-classroom methods resulted in improved outcomes such as increased course satisfaction and academic achievement among learners.

From the program and institutional-effectiveness perspectives, OTS leadership reviewed cadet-course satisfaction surveys and achievement scores, but desired more empirical evidence to determine if the program changes to TFOT created a program that produced better officers. The problem this study seeks to investigate is if traditional, lecture-based classes or the flipped-teaching model resulted in significantly different course-satisfaction ratings and academic-achievement scores for OTS TFOT cadets.

Purpose of the Study

The purpose of this nonexperimental, quantitative, correlational study was to determine if course satisfaction and academic achievement differ between the traditional, lecture-based course and flipped-teaching formats for Officer Training School (OTS), Total Force Officer Training (TFOT) cadets. This study examined existing course-satisfaction ratings and academic-achievement scores based on course-teaching method and de-identified, cadet-demographic data. To accomplish the investigation, the researcher used de-identified academic-achievement scores from course multiple-choice exams to determine if differences in cadet-academic achievement existed between TFOT classes 17-01 and 17-02, which heavily relied on lecture-based methods, and TFOT classes 18-05 and 18-06, which added the online prerequisite course and primarily used flipped-teaching methods. The researcher also used de-identified surveys with Likert-scale scoring to determine if differences in cadet-course satisfaction existed between the same classes.

For this study, course satisfaction and academic achievement served as dependent variables; teaching method served as the independent variable; and, career status and age served as covariates. Additionally, the researcher investigated if an interaction existed among teaching method and the cadet demographics of age and career status (i.e., active duty, non-prior service, or Reserve component). The results of this research could inform and guide the design and implementation of future flipped education and training programs within the military. This study adds to the body of knowledge in adult education by following the recommendations of previous researchers who called for additional research on flipped-classroom designs with large sample sizes in multi-disciplined institutions (Njie-Carr et al., 2017; Pierce & Fox, 2012).

Research Questions

To address the problem of this study, the researcher raised the following research questions:

Research Question 1: Does course teaching method affect academic achievement in OTS TFOT cadets?

Research Question 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

Research Question 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?

Research Question 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

Organization of Data Analysis

All analyses for the data screening and research questions (RQ) were conducted using SPSS version 25 and are as follows. First, the researcher conducted data screening procedures as outlined by Mertler and Vannatta (2013) to examine the data for accuracy, missing values, and outliers, and test assumptions. The researcher used descriptive statistics to compute means and standard deviations for descriptions and comparisons of the population, sample, academic achievement scores, and course satisfaction results by teaching method and de-identified, cadet-demographic data. Next, for RQ1 and RQ2, the researcher used HLR analyses to investigate the effect of teaching method first on cadets' achievement scores and then on satisfaction ratings while controlling for the influence of the cadets' demographics of career status and age. Last, for RQ3 and RQ4, the researcher investigated the uniqueness of the relationships between teaching method, cadet-career status, and age by testing for interactions.

Cadet-career status and age were chosen as the most important demographic variables of interest since both variables represent an indication of adult status and experience. For this study, a determinant that a learner is an adult was associated with 1) age (i.e., the four definitions of an adult include biological, legal, social, and psychological where all definitions are associated with the learner's age) and 2) cadet-career status, or experience, which represents prior military (domain) knowledge (Knowles et al., 2015). As discussed by Knowles et al. (2015), an adult learner's greatest resource is the quality of their life experience.

First, the researcher used descriptive statistics to describe and compare the OTS TFOT population and sample. Table 10, Descriptive Statistics of OTS TFOT Demographics for AY11 to AY18; Table 11, Descriptive Statistics of the OTS TFOT Population Demographics; and, Table 12, Descriptive Statistics of the OTS TFOT Sample Demographics, display the de-identified demographic variables comparing previous classes with the classes presented in the study, and the cadet population (N = 3,621) and sample (n = 916). Means and percentages were computed for classes AY2011 through AY2018, and the AY17 and AY18 population and sample. To note, fluctuations in the class sizes between AY11 through AY18 reflect the yearly variations in officer-accession targets, as established by Headquarters Air Force, where the makeup of each class across cadet demographics, regardless of overall class size, was largely consistent between academic years. Additionally, Table 13, Descriptive Statistics for Academic Achievement by Teaching Method and Career Status; Table 14, Sample Satisfaction Descriptive Statistics by Item, Teaching Method, and Career Status; and, Table 15, Sample Course Satisfaction Descriptive Statistics by Item and Teaching Method, display the mean achievement scores and standard deviations by teaching method and cadet-career status, and mean satisfaction results and standard deviations for the surveys by item, teaching method, and cadet-career status.

Next, the researcher conducted two HLR analyses to analyze the effect of the independent variable of teaching method on the dependent variables of academic achievement and course satisfaction (Pedhazer, 1997; Ross & Shannon, 2011). The researcher determined

HLR analyses were the appropriate statistical tests for the research questions, problem, and data sets since regression analysis 1) permitted the researcher to add, order, and isolate variables based on the a priori theory; 2) produced unstandardized and standardized coefficients for each variable; and, 3) included R^2 values to measure the variance accounted for in the dependent variables by the independent variable (Pedhazer, 1997). For RQ1 and RQ2, the researcher isolated the cadets' career status and age to examine the influence of the independent variable of teaching method on each dependent variable (Mertler & Vannatta, 2013). The de-linked nature of the achievement and satisfaction data sets precluded multivariate analysis. As such, the researcher conducted a HLR analysis for RQ1 and a separate HLR analysis for RQ2.

Last, the researcher tested the effect of teaching method across cadet-career status and age. For RQ3, the researcher examined the effect of teaching method across cadet-career status in the achievement and satisfaction data sets. For RQ4, the researcher examined the effect of teaching method across cadet age in the achievement data. A simple effects analysis was performed to interpret the contribution of each effect where an interaction existed.

Data Analysis Results

Prior to conducting the statistical analyses, the researcher screened the demographic, achievement, and satisfaction data sets for accuracy, missing values, and outliers (Mertler & Vannatta, 2013). The data screening procedures revealed missing values in each data set. As displayed in Table 7, Summary of Missing Demographic Values for the Population; Table 8, Summary of Missing Values for the Achievement Data Set; and, Table 9, Summary of Missing Values for the Satisfaction Data Set, the missing data analyses revealed 5% of the demographic data, .4% of the achievement data, and .4% of the satisfaction data were missing. Following the procedures outlined by Pituch and Stevens (2016), the researcher performed a multiple imputation procedure to impute missing values for the "Missing Completely at Random" demographic data to obtain the most unbiased parameter estimates as possible (p. 19). Since missing values for the achievement and satisfaction data sets were <1% for each data set, the researcher followed the guidance from Mertler and Vannatta (2013) and used the Listwise default method to omit cases with missing values in each data set before conducting the analyses.

Table 7

*Summary of Missing Demographic Values for the Population (*N *= 3,621)*

Variable	Missing values summary					
	N	Percent	Valid N	*M*	*SD*	Imputed values
Age[a]	18	0.5	3,603	29.07	3.92	90
Time in service[a]	490	13.5	3,131	5.21	5.27	2,450
Career status[b]	308	8.5	3,313	-	-	1,540
Gender[b]	1	0.0	3,620	-	-	5
Race[b]	31	1.0	3,590	-	-	155

Note: All errors are due to rounding. Calculations are the result of a missing values analysis where the minimum percentage missing for variable to be displayed was set at 0.01.
[a]Scale variable. [b]Categorical variable.

Table 8

*Summary of Missing Values for the Achievement Data Set (*n *= 916)*

	Missing values summary				
Lecture classes (*n* = 462)	*N*	Percent	Valid N	*M*	*SD*
Variable					
Age					
Active duty	1	0.2	461	31.4	2.28
Reserve component	1	0.2	461	29.7	4.09
Flipped classes (*n* = 454)					
Variable					
Age					
Active duty	3	0.7	451	29.4	3.02
Non-prior service	2	0.4	452	26.5	2.90
Reserve component	9	2.0	445	29.8	4.16

Note: 16 cases with missing values were omitted from analysis using the Listwise default method for classes 17-01, 17-02, 18-05, and 18-06.

Table 9

*Summary of Missing Values for the Satisfaction Data Set (*n *= 639)*

Missing values summary					
Lecture classes (*n* = 353)	*N*	Percent	Valid N	*M*	*SD*
Item					
2. The course was conducted by a competent faculty.	1	0.2	352	5.35	.77
3. Useful feedback was provided following each leadership opportunity.	4	1.1	349	5.00	.95
4. The course was intellectually stimulating.	1	0.2	352	4.82	1.16
15. I will use what I learned in this course in the future.	1	0.2	352	5.19	.92
Flipped classes (*n* = 286)					
Item					
2. The course was conducted by a competent faculty.	2	0.7	284	5.02	.77
3. Useful feedback was provided following each leadership opportunity.	3	1.0	283	4.61	1.00

Note: Overall, six cases contained the 12 missing values and were omitted from analysis using the Listwise default method for classes 17-01, 17-02, 18-05, and 18-06.

Table 10

Descriptive Statistics of OTS TFOT Demographics for AY11 to AY18

Variable	Academic year							
	AY11 (*n* = 1,042)	AY12 (*n* = 1,075)	AY13 (*n* = 1,445)	AY14 (*n* = 1,260)	AY15 (*n* = 1,012)	AY16 (*n* = 1,708)	AY17 (*n* = 1,773)	AY18 (*n* = 1,848)
Gender								
Male	898 (86%)	903 (84%)	1,201 (83%)	1,032 (82%)	857 (85%)	1,422 (83%)	1,446 (82%)	1,527 (83%)
Female	144 (14%)	172 (16%)	244 (17%)	228 (18%)	155 (15%)	286 (17%)	327 (18%)	321 (17%)
Race								
White	795 (76%)	777 (72%)	993 (69%)	868 (69%)	748 (74%)	1,285 (75%)	1,455 (82%)	1,463 (79%)
Black/ African Am	44 (4%)	34 (3%)	73 (5%)	49 (4%)	50 (5%)	115 (7%)	120 (7%)	133 (7%)
Am Indian	-	-	-	-	-	-	6 (0.2%)	2 (0.1%)
Asian	39 (4%)	31 (3%)	51 (4%)	35 (3%)	38 (4%)	84 (5%)	103 (6%)	83 (5%)
Alaska Native	1 (.1%)	3 (.3%)	1 (.07%)	0	4 (.4%)	13 (.7%)	3 (0.1%)	10 (0.5%)
Native Hawaiian	9 (1%)	5 (.5%)	5 (.3%)	10 (.8%)	3 (.3%)	13 (.7%)	11 (0.5%)	9 (0.4%)
Hispanic/ Latino	63 (6%)	59 (5%)	82 (6%)	80 (6%)	83 (8%)	113 (7%)	9 (0.4%)	48 (2%)
Puerto Rican	-	-	-	-	-	-	5 (0.2%)	2 (0.1%)
Multi-racial	23 (2%)	39 (4%)	51 (4%)	26 (2%)	26 (3%)	57 (3%)	46 (3%)	83 (5%)
DTR	68 (7%)	127 (12%)	189 (13%)	192 (15%)	60 (6%)	28 (2%)	15 (0.6%)	15 (0.9%)
Career status								
NPS	347 (33%)	388 (36%)	555 (38%)	370 (29%)	304 (30%)	551 (32%)	624 (35%)	611 (33%)
RC	591 (57%)	557 (52%)	608 (42%)	726 (58%)	568 (56%)	630 (37%)	703 (40%)	651 (35%)
AD	104 (10%)	130 (12%)	282 (20%)	164 (13%)	140 (14%)	527 (31%)	446 (25%)	586 (32%)
TIS								
Mean	-	-	-	-	-	-	5.40	5.37
Age								
Mean	28.56	28.17	28.03	28.58	28.55	29.05	29.34	28.81

Note: All errors due to rounding. Before AY17, the ethnic classification of American Indian and Alaska Native were recorded as a single category: "American Indian/Alaska Native"; and, the ethnic classification of Puerto Rican was not a single category. DTR – Declined to respond. Career status categories: NPS (Non-prior service); RC (Reserve Component); AD (active duty). TIS - Time in service; TIS was not tracked before AY17.

Table 11

*Descriptive Statistics of the OTS TFOT Population Demographics (*N *= 3,621)*

Variable	Population AY17 (*n* = 1,773)	AY18 (*n* = 1,848)	Total (*N* = 3,621)
Gender			
Male	1,446 (82%)	1,527 (83%)	2,973 (82%)
Female	327 (18%)	321 (17%)	648 (18%)
Race			
White	1,455 (82%)	1,463 (79%)	2,918 (81%)
Black/African Am	120 (7%)	133 (7%)	253 (7%)
American Indian	6 (0.2%)	2 (0.1%)	8 (0.2%)
Asian	103 (6%)	83 (5%)	186 (4.5%)
Alaska Native	3 (0.1%)	10 (0.5%)	13 (0.3%)
Native Hawaiian	11 (0.5%)	9 (0.4%)	20 (0.5%)
Hispanic/Latino	9 (0.4%)	48 (2%)	57 (2%)
Puerto Rican	5 (0.2%)	2 (0.1%)	7 (0.2%)
Multi-racial	46 (3%)	83 (5%)	129 (3.5%)
Declined to respond	15 (0.6%)	15 (0.9%)	30 (0.8%)
Career status			
Non-prior service	624 (35%)	611 (33%)	1,235 (34%)
Reserve component	703 (40%)	651 (35%)	1,354 (37%)
Active duty	446 (25%)	586 (32%)	1,032 (29%)
Time in service			
Mean	5.40	5.37	5.39
Age			
Mean	29.34	28.81	29.08

Note: This table contains the population demographics with imputed values that replaced the missing data. All errors are due to rounding.

Table 12

*Descriptive Statistics of the OTS TFOT Sample Demographics (*n *= 916)*

Variable	Sample				Total
	17-01 (*n* = 228)	17-02 (*n* = 234)	18-05 (*n* = 251)	18-06 (*n* = 203)	(*n* = 916)
Gender					
Male	176 (77%)	202 (86%)	199 (79%)	170 (84%)	747 (82%)
Female	52 (23%)	32 (14%)	52 (21%)	33 (16%)	169 (18%)
Race					
White	198 (86%)	188 (80%)	188 (75%)	167 (82%)	741 (81%)
Black/African Am	13 (7%)	17 (7%)	19 (8%)	17 (8%)	66 (7%)
American Indian	1 (0.5%)	2 (0.6%)	0	0	3 (0.3%)
Asian	9 (4%)	16 (7%)	19 (8%)	9 (5%)	53 (6%)
Alaska Native	1 (0.5%)	0	1 (0.3%)	1 (0.5%)	3 (0.3%)
Native Hawaiian	0	4 (2%)	3 (.85%)	1 (0.5%)	8 (1%)
Hispanic/Latino	0	0	0	0	0
Puerto Rican	0	1 (0.4%)	0	1 (0.5%)	2 (0.2%)
Multi-racial	3 (1%)	6 (3%)	18 (7%)	4 (2%)	31 (3%)
Declined to respond	3 (1%)	0	3 (.85%)	3 (1.5%)	9 (1.2%)
Career status					
Non-prior service	119 (52%)	102 (44%)	70 (28%)	54 (27%)	345 (38%)
Reserve component	76 (33%)	79 (34%)	89 (35%)	63 (31%)	307 (34%)
Active duty	33 (15%)	53 (22%)	92 (37%)	86 (42%)	264 (28%)
Time in service					
Mean	3.95	6.46	5.23	5.67	5.33
Age					
Mean	29.92	28.65	28.41	29.09	29.02

Note: This table contains the sample demographics with imputed values that replaced the missing data. All errors are due to rounding. OTS TFOT Classes 17-01 and 17-02 represent the lecture-based courses and Classes 18-05 and 18-06 represent the flipped courses.

Table 13

*Descriptive Statistics for Academic Achievement by Teaching Method and Career Status (*n = *916)*

Teaching method	Career status	*M*	*SD*	*N*
Lecture-based				
	NPS	87.36	5.57	221
	RC	89.12	4.77	155
	AD	89.91	4.95	86
	Total	88.43	5.30	462
Flipped				
	NPS	87.35	4.88	124
	RC	86.78	4.50	152
	AD	88.69	4.43	178
	Total	87.68	4.65	454
Total				
	NPS	87.35	5.33	345
	RC	87.96	4.78	307
	AD	89.09	4.63	264
	Total	88.06	5.00	916

Table 14

Sample Satisfaction Descriptive Statistics by Item, Teaching Method, and Career Status

	AY17 - Lecture (*n* = 353)						AY18 - Flipped (*n* = 286)					
	NPS (*n* = 23)		RC (*n* = 118)		AD (*n* = 212)		NPS (*n* = 19)		RC (*n* = 91)		AD (*n* = 176)	
Survey question	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
1. The OTS mission is to "Produce leaders of moral character." The course I just completed met the stated mission.	5.17	.65	4.99	.81	5.02	.90	5.00	.75	4.81	.91	4.99	.77
2. The course was conducted by a competent faculty.	5.47	.51	5.40	.75	5.35	.77	5.26	.99	5.15	.67	5.02	.77
3. Useful feedback was provided following each leadership opportunity.	5.13	1.10	4.89	1.08	5.00	.95	5.37	.83	4.75	1.04	4.61	1.00
4. The course was intellectually stimulating.	4.48	1.08	4.66	1.19	4.82	1.16	5.16	.90	4.52	.95	4.61	.97
5. I understand my roles and responsibilities as an Air Force officer.	5.00	1.04	5.31	.80	5.19	.88	5.05	1.03	5.16	.79	5.12	.85
6. I understand the Air Force human relations programs such as equal opportunity and treatment.	5.35	.71	5.49	.60	5.42	.68	5.21	.79	5.42	.65	5.45	.61
7. I understand the importance of adherence to Air Force Core Values.	5.74	.45	5.66	.54	5.65	.64	5.68	.48	5.72	.45	5.73	.48
8. I understand the principles of cross-cultural communications.	5.43	.73	5.36	.69	5.33	.82	5.32	.89	5.33	.73	5.35	.75
9. I can more effectively apply leadership skills.	5.04	1.26	5.16	.89	5.13	.94	5.37	.68	5.22	.80	5.20	.79
10. I can more effectively apply followership skills.	5.13	.97	5.21	.87	5.23	.80	5.47	.70	5.23	.75	5.26	.74
11. I can effectively apply ideas verbally in a military setting.	4.96	.93	5.36	.68	5.16	.88	5.21	.54	5.26	.73	5.28	.73
12. I can effectively apply ideas in writing using military writing formats.	4.87	1.36	5.01	1.02	4.90	1.01	5.05	.78	4.86	.98	4.98	.92
13. I know the role of air and space power in maintaining national security.	5.30	.63	5.38	.73	5.33	.75	5.32	.82	5.24	.81	5.24	.79
14. I know the role of joint operations in US national security.	5.26	.69	5.26	.85	5.21	.81	5.21	.92	5.05	.94	5.03	.98
15. I will use what I learned in this course in the future.	5.39	.72	5.15	.96	5.19	.92	5.42	.69	5.09	.96	5.19	.78

Note: See Appendices A and B for complete copies of the surveys.

Table 15

*Sample Course Satisfaction Descriptive Statistics by Item and Teaching Method (*n *= 639)*

	AY17- Lecture (n = 353)		AY18 - Flipped (n = 286)	
Survey question	*M*	*SD*	*M*	*SD*
1. The OTS mission is to "Produce leaders of moral character." The course I just completed met the stated mission.	5.02	.86	4.94	.82
2. The course was conducted by a competent faculty.	5.38	.75	5.08	.76
3. Useful feedback was provided following each leadership opportunity.	4.97	1.00	4.70	1.01
4. The course was intellectually stimulating.	4.74	1.116	4.62	.97
5. I understand my roles and responsibilities as an Air Force officer.	5.22	.87	5.13	.84
6. I understand the Air Force human relations programs such as equal opportunity and treatment.	5.44	.66	5.42	.64
7. I understand the importance of adherence to Air Force Core Values.	5.66	.60	5.73	.47
8. I understand the principles of cross-cultural communications.	5.35	.77	5.34	.75
9. I can more effectively apply leadership skills.	5.14	.95	5.22	.78
10. I can more effectively apply followership skills.	5.22	.83	5.27	.74
11. I can effectively apply ideas verbally in a military setting.	5.22	.83	5.27	.72
12. I can effectively apply ideas in writing using military writing formats.	4.93	1.04	4.95	.93
13. I know the role of air and space power in maintaining national security.	5.35	.73	5.24	.80
14. I know the role of joint operations in US national security.	5.23	.81	5.05	.96
15. I will use what I learned in this course in the future.	5.19	.92	5.17	.84

Note: See Appendices A and B for copies of the complete OTS TFOT surveys.

For RQ1 and RQ2, the researcher conducted a HLR analysis using guidance from Pedhazer (1997) to assess if the independent variable of teaching method significantly predicted academic achievement and course satisfaction in OTS TFOT cadets. The HLR analyses for RQ1 and RQ2 included the independent variable of teaching method on the dependent variables of achievement and satisfaction while controlling for cadet status [i.e., non-prior service (NPS), Reserve component (RC), active duty (AD)] and age. For RQ3 and RQ4, the researcher used the results from the HLR analyses to determine the effect of teaching method across career status and age by testing for an interaction between teaching method and career status, and teaching method and age. A simple effects analysis was performed to interpret the contribution of each effect where an interaction existed. Based on guidance by Pedhazer (1997) for HLR analysis and tests for interaction between continuous and categorical regressors, the researcher used the following coding scheme to represent the variables: teaching method [TM; lecture (0) and flipped (1), where lecture served as the reference group], career status [CS; NPS (1, 0, 0) and RC (0, 1, 0), where AD (0, 0, 0) served as the reference group], and the centered value of cadet age (Centered_Age) based on the overall mean age. Interaction terms were computed to test for an interaction between the dummy-coded variables: TM*NPS, TM*RC, and TM*Centered_Age. Prior to the primary analysis, the researcher conducted tests for normality and homoscedasticity.

Normality

An evaluation of normality was assessed with Q-Q scatterplots for each data set (Mertler & Vannatta, 2013). Use of graphs to represent data serves as an integral component in the process of analyzing data (Mertler & Vannatta, 2013). As general rule, violations of normality with large samples bring no adverse effects for the analysis (Mertler & Vannatta, 2013). For the achievement and satisfaction data sets, the researcher determined the assumptions of normality were tenable. Figure 3, Q-Q scatterplot testing normality of academic achievement, and Figure 4, Q-Q scatterplot testing normality of course satisfaction, represent the Q-Q scatterplots for normality of the academic achievement scores and course satisfaction results.

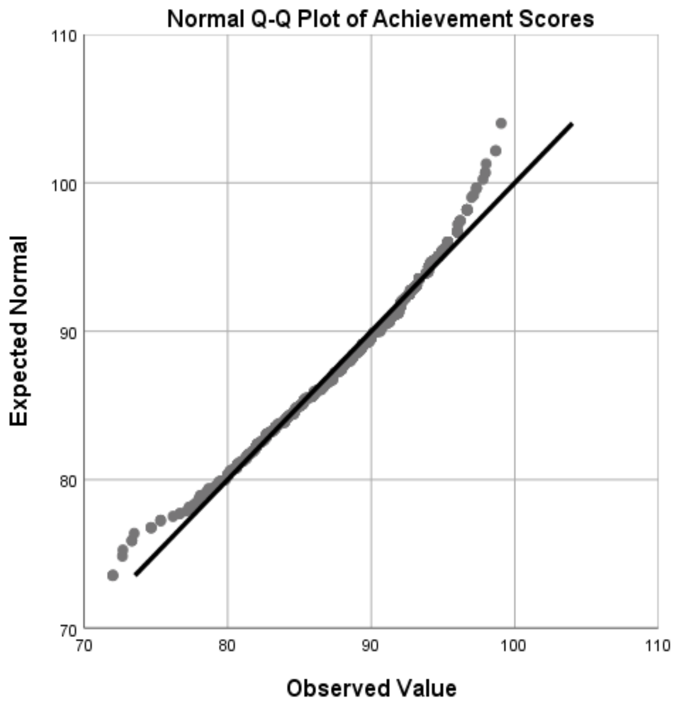

Figure 3. Q-Q scatterplot testing normality of academic achievement.

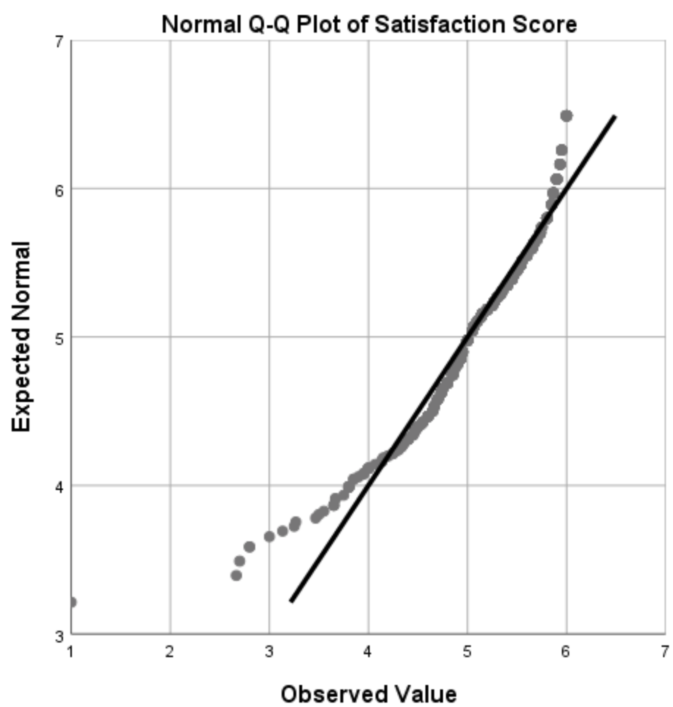

Figure 4. Q-Q scatterplot testing normality of course satisfaction.

Homoscedasticity

In regression analysis, the assumption of homoscedasticity expects consistent variance in error terms (Mertler & Vannatta, 2013; Pedhazer, 1997). The assumption of homoscedasticity suggests that variability of scores for a continuous dependent variable should be consistent at the same levels of the independent variable (Mertler & Vannatta, 2013). Homoscedasticity can be evaluated in regression analysis by conducting a residual plot (Ross & Shannon, 2011). For the achievement and satisfaction data sets, the researcher determined the assumptions of homoscedasticity were tenable. Figure 5, Scatterplot testing homoscedasticity of academic achievement, and Figure 6, Scatterplot testing homoscedasticity of course satisfaction, are the standardized predicted by standardized residual scatterplots of homoscedasticity for the data sets.

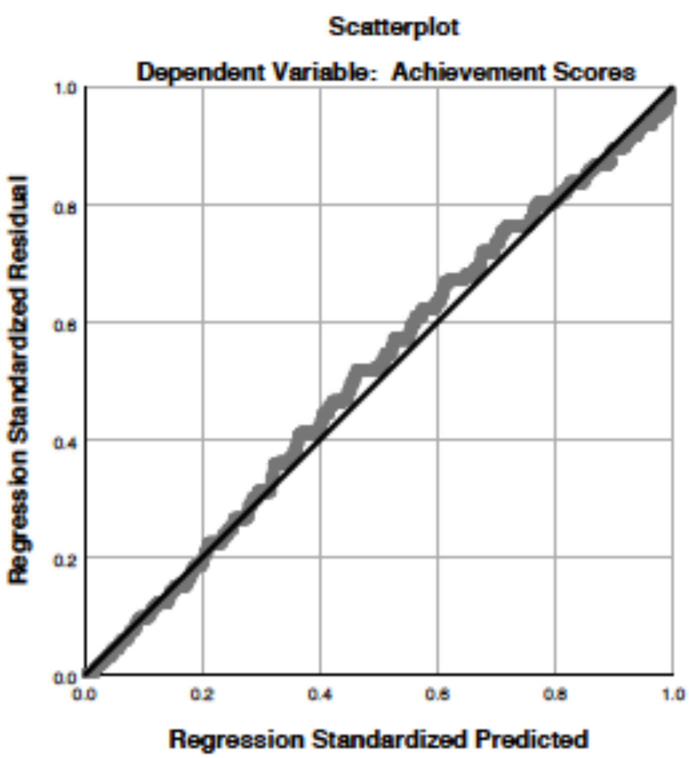

Figure 5. Scatterplot testing homoscedasticity of academic achievement.

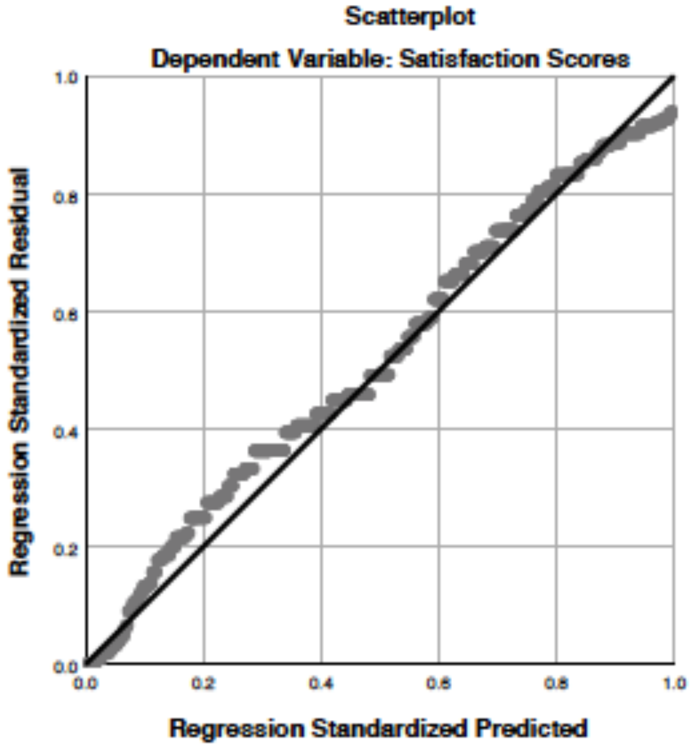

Figure 6. Scatterplot testing homoscedasticity of course satisfaction.

Results for RQ1

RQ1: Does course teaching method affect academic achievement in OTS TFOT cadets?

A HLR analysis was conducted to determine the effect of the independent variable teaching method on the dependent variable academic achievement while controlling for cadet status and age. Data screening in the preliminary analysis resulted in the removal of 16 cases with missing values for the age variable where the sample used for analysis was n = 900. From the HLR analysis, results indicated that teaching method did significantly affect academic achievement [R^2 = .037, R^2_{adj} = .033, $F(1, 895) = 8.674$, $p < .001$] with cadets in the lecture courses scoring higher than cadets in the flipped courses. Regression results indicated that teaching method explained 1.5% of variance in academic achievement while controlling for cadet-career status and age, where lecture and active duty served as the reference groups in the analysis. Table 15, Coefficients for Model Variables of Academic Achievement, displays a summary of regression coefficients. The regression equation for academic achievement is expressed as

$$Academic\ Achievement = \beta_0 + b_1X_{TM} + b_2X_{NPS} + b_3X_{RC} + b_4X_{Age}$$

Table 16

Coefficients for Model Variables of Academic Achievement

	B	β	*t*	*p*	Bivariate r	Partial r
(Constant)	90.064	-	231.179	< .001	-	-
Teaching Method	-1.253	-.126	-3.692	< .001	-.077	-.121
NPS	-2.371	-.231	-5.196	< .001	-.113	-.144
RC	-1.487	-.140	-3.528	< .001	-.019	-.099
Age	-.039	-.030	-.829	.407	.036	-.020

Results for RQ2

RQ 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

A HLR analysis was conducted to determine the effect of the independent variable teaching method on the dependent variable course satisfaction while controlling for cadet-career status (the age variable was not available for the satisfaction data set). Data screening in the preliminary analysis resulted in the removal of six cases with missing values where n = 633 was available for analysis. From the HLR analysis, results indicated that teaching method did not significantly affect course satisfaction in cadets [R^2 = .005, R^2_{adj} = .000, $F(1, 626)$ = 1.086, p = .354]. Regression results indicated that teaching method explained 0% of variance in course satisfaction while controlling for cadet-career status and where lecture and active duty served as the reference groups in the analysis. Table 16, Coefficients for Model Variables of Course Satisfaction, displays a summary of regression coefficients. The regression equation for course satisfaction is expressed as

$$Course\ Satisfaction = \beta_0 + b_1X_{TM} + b_2X_{NPS} + b_3X_{RC}$$

Table 17

Coefficients for Model Variables of Course Satisfaction

	B	β	*t*	*p*	Bivariate r	Partial r
(Constant)	5.063	-	131.936	< .001	-	-
Teaching Method	.081	.066	1.665	.096	.067	.066
NPS	.060	.025	.605	.545	.026	.024
RC	-.011	-.008	-.205	.838	-.014	-.008

Results for RQ3 and RQ4

RQ 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets? And, RQ 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

First, a HLR analysis was conducted to determine if the effect of teaching method varied across cadet career status and age when predicting academic achievement. Data screening in the preliminary analysis resulted in the removal of 16 cases with missing values for the age variable where the sample used for analysis was $n = 900$. From the HLR analysis, the results indicated the test of the incremental R^2 for the interactions, above the main effects, was significant for academic achievement [$R^2 = .047$, $R^2_{\text{adj}} = .040$, $F(7, 892) = 6.303$, $p < .001$]. Regression results indicated that the significant effect of teaching method across cadet-career status and age explained 1% of the variance in academic achievement, where lecture and active duty served as the reference groups in the analysis.

When a test of the incremental R^2 is significant, one should assume different slopes for each group (i.e., lecture group and flipped group; Pedhazer, 1997). Because the interactions depend on the relationship between the independent variable(s) and the covariate(s), Pedhazer (1997) states that each group needs its own regression equation where the interaction terms are omitted from the separate equations. The regression equations for the effect of teaching method across cadet-career status and age for academic achievement are expressed as

$$Lecture\ (Achievement) = \beta_0 + b_1X_{NPS} + b_2X_{RC} + b_3X_{Age}$$

$$Flipped\ (Achievement) = \beta_0 + b_1X_{NPS} + b_2X_{RC} + b_3X_{Age}$$

Table 18, Coefficients for Model Variables of the Lecture Group, and Table 19, Coefficients for Model Variables of the Flipped Group, display summaries of regression coefficients for the lecture and flipped groups.

Table 18

Coefficients for Model Variables of the Lecture Group

	B	β	*t*	*p*	Bivariate r	Partial r
(Constant)	90.107	-	150.449	< .001	-	-
NPS	-2.823	-.266	-3.736	< .001	-.196	-.172
RC	-.963	-.086	-1.350	.178	.090	-.063
Age	-.032	-.024	-.456	.649	.088	-.021

Table 19

Coefficients for Model Variables of the Flipped Group

	B	β	*t*	*p*	Bivariate r	Partial r
(Constant)	88.789	-	256.088	< .001	-	-
NPS	-1.588	-.153	-2.787	.006	-.049	-.132
RC	-2.066	-.210	-4.047	< .001	-.153	-.190
Age	-.049	-.039	-.775	.439	-.023	-.037

To obtain and interpret the contribution of each effect, separate simple effects analyses were conducted. The simple effects analyses for academic achievement indicated that the effect of teaching method did significantly vary across career status [$F(2, 894) = 4.569$, $p = .011$], but not for age [$F(17, 862) = .963$, $p = .499$]. The simple effects analysis revealed active duty cadets in both the lecture and flipped classes scored significantly higher [$F(2, 894) = 4.569$, $p = .011$] than Reserve component [$t(894) = 3.49$, $p = .002$] and non-prior service cadets [$t(894) = 4.82$, $p < .001$] in academic achievement. The difference in means between Reserve-component and non-prior service cadets in academic achievement was not significant [$t(894) = 1.40$, $p = .488$].

Next, as stated above, the HLR analysis for RQ2 revealed an insignificant model for the effect of teaching method on course satisfaction. Likewise, the HLR analysis revealed no interaction for the effect of teaching method across cadet-career status when predicting course satisfaction [$R^2 = .006$, $R^2_{\text{adj}} = -.002$, $F(5, 624) = .753$, $p = .584$]. Table 20, Coefficients for Model Variables of Teaching Method and Cadet-Career Status for Course Satisfaction, displays a summary of regression coefficients.

Table 20

Coefficients for Model Variables of Teaching Method and Cadet-Career Status for Course Satisfaction

	B	β	*t*	*p*	Bivariate r	Partial r
(Constant)	5.064	-	119.365	< .001	-	-
Teaching Method	.079	.064	1.250	.212	.067	.050
NPS	.001	.000	.009	.993	.026	.000
RC	-.003	-.002	-.041	.967	-.014	-.002
TM*NPS	.130	.036	.651	.515	.050	.026
TM*RC	-.018	-.010	-.171	.865	.015	-.007

Summary

This chapter presented the organization of the statistical analyses used on the independent and dependent variables and covariates. This chapter also presented the results of the analyses performed for this study. First, this chapter reviewed the study's problem statement, purpose of the study, and research questions. Next, the chapter presented an organization of the data analyses and provided the results of the data screening, descriptive statistics, HLR, and simple effects analyses needed to investigate the data sets and research questions. Last, the chapter summarized the analyses and results.

HLR and simple effect analyses were used to investigate the effect of teaching method on academic achievement and course satisfaction, and to investigate if the effect of teaching method varied across the de-identified demographic variables of cadet-career status and age. The results of HLR analyses revealed that teaching method did significantly affect academic achievement [$R^2 = .037$, $R^2_{adj} = .033$, $F(1, 895) = 8.674$, $p < .001$] with cadets in the lecture courses scoring higher than cadets in the flipped courses, but that teaching method did not significantly affect course satisfaction in cadets [$R^2 = .005$, $R^2_{adj} = .000$, $F(1, 626) = 1.086$, $p = .354$]. The HLR analysis results also indicated that the test of the incremental R^2 for the interactions, above the main effects, was significant for academic achievement [$R^2 = .047$, $R^2_{adj} = .040$, $F(7, 892) = 6.303$, $p < .001$]. A HLR analysis revealed no interaction for the effect of teaching method across cadet-career status when predicting course satisfaction [$R^2 = .006$, $R^2_{adj} = -.002$, $F(5, 624) = .753$, $p = .584$].

To obtain and interpret the contribution of each effect, separate simple effects analyses were conducted. The simple effects analyses for academic achievement indicated that the effect of teaching method did significantly vary across career status [$F(2, 894) = 4.569$, $p = .011$], but not for age [$F(17, 862) = .963$, $p = .499$]. The simple effects analysis revealed active duty cadets in both the lecture and flipped classes scored significantly higher [$F(2, 894) = 4.569$, $p = .011$] than Reserve component [$t(894) = 3.49$, $p = .002$] and non-prior service cadets [$t(894) = 4.82$, $p < .001$] in academic achievement. The difference in means between Reserve-component and non-prior service cadets in academic achievement were not significant [$t(894) = 1.40$, $p = .488$].

Chapter 1 served as the introduction to this study. Chapter 2 provided a discussion of the research findings from the literature on the flipped classroom and discussed the theoretical framework guiding the study, and offered a conceptual model combining the theoretical framework and flipped-classroom research to inform and guide the instructional-design process. Chapter 3 described the methods used to conduct this study to include a description of the population and sample; instrumentation; data collection process; and, data analysis procedures. Chapter 4 presented the study results. Chapter 5 concludes this study with a summary, conclusion, study implications, and recommendations for future practice and further research.

Chapter 5 Summary, Conclusion, Implications, and Recommendations

Overview

Chapter 1 served as the introduction to this study and presented the background, description of the organization serving as the study focus, theoretical background, problem statement, purpose, research questions, significance, limitations, assumptions, and definition of terms. Chapter 2 provided a discussion of the research findings from the literature on the flipped classroom and discussed the theoretical framework guiding the study, and offered a conceptual model combining the theoretical framework and flipped-classroom research to inform and guide the instructional-design process. Chapter 3 described the methods used to conduct this study to include a description of the population and sample; instrumentation; data collection process; and, data analysis procedures. Chapter 4 presented the study results. Chapter 5 concludes this study with a summary, conclusions, study implications, and recommendations for future practice and further research. This chapter explains how the study results can be used to inform future research and current practices as related to the literature and the study problem.

Problem Statement

In the growing body of flipped-classroom literature, educators lamented the extensive time and enormous expense with transitioning from teacher-centered methods to learner-centered methods. Despite the immense effort creating an effective learner-centered environment, educators revealed mixed results when measuring changes in learning outcomes and learner improvements. Educators admittedly struggled to empirically determine if the changes from traditional-lecture methods to flipped-classroom methods resulted in improved outcomes such as increased course satisfaction and academic achievement among learners.

From the program and institutional-effectiveness perspectives, OTS leadership reviewed cadet-course satisfaction surveys and achievement scores, but desired more empirical evidence to determine if the program changes to TFOT created a program that produced better officers. The problem this study seeks to investigate is if traditional, lecture-based classes or the flipped-teaching model resulted in significantly different course-satisfaction ratings and academic-achievement scores for OTS TFOT cadets.

Purpose of the Study

The purpose of this nonexperimental, quantitative, correlational study was to determine if course satisfaction and academic achievement differ between the traditional, lecture-based course and flipped-teaching formats for Officer Training School (OTS), Total Force Officer Training (TFOT) cadets. This study examined existing course-satisfaction ratings and academic-achievement scores based on course-teaching method and de-identified, cadet-demographic data. To accomplish the investigation, the researcher used de-identified academic-achievement scores from course multiple-choice exams to determine if differences in cadet-academic achievement existed between TFOT classes 17-01 and 17-02, which heavily relied on lecture-based methods, and TFOT classes 18-05 and 18-06, which added the online prerequisite course and primarily used flipped-teaching methods. The researcher also used de-identified surveys with Likert-scale scoring to determine if differences in cadet-course satisfaction existed between the same classes.

For this study, course satisfaction and academic achievement served as dependent variables; teaching method served as the independent variable; and, cadet-career status and age served as covariates. Additionally, the researcher investigated if an interaction existed among teaching method and the cadet demographics of age and career status (i.e., active duty, non-prior service, or Reserve component). The results of this research could inform and guide the design and implementation of future flipped education and training programs within the military. This study adds to the body of knowledge in adult education by following the recommendations of previous researchers who called for additional research on flipped-classroom designs with large sample sizes in multi-disciplined institutions (Njie-Carr et al., 2017; Pierce & Fox, 2012).

Research Questions

To address the problem of this study, the researcher raised the following research questions:

Research Question 1: Does course teaching method affect academic achievement in OTS TFOT cadets?

Research Question 2: Does course teaching method affect course satisfaction in OTS TFOT cadets?

Research Question 3: Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?

Research Question 4: Does the effect of teaching method vary by age for OTS TFOT cadets?

Summary

The problem this study analyzed was if lecture-based or flipped-classroom methods resulted in significant differences in academic achievement scores and course satisfaction ratings. To analyze the problem, this study examined archival data from a sample of 916 cadets attending the USAF's OTS TFOT program. On the first instrument, 916 cadets completed course multiple-choice tests which allowed the researcher to calculate an aggregated score to represent academic achievement. On the second instrument, 639 cadets completed the voluntary and anonymous end-of-course satisfaction surveys. The researcher used the surveys' Likert-scale ratings to calculate an aggregated score for each survey item to represent course satisfaction. The de-identified demographic information of cadet-career status (i.e., non-prior service, Reserve component, and active duty), military time-in-service, age, gender, and race was used to describe and compare the population (*N* = 3,621) and sample of *n* = 916 for the achievement data and *n* = 639 for the satisfaction data. For the study instruments and available demographic information, only the demographic variables of career status and age were linked to academic achievement, and only the variable of career status was linked to the end-of-course satisfaction surveys. Since the achievement and satisfaction instruments were not linked, the quantitative tests consisted of separate univariate analyses.

The purpose of this study was to determine if academic achievement and course satisfaction differed based on course teaching method for OTS TFOT cadets. Examining the effect of teaching method on academic achievement, the researcher conducted a hierarchical linear regression (HLR) analysis and found a significant difference in achievement scores based on teaching method where cadets in the lecture-based course scored significantly higher than cadets in the flipped course. Examining the effect of teaching method on course satisfaction, the researcher conducted a HLR analysis and found no significant difference in satisfaction between cadets who attended the lecture-based course and cadets who attended the flipped course.

To interpret the interaction effects, the researcher conducted separate simple effects analyses for the effect of teaching method on cadet-career status, and teaching method on age. The simple effects analyses for academic achievement indicated that the effect of teaching method did significantly vary across career status, but not for age. The simple effects analysis revealed active duty cadets in both the lecture and flipped classes scored significantly higher than Reserve component and non-prior service cadets in academic achievement. The difference in means between Reserve-component cadets and non-prior service cadets in academic achievement was not significant

Conclusion

Throughout the literature, educators sought to empirically determine if changes from teacher-centered, lecture-based methods to learner-centered, flipped-teaching methods were worth the time, effort, and expense. With the changes in the OTS TFOT program, the OTS leadership also sought to determine if changes in the program's teaching methods impacted cadets' academic achievement and course satisfaction. The results of this study could inform and guide the design and implementation of future education and training programs within the military.

First, for RQ1 (Does course teaching method affect academic achievement in OTS TFOT cadets?), the findings that cadets in the lecture-based course achieved a significantly higher academic achievement average than cadets in the flipped course, and that teaching method accounted for 1.5% of the variance in academic achievement, are consistent with the literature (Cabi, 2018; Earley, 2018; Pedhazur, 1997; Peterson, 2016). Educators who conducted a flipped classroom often found their learners achieved higher quantitative scores in the teacher-centered, lecture-based courses due to what Knowles et al. (2015) described as situational and individual differences (i.e., goals, subject or prior-domain knowledge, self-efficacy, self-regulation, maturity, self-directed study habits, out-of-class commitments, cognitive abilities), and a general unpreparedness for the rigor of self-directed learning (Peterson, 2016). A finding from this study, with particular interest for OTS TFOT, is that the drop in academic achievement from the lecture to the flipped courses for Reserve component cadets warrants more investigation into the lower mean academic achievement scores. A tenable solution is that Reserve cadets may benefit from a prepare-the-learner, active-learning activity in either the online-prerequisite course or the resident OTS TFOT course as cadets will increasingly engage in self-directed learning and active-learning activities (Knowles et al.; 2015).

Second, for RQ2 (Does course teaching method affect course satisfaction in OTS TFOT cadets?), the finding of no significant difference in course satisfaction ratings between the lecture-based and flipped courses is also consistent with the literature. Throughout the literature, educators often found mixed results for learners regarding course satisfaction. While the course satisfaction ratings may reflect high quantitative marks (i.e., mean 5.11 overall OTS TFOT course satisfaction rating on a 6-point Likert scale which indicates a high level of course satisfaction), learners often qualitatively expressed dissatisfaction with the flipped-teaching method due to the perceived increase in out-of-class workload and time commitment (Earley, 2018; Njie-Carr et al., 2017; Peterson, 2016).

However, educators often found that learners expressed great satisfaction with the flipped classroom when in-class activities allowed learners to engage class concepts, peers, and the instructor in assessments that mimicked real-world problems. Interestingly, the same learners also expressed dissatisfaction with out-of-class preparations and the perspective of paying for a college class while assuming primary responsibility of teaching one-self (i.e., what teachers deemed as an absence of time-management skills and a low-level of self-regulation; Cabi, 2018; Earley, 2018, Njie-Carr, 2017; Wilson, 2013).

Third, for RQ3 (Does the effect of teaching method vary across cadet-career status for OTS TFOT cadets?), the finding that there was a significant interaction between teaching method and cadet-career status (i.e., career status an indication of experience, self-efficacy, maturity, and prior domain knowledge) is consistent with the literature. Cook et al. (2007) remarked that high-performing, high-achieving learners will perform well academically regardless of how the learning environment is structured and will typically meet or even exceed the demands of the course and expectations of the teacher. Additionally, Cook et al. (2007) noted that highly motivated learners and the abilities of high-performing, high-achieving learners reflect the commitment and achievement of those who can adapt to a variety of instructional methods and course designs, and who are overall intellectually agile, adaptable, and capable. Speaking specifically of military veterans, Griffith (2006) thoroughly documented the direct effect of military (career) status on academic achievement and how veterans are well equipped for academic success.

Last, for RQ4 (Does the effect of teaching method vary by age for OTS TFOT cadets?), the finding of no interaction between teaching method and age is consistent with the literature. The literature reflected that when analyzing age as a standalone variable, researchers found mixed results when age was examined for effect on an observed or latent variable. Further, researchers noted more discernable explanations when the effect of age was integrated with other constructs such as maturity, knowledge, experience, and motivation (Griffith, 2006). While examining learners' personal and social factors on levels of academic engagement and achievement, Diep et al. (2017) and Errey and Wood (2011) found the effect of age as a non-essential descriptive variable especially when examined next to other qualities of an adult like life circumstances, individual characteristics, personal attributes, processes of thinking and learning, and direct measures of prior-domain knowledge or experience.

Cook et al. (2007) warned that many studies fail to prove or disprove one treatment (i.e., teaching method) over another or influence of one learner or teacher characteristic over another due to an overall effectiveness of teaching or course design. Cook et al. (2007) added, "Once effective instructional methods are employed, intellectually capable and motivated learners may learn equally well, regardless of (other factors)" (p. 903). Evenly poorly designed courses or ineffective teaching can still provide an environment for capable learners to achieve course knowledge or skills, attain course goals, and pass a course will high marks. As described in chapter 2, teacher preparation and flexible course designs further increase the likelihood for an effective learning experience in a flipped classroom despite the mixed quantitative results found in the literature. Teachers seeking to design and implement an effective flipped classroom can adapt best practices and findings from the literature for the approach and activities best suited to their local context and that maximize their learners' academic achievement and course satisfaction (McGee, 2014; McGee & Reis, 2012; McGee, Valdes, & Bullis, 2016).

Implications

The findings from this study contain valuable implications and benefits for future research and practice. The first implication applies to educational contexts where sample size offers enough statistical power to detect very small differences in the constructs measured. If a sample size is large enough, the researcher may find very small differences to be statistically significant. If a sample size is small, a statistically significant difference may be harder to find. According to Fraenkel et al. (2015), statistical significance means that a researcher's "results are likely to occur by chance less than a certain percentage of the time," often 5% for the social sciences (p. 230). Practical significance refers to results or an effect that may yield a statistically significant result, but contribute little or no practical or educational value to a learning environment (Fraenkel et al., 2015). Conversely, results or an effect may yield a nonsignificant statistical result, but contain practical significance or contribute considerable educational value to a learning environment. Most often, experts within the field of interest make the determination if research results contain practical importance (Pituch & Stevens, 2016). The role of the two concepts points to the reason why practitioners should consider the entire research context for such factors as: power, effect size, sample size, confidence level, statistical test(s), size of the difference, strength of the relationship, covariates, research problem, and theoretical framework (Gravetter & Wallnau, 2017; Mertler & Vannatta, 2013; Pituch & Stevens, 2016).

Statistical- and practical-significance considerations apply to the results of statistical analysis, in any education-research study, where, for example, learners are exposed to new methods or treatments which result in a statistically significant difference from an existing method. Whether a new or old treatment produces a statistically significant difference, the results may contain little-to-no practical or educational value for the learning environment (i.e., decisions regarding expense of a treatment for only minimal gain or increases in the amount of time required to attain an educational benefit) or vice versa. For the case of flipped-learning environments, the evidence points researchers to reexamine existing analytics, indicators, phenomena, and constructs used to measure learning gains, teaching effectiveness, and course value. Existing aggregated, quantitative measures of achievement, and learner self-reported achievement and satisfaction measures, generally fail to capture hard-to-measure outcomes such as deep learning and leadership growth and development. The imperative for learning institutions aiming to fundamentally transform their existing education and training paradigms, as the USAF and its Continuum-of-Learning initiative, is to find measures of the learning environment that capture the most important learner-development constructs that yield meaningful data for their new, context-specific paradigm (Roberson & Stafford, 2017).

Next, pertaining to the discussion of prerequisite situational variables and the finding that 1.5% of the variance in achievement was accounted for by teaching method, a researcher's assessment of the local environment and learning context can reveal data or variables that reside at varying hierarchical levels (i.e., nested data; Woltman, Feldstain, MacKay, & Rocchi, 2012). Since our world is multivariate and multilevel by nature, the imperative exists for researchers to make an a priori decision in research designs and analyses that are sufficient to account for the shared variance in relationships within and between hierarchical levels of grouped data (Ross & Shannon, 2011; Pedhazer, 1997; Woltman et al., 2012). Pedhazur (1997) describes the limitations of simpler construct-measures and statistical analysis common in educational settings by stating,

> Although researchers use students' grade point average (for example) as a dependent variable, this is very often done not because it is believed that this index captures the complex phenomenon of academic achievement, but because it is a single, easily obtainable index. When the phenomenon being studied is multidimensional, one cannot encapsulate it in a single score without thereby distorting it or even stripping it entirely of its meaning (p. 894).

Woltman et al. (2012) add, "Up to 80-90% of the variability due to individual differences may be lost" when aggregating or disaggregating data (p. 55). Using models that can account for the simultaneous investigation of hierarchical relationships implies that researchers may need to accommodate such complex investigations by re-examining their current student-level variables; course-level factors; data collection techniques; measurement instruments; personal knowledge of research methods and statistical tests; and, exogenous factors such as institutional procedures, capabilities, and limitations (Martella et al., 1999; Woltman et al., 2012).

Third, introduced as a perspective on instructional design, a best practice to increase not only the effectiveness of instructional design, but also add rigor to research, is use of a team approach comprised of a balanced group of multidisciplinary experts (i.e., technologist, methodologist, researcher, instructional designer, subject matter expert) for instructional design and research. To achieve the rigor advocated by Woltman et al. (2012) and Pedhazur (1997) in the previous paragraph, practitioners using a collaborative-production or research team can add effectiveness and efficiency to an otherwise labor-intensive, multifaceted endeavor. A team approach produces such benefits and achieves such efficiencies as the division of labor, flexible instructional or research design, checks/balances, constructive peer reviews, responsive maintenance/support, and attainment of high quality/standards (Herron et al., 2012). As expressed by Korr et al. (2012), course development and research studies are exhausting endeavors and the absence of expertise or quality in any area will undoubtedly get exposed in the final product and therefore cast doubt on the accuracy of the entire work.

The last benefit discussed here is the synthesis of andragogy, experiential learning, and flipped-classroom benefits. As presented in chapter 2, a noted characteristic of the flipped classroom is that this teaching method is without a unifying theory, model, or process. In the absence of a single model, teachers admittedly struggled to transition their course regardless of their instructional-design process. The synthesized model presented in Table 6, Synthesis of Andragogical Process Elements, Kolb's ELM, Adult-Learning Principles, and Flipped-Classroom Benefits, provides a solution to the designer's dilemma by offering teachers a flexible process for transforming a course or guiding an implemented course in a manner that aligns course goals, content, active-learning methods, and needs of adult learners in one unifying framework. This unified framework presents a practical means of implementing learner-centered, active-learning strategies guided by and grounded in adult learning theory.

Recommendations

More and more, teachers are looking to design and implement courses that challenge learners to exercise higher-order thinking, take control of their learning, and actively apply course concepts. As presented in the literature, teachers such as Wilson (2013) expressed a great desire with and satisfaction in moving learners from timid and passive observers to confident and skilled users of course material and concepts. Adding to the literature on flipped learning and adult education, researchers should consider areas for further research that include variations of longitudinal analysis (i.e., tested over predetermined periods of time) with large samples (i.e., $n > 100$), and a variety of participants (i.e., learners, institution faculty), academic levels (i.e., student-level, classroom-level or course-level, school-level or geographic region), cohorts, course assessments, and data collection techniques (Woltman et al., 2012). Additionally, studies of an institution's teaching faculty with examinations of teaching experience, teaching style, faculty preparation, in-class/out-of-class demands, and overall satisfaction with course or teaching method would produce invaluable insight.

Pituch and Stevens (2016) remarked, "(Researchers must) understand that they should not expect large, positive findings to emerge routinely from a single study of a new program" (p. 163). Regarding all research findings, Pedhazur (1997) cautions about "the dubious value" associated with any method used to explain phenomena and should therefore exercise care when using results as a guide, especially for making policy (p. 283). However, as expressed from the research presented in this study, researcher persistence and perseverance through trial-and-error, and a commitment to improve our profession, are worth the labor and produce all manner of results from which we all can benefit.

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Appendix A

OTS End of Course Survey for AY17

WELCOME TO THE OTS END OF COURSE FEEDBACK
AU SCN: 17-063 Expires 14 October 2017

IAW AFI 38-501, para 2.2, your participation in this survey is encouraged but voluntary. Strict confidentiality concerning any identifiers of individual survey respondents is maintained and data collection is anonymous. Your feedback is critical to academic program improvement and greatly appreciated.

We continually strive to improve our products and processes; therefore, feel free to tell us what you think. We request you give us your candid responses. Since we are not asking for any names or demographics, your anonymity is guaranteed. Please answer all questions based on your experience at OTS. Once you have completed the survey,
CLICK THE FINISH BUTTON.

Class Number	Course	Status
17-01	Total Force Officer Training Course	Active Duty (AD)
17-02	Commissioned Officer Training Course	Non-Prior Service (NPS)
17-03	Reserve Commissioned Officer Training Course	ANG
17-04		AFR (Res)
17-05		
17-06		
17-07		
17-08		

THE OTS MISSION

The OTS mission is to "Produce leaders of moral character." The course I just completed met the stated mission.
Strongly Agree, Agree, Slightly Agree, Slightly Disagree, Disagree, Strongly Disagree

OTS STAFF (Squadron leadership, Flt/CCs, enlisted instructors, support personnel)						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
Useful feedback was provided following each leadership opportunity.						

CURRICULUM						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
I understand my roles and responsibilities as an Air Force officer.						
I understand the Air Force human relations programs such as equal opportunity and treatment.						

I understand the importance of adherence to Air Force Core Values.						
I understand the principles of cross-cultural communications.						
I can effectively apply leadership skills.						
I can effectively apply followership skills.						
I can effectively apply ideas verbally in a military setting.						
I can effectively apply ideas in writing using military writing formats.						
I know the role of air and space power in maintaining national security.						
I know the role of joint operations in US national security.						
The physical conditioning program demonstrated how to live a healthy lifestyle and promoted the AF "Fit to Fight" philosophy.						

SPECIAL INTEREST ITEMS						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
I had sufficient information to prepare me for OTS.						
TFIT properly prepared me for TFOT.						
The OTS Web site contained necessary information to help						

me prepare for OTS.						
The information technology resources (Computers/Printers /Wireless/Audio Visual Equipment/TV Monitors) supported my training needs.						
The AAFES staff was helpful.						
The Dining Facility met my nutritional needs.						
A chaplain was available if I needed to talk.						

AU QUESTIONS						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
The course was conducted by a competent faculty.						
The course was intellectually stimulating.						
The course enhanced my leadership capabilities.						
I am prepared to speak positively about the Air Force's role in the joint fight.						
This course made a difference in my professional life.						
I will use what I learned in this course in the future.						

OVERALL, WHAT WAS THE MOST EFFECTIVE ASPECT OF OTS?

WHAT WAS THE LEAST EFFECTIVE ASPECT OF OTS?

OTHER COMMENTS (If Applicable):

Appendix B

OTS End of Course Survey for AY18

WELCOME TO THE OTS END OF COURSE FEEDBACK
Control Number: 2017AUCN1031Ha Expires 30 Oct 2018

IAW AFI 38-501, para 2.2, your participation in this survey is encouraged but voluntary. Strict confidentiality concerning any identifiers of individual survey respondents is maintained and data collection is anonymous. Your feedback is critical to academic program improvement and greatly appreciated.

We continually strive to improve our products and processes; therefore, feel free to tell us what you think. We request you give us your candid responses. Since we are not asking for any names or demographics, your anonymity is guaranteed. Please answer all questions based on your experience at OTS. Once you have completed the survey,
CLICK THE FINISH BUTTON.

Class Number	Course	Status
18-01	Total Force Officer Training Course	Active Duty (AD)
18-02	Commissioned Officer Training Course	Non-Prior Service (NPS)
18-03	Reserve Commissioned Officer Training	ANG
18-04	Course	AFR (Res)
18-05		
18-06		
18-07		
18-08		

THE OTS MISSION

The OTS mission is to "Produce leaders of moral character." The course I just completed met the stated mission.
Strongly Agree, Agree, Slightly Agree, Slightly Disagree, Disagree, Strongly Disagree

OTS STAFF (Squadron leadership, Flt/CCs, enlisted instructors, support personnel)						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
The course was conducted by a competent faculty.						
Useful feedback was provided following each leadership opportunity.						

CURRICULUM						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
The course was intellectually stimulating.						
I understand my roles and responsibilities as an Air Force officer.						

I understand the Air Force human relations programs such as equal opportunity and treatment.						
I understand the importance of adherence to Air Force Core Values.						
I understand the principles of cross-cultural communications.						
I can effectively apply leadership skills.						
I can effectively apply followership skills.						
I can effectively apply ideas verbally in a military setting.						
I can effectively apply ideas in writing using military writing formats.						
I know the role of air and space power in maintaining national security.						
I know the role of joint operations in US national security.						
I will use what I learned in this course in the future.						

ADMINISTRATIVE ITEMS						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
The information technology resources (Computers/Printers /Wireless/Audio Visual Equipment/TV Monitors) supported my training needs.						

Dormitory facility supported my training needs.						

STUDENT SUPPORT SERVICES ITEMS						
	Strongly Agree	Agree	Slightly Agree	Slightly Disagree	Disagree	Strongly Disagree
The physical conditioning program demonstrated how to live a healthy lifestyle and promoted the AF "Fit to Fight" philosophy.						
The AAFES staff was helpful (delivering alteration request in timely manner, addressing uniform size requirements, etc.).						
The Dining Facility met my nutritional needs.						
A chaplain was available if I needed to talk.						

ADDITIONAL COMMENTS (If Applicable):

Appendix C

Auburn University Request to Air University for OTS Documentation

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

EDUCATIONAL FOUNDATIONS, LEADERSHIP AND TECHNOLOGY

April 12, 2018

Dr. R. Joel Farrell
Air University A3, Academic Analytics
55 LeMay Plaza South, Ste 241
Maxwell AFB, AL 36116-6335

Subject: Request for Documents and Data Needed for Auburn Institutional Review Board (IRB)

Dear Dr. Farrell,

AFIT Civilian Institution Program PhD student, Lt Col Klifford (Kliff) Mosley, is proposing a research study involving Air University's Officer Training School (OTS). The proposed research will be a nonexperimental, descriptive study using existing data and seeks to investigate OTS-cadet satisfaction and achievement in Total Force Officer Training (TFOT) classes 17-01, 17-02, 18-05, and 18-06. The proposed study will compare cadet satisfaction and achievement in TFOT classes 17-01 and 17-02, where auditorium lecture was used as a primary teaching method, to classes 18-05 and 18-06, currently in-progress, where the number of lecture-hours have been greatly reduced and use of a 30-hour online prerequisite course was added for cadets to complete prior to arrival at the in-residence course. The implications of this research could offer empirical evidence for informing and improving Air University programs and OTS education and training operations into the future.

The documentation requested is unclassified, publically available information describing the OTS organization and syllabuses for the TFOT courses for AY17 and AY18. The requested data is for aggregate, "de-identified" satisfaction and achievement data with core, but non-personally identifiable demographic information [i.e., gender, age, race, time-in-service, AFSC, education level, and cadet status (active duty, non-prior service, and Air National Guard)] in the stated classes and core demographics of the larger population of AY17 and AY18 TFOT classes. Other documentation required for the Auburn IRB includes copies of the AY17 and AY18 satisfaction surveys with questions, available survey and test validity and reliability information, and a description of the Inquisite and WINGS information systems used to collect and store the data. Last, Lt Col Mosley requests permission for structured-direct, nonparticipant observation of OTS to gain an understanding of the organization, operations, and instructional processes, as needed, to develop the research proposal. All documentation and data can be submitted directly to Lt Col Mosley for consolidation.

After Lt Col Mosley successfully defends the research proposal and the IRB approves the study, Auburn University will provide Air University with the IRB research number. We are excited at this opportunity to investigate how the Continuum of Learning initiatives of lifelong learning, education on-demand, and learner choice may transform existing military education and training models, and how maximizing use of current technologies can hone individual learning experiences and opportunities to meet Air Force needs.

If you have any questions, please feel free to contact me at [redacted] or [redacted] or Lt Col Mosley at [redacted] or [redacted]

Regards,

Maria M. Witte

Maria M. Witte, Professor
Adult Education

4036 Haley Center, Auburn, AL 36849-5221; Telephone: 334-844-4460: Fax: 334-844-3072

www.auburn.edu

Appendix D

Air University Permission to Release OTS Documentation Needed for IRB

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY (AETC)

5 April 2018

Dr. R. Joel Farrell II
Air University A3, Institutional Analytics
55 LeMay Plaza South, Ste 241
Maxwell AFB, AL 36116-6335

The Office of Research Compliance at Auburn University
202 Samford Hall
Auburn University, AL 36849
(334) 844-5966; irbadmin@auburn.edu

Subject: Permission to Access and Use Documentation and Data Needed to Conduct Research

Dear Sir or Ma'am,

This letter conveys Air University's support to provide existing institutional data for the proposed research study by Auburn University, College of Education PhD student, Klifford (Kliff) Mosley. Air University will support the proposed research to conduct a nonexperimental, descriptive study using existing institutional data to investigate OTS-cadet satisfaction and achievement in TFOT classes 17-01, 17-02, 18-05, and 18-06. Air University considers the proposed research valuable to the institution due to the potential to inform the continuous improvement and planning process of the Officer Training School.

Air University's support is contingent upon the review and approval of a human subjects protection protocol by Auburn University's Institutional Review Board and the subsequent review by the Air Force Research Oversight and Compliance for researchers external to the Air Force (http://www.airforcemedicine.af.mil/Organizations/AFMSA-SGE-C/). After these approvals, Air University will provide access to and use of documentation and data requested for the research protocol. Air University will allow access to unclassified, de-identified, aggregated institutional data for the Officer Training School including course evaluation surveys (satisfaction data), course organization, and course syllabi. Air University will also allow access to conduct structured-direct, nonparticipant observation of the Officer Training School instruction.

If you have any questions, please feel free to contact me via email at robert.farrell.16@us.af.mil or robert.farrell.16@HQAU365.onmicrosoft.com, or via commercial phone [redacted] or cell phone [redacted]

Sincerely,
FARRELL.ROBERT.J.II.1408930363 Digitally signed by FARRELL.ROBERT.J.II.1408930363 Date: 2018.05.17 14:18:57 -05'00'
R. JOEL FARRELL, PhD, DAF
AD-25
Air University Chief of
Institutional Analytics

Appendix E

Auburn University Email Notification of IRB Approval

IRB Administration <irbadmin@auburn.edu>

Reply all |
Fri 10/5, 10:03 AM
To: Klifford Mosley; James Witte

Subject: Approval, Mosley Exempt Protocol #18-411 EX 1810 "Comparing Lecture-Based and Flipped Classroom Methods in the US Airforce's Officer Training School: An Analysis of Learner Satisfaction and Achievement"

Dear Klifford,

Your protocol entitled "Comparing Lecture-Based and Flipped Classroom Methods in the US Airforce's Officer Training School: An Analysis of Learner Satisfaction and Achievement" "Exempt" under federal regulation 45 CFR 46.101(b)(4). Attached is a scan of your approved protocol.

Official notice:
This e-mail serves as official notice that your protocol has been approved. A formal approval letter will not be sent unless you notify us that you need one. By accepting this approval, you also accept your responsibilities associated with this approval. Details of your responsibilities are attached.

Consent documents:
Since you do not have to wait to for the return of any consent documents, please conduct your study at your convenience.

When you have completed all research activities, have no plans to collect additional data and have destroyed all identifiable information as approved by the IRB, please notify this office via e-mail. A final report is no longer required for Exempt protocols.

If you have any questions, please let us know.

Best wishes for success with your research!

Thank you,

Beth Ann

Beth Ann Spencer
Administrative Support Specialist II
Office of Research Compliance
Ramsay Hall, Suite 119 | Auburn University, AL 36849
(334) 844-5916 | bas0088@auburn.edu

Appendix F

AF Research Oversight and Compliance Division Approval of Study

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

20 DEC 2018

MEMORANDUM FOR AUBURN UNIVERSITY
ATTN: LT COL KILFFORD MOSLEY

FROM: AFMSA/SGE-C
Research Oversight & Compliance Division
7700 Arlington Blvd. Ste. 5151
Falls Church, VA 22042-5151

SUBJECT: Comparing Lecture-Based and Flipped-Classroom Methods in the U.S. Air Force's Officer Training School: An Analysis of Learner Satisfaction and Achievement (Protocol Number: **FSG20180042N**)

1. The above-referenced protocol and supporting documents were reviewed by AFMSA/SGE-C for the applicability of human subjects protection regulations.

2. The study involves the use of archived data that has been de-identified from the Holms Center at Air University. Data types are controlled by the respective owner (OTS survey monitor, test-control officer, and registrar) and will be emailed with de-identified information that may only be accessed via email with a Department of Defense issues command access card. Auburn University's Institutional Review Board determined that the protocol is exempt under section 101(b)(4) of 32 CFR 219.

3. The HRPO determined the project is research not involving human subjects as the research activities do not involve living individuals about whom an investigator conducting research obtains data through intervention or interaction with the individual or identifiable private information in accordance with section 102(f) of 32 CFR 219. The project may proceed with no further requirement for review by the HRPO.

4. No further life cycle actions are required for this protocol unless there are significant changes to the study design which would impact the HRPO determination. Please contact AFMSA/SGE-C at usaf.pentagon.af-sg.mbrx.afmsa-sge-c@mail.mil or Dr. Sanjur Brooks sanjur.brooks.civ@mail.mil.

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