DISSIMILAR COGNITIVE STYLES AND THEIR RELATIONSHIPS WITH UNDERGRADUATE STUDENT STRESS, MOTIVATION, AND ENGAGEMENT

By

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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

2006

This document is dedicated to my parents, Larry and Susan Friedel.
Thank you for everything.

ACKNOWLEDGMENTS

There are many people to thank who have pushed and pulled me to the creation of this document. First, I would like to thank Dr. Rick Rudd for his advising, encouragement, and friendship, all of which gave reason for me to start and complete my Ph.D. My advisory committee members, Drs. Gary Fairchild, Howard Ladewig, and Ed Osborne, all contributed in their own way by adding their expertise. This document is a reflection of the scholarship and rigor imposed by these three gentlemen. Also, I would like to thank Dr. Michael Kirton for his wisdom and counsel regarding cognitive style.

To say that my Ph.D. in agricultural education was earned in my three years at the University of Florida would be an exaggeration. I owe many thanks to my undergraduate advisor, Dr. Marvin Hoskey, a master teacher. Likewise, I appreciate the teachers and administrators at Laurel-Concord Public Schools who served as models of excellent teaching and learning early in my career.

I cannot say thank you enough to my parents for teaching me the value of hard work and never letting me forget what is important in life. I also must thank my wife, Beth, not only for patiently waiting for me to write this document, but for showing me her approach towards life which helps me become better each and every day.

Last, but not least, a special thank you goes to my fellow graduate students with whom I shared an office. The times we spent making trips for ice cream, discussing the unspeakable over lunch, spending time at the Jones's on weekends, and building camaraderie have all helped the time fly by. I have learned from all of them.

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December, 2006

Chair: Rick Rudd
Major Department: Agricultural Education and Communication

Few studies have examined dissimilar cognitive style between faculty members and students and its relationships with student stress, motivation and engagement. In the search for variables explaining student engagement, researchers have examined the cognitive level of instructional discourse, but few have examined the cognitive style of the instructor as it corresponds to the cognitive style of the student. Identifying how dissimilar learning styles relate to student stress and motivation may have implications for increasing student engagement.

Kirton's Adaption-Innovation theory provided the theoretical framework for this study. An *ex post facto* design was used to accomplish the objectives of this study. Nine undergraduate courses in the College of Agriculture and Life Sciences at the University of Florida were administered four standardized instruments: Kirton's Adaption-Innovation Inventory, Student-life Stress Inventory, Motivated Strategies for Learning Questionnaire, and National Survey of Student Engagement. Dissimilar cognitive style

was measured by subtracting the faculty members' cognitive style score from each individual student's cognitive style score. The difference provided a cognitive style gap which was used to determine relationships among student stress, motivation and engagement in the classroom.

Findings indicated that in these courses, students with more than a 20-point cognitive style gap did not have higher levels of stress than students with less than a 20-point cognitive style gap. However, students with more than a 20-point cognitive style gap did have significantly lower levels of motivation. Student motivation was further decreased when students were taught by an adaptive faculty member. Backwards stepwise multiple regression was used to explain student stress, student motivation and student engagement based on cognitive style gap and selected demographic variables. Results provided evidence that cognitive style gap did contribute to the explanation of student stress, motivation and engagement in some classes. However, cognitive style gap was not significant in explaining these dependent variables in all nine classes.

Further research should employ qualitative methods to examine how cognitive style is exhibited in instructional discourse. Researchers may use these findings to further examine the relationships between learning style and learning process in the effort of improving student engagement.

CHAPTER 1
INTRODUCTION TO THE STUDY AND PROBLEM STATEMENT

Background of Study

This study examined relationships between dissimilar cognitive styles (Kirton, 2003), stress, motivation and classroom engagement at the University of Florida. Educators have long known through pragmatic and empirical evidence that students learn in a variety of styles. Many assessments of learning styles and personality have been developed to determine how students interact with and process the learning environment. All learning style theories share in common the contention that learning improves in learning environments that match a student's learning style (Coffield, Moseley, Hall and Ecclestone, 2004). Nevertheless, few studies have been conducted to assess the interaction between the learning style of the student and the learning style of the instructor; nor the positive and negative effects from this interaction. Cognitive style as defined by Kirton may offer insight into how a style of learning influences other variables in the college classroom. Using the Kirton's Adaption-Innovation Inventory (KAI), the researcher determined the cognitive style of undergraduate students and university instructors in the college classroom. The interval difference between an individual student's cognitive style and the instructor's cognitive style yielded a cognitive style gap score (Kirton). Individual cognitive style gap scores were compared to other student variables including student stress, motivation, engagement, and selected demographics.

Introduction to Learning Styles

A current trend in undergraduate education is a transition from teacher-centered classrooms to student-centered classrooms (Acharya, 2002). Although teachers are still accountable for student learning, great interest has been given in support of self-regulated learning (Winne, 1995) and student engagement (Kuh, 2003). Boekaerts (1999) stated that student understanding of learning styles is critical to increasing successful learning.

But, what is a learning style? To define learning style, the researcher reviewed an array of definitions, theories, measurements and beliefs which included those written by Allinson and Hayes (1996), Apter (2001), Dunn (1984), Gregorc (1979), James and Gardner (1995), Keefe (1979), Kirton (1976), Kolb (1984), Sternberg (1988) and Witkin and Goodenough (1977). Throughout the literature the terms learning style and cognitive style have been used interchangeably with few authors making distinctions between the two concepts (Sadler-Smith, 2001). Additionally, authors have been congruent in defining both learning style and cognitive style. For example, Claxton and Ralston (1978, p. 7) define learning style as a "consistent way of responding to and using stimuli in the context of learning." Messick (1984, p. 143) defines cognitive style as a "consistent individual differences in ways of organizing and processing information and experience." Both definitions were deemed appropriate for use in this study with the two terms used synonymously throughout this document.

In a literature review of learning styles, Coffield, Moseley, Hall and Ecclestone (2004) reported 71 different assessments of learning style. To categorize the various learning style theories, a continuum of learning style families was developed based on the degree of the learning style being fixed and innate. Anchoring one end of the continuum were strongly fixed and innate learning styles possibly stemming from genetics. The other end of the continuum is anchored by learning styles which are influenced by situational factors such as the environment, motivation, stress and learning strategies. From one through five, this continuum of learning style families and their respective theorists included the following:

1. Learning styles and preferences are largely constitutionally based including the four modalities: visual, auditory, kinesthetic, and tactile. Learning style theorists in this family include Bartlett, Betts, Dunn and Dunn, Gordon, Gregorc, Marks, Paivio, Richardson, Sheehan and Torrance.

2. Learning styles reflect deep-seated features of the cognitive structure, including patterns of ability. Learning style theorists in this family include Broverman, Cooper, Gardner et al., Guilford, Holzman and Klein Hudson, Hunt, Kagan, Kogan, Messick, Pettigrew, Riding, and Witkin.

3. Learning styles are one component of a relatively stable personality type. Learning style theorists in this family include Apter, Epstein and Meier, Harrison-Branson, Jackson, Miller, and Myers-Briggs.

4. Learning styles are stable learning preferences with a degree of flexibility. Learning style theorists in this family include Allinson and Hayes; Felder and Silverman; Herrmann; Hermanussen, Wierstra, de Jong, and Thijssen; Honey and Mumford; Kaufmann; Kirton; Kolb; and McCarthy.

5. Learning styles are approaches, strategies, orientations and conceptions of learning. Learning style theorists in this family include Biggs; Conti and Kolody; Entwistle; Grasha-Riechmann; Hill; Marton and Säljö; McKenney and Keen; Pask; Pintrich, Smith, Garcia and McCeachie; Schmeck; Sternberg; Vermunt; Weinstein, Zimmerman and Palmer; and Whetton and Cameron.

(Coffield, Moseley, Hall & Ecclestone, 2004, p. 9)

This simple categorization of learning styles ignores the depth of theory supporting learning, validity and reliability of the instrumentation, and classroom implications; however, the work done by Coffield, Moseley, Hall and Ecclestone gives the best reference point for the discussion of strengths, weaknesses, and similarities of learning styles.

Even within categories of learning styles there are disagreements. For example in category four, Kolb (1984) defines his measure of learning style as stable cognitive programs formed by past experiences of education, choice of career, and the current task at hand. Kirton (2003) asserts his measure of learning style is based on fixed and innate traits used in problem solving, but people may cope outside of their style. Kolb's (1984) model of experiential learning requires four learning styles to complete the experiential learning process. Kirton (2003) claims that the process of learning is independent of learning style (de Ciantis & Kirton, 1996). Additionally, Kolb (1984) claims that a preferred learning style will allow a person to be more competent in completing a particular task. Kirton (2003) argues that everyone has the capability to solve all problems within their own style. That is, learning style is distinct and independent of learning level or capacity. Level of learning can be defined as an individual's ability to learn and can be expressed as intelligence (Kirton, 2003). The literature is unclear in distinguishing an individual's style of learning and level of learning, which is an assertion of Kirton's theory. This assertion is supported by the literature as Ericsson, Krampe and Tesch-Romer (1993) found that in all domains of knowledge, the single greatest contribution to expertise was deliberate practice. In addition, no evidence was found that a particular learning style or individual difference played a role in acquiring expertise within a domain of knowledge. However, it may be possible that experts have a preferred style when producing an expert performance.

Learning styles have been included as a variable in many educational studies. Still, research conducted in the area of learning styles has provided conflictive findings. For example, Smith, Sekar and Townsend (2002) reviewed studies in which students were given instructional discourse that matched their individual learning style. Results were mixed with only nine of eighteen studies supporting the contention that students learn best when taught in their preferred learning style. In another example, Wingenbach (2000) used the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin & Karp, 1971) and found undergraduates with field-independent learning styles had a moderately positive and significant relationship with student academic achievement. However, DeTure (2004) used the GEFT and found no evidence to significantly predict student academic achievement from learning style. Why do these findings conflict? If Kirton (2003) is correct, all students are capable of achieving academic success within their own cognitive style. If academic achievement is dependent on the expectations of the faculty member, could dissimilar cognitive style between students and the faculty member be an intervening variable?

Kirton's Adaption-Innovation (A-I) Theory (2003) identifies cognitive style as a preference to the amount of structure that one undertakes when solving problems. Within the continuum of learning style families (Coffield et al., 2004), Kirton's work resides in the fourth family noted above, "flexibly stable learning preferences" (p.9). Some people are more adaptive when solving problems, and other people are more innovative when solving problems. Adaptiveness and innovativeness anchor on continuums of how people approach problems, produce ideas, and adhere to structures. These three constructs measure a fixed perception of an environment in which the individual interacts with and responds in the process of learning while solving a problem; a fit to this study's definition of learning style (Claxton and Ralston, 1978). More detail will be given to Kirton's cognitive style's relationship to learning in chapter 2.

Instructional material designed to incorporate learning styles may increase students' motivation to learn, (Larkin-Hein, 2000); however, more research is warranted in this area. Few studies have been conducted to measure the impact of curriculum delivered in a learning style different than the student. Nor have studies been conducted to examine how instructional discourse of a dissimilar learning style relates to a student's stress and motivation in the classroom; an assertion of Kirton's A-I theory.

The primary focus of research and practice of learning style theory is aligning curriculum and instruction to meet the needs of diverse learning styles in a given classroom (Curry, 1990). However, much of the literature fails to recognize the learning style of the instructor and how this variable plays in the context of the classroom. The effect of dissimilar learning styles of people working together to develop a new idea or product and the stress resulting from this interaction is lacking in the literature (Smulders, 2004); yet the study of this phenomenon is the aim of A-I theory (Kirton, 2003). Since students and teachers of different learning styles commonly come together in a classroom to generate ideas with varying degrees of motivations, attitudes and stressors, it is clear that many research questions are still unanswered.

Limitations have been placed on the application of learning styles in the classroom. After an extensive review of the literature, Coffield, Moseley, Hall and Ecclestone (2004) cautioned practitioners' application of learning styles in the classroom as many types of style have little theoretical backing, low reliability and insufficient validity. Furthermore, few studies have found learning styles to "explain more than 16% of the variance in academic achievement" (p. 127). Other authors have agreed that many measures of learning style are psychometrically weak and therefore offer little use to the practitioner (Curry, 1990; Hargreaves, 2005; Price, 2004; Smith 2002,). It is evident that future research must use psychometrically solid measures of learning style with strong theoretical ties in order to provide recommendations to education practitioners.

Introduction to Kirton's Theory of Adaption-Innovation

In Kirton's (2003) A-I theory, a person's cognitive style can be determined as more adaptive versus more innovative along a continuum. Cognitive style is ultimately a measure of how individuals solve problems with indication of preferences for learning (de Ciantis & Kirton, 1996). Kirton (2003) describes cognitive style in context as individuals interacting and reacting to the environment in consistent and stable approaches when solving problems, which is consistent with definitions of learning style and cognitive style used in this study (Claxton & Ralston, 1978; Messick, 1984). A person may find their preferred style of problem solving along the adaptive-innovative continuum by completing the Kirton Adaption-Innovation Inventory (KAI).

Kirton's (2003) measure of cognitive style along a continuum allows for interval scale distinction between dissimilar cognitive styles of two individuals. Additionally, dissimilarity of cognitive style can be determined between two innovative individuals or two adaptive individuals. The calculated difference between two individuals' cognitive style scores yields a cognitive style gap (Kirton) which determines the dissimilarity of two approaches to problem solving. Cognitive style gap was calculated in this study by subtracting faculty members' cognitive style score from each student's cognitive style score.

A cognitive style gap larger than 20 points may contribute to inefficiencies in communication (Kirton, 2003). Stress is a result of cognitive gap (Kirton) which may present important implications to learning. The literature suggests that stress in the form of anxiety may affect students' self-esteem and academic achievement (Pintrich & Schunk, 2002). Fortunately, individuals can be motivated to operate outside of a preferred cognitive style and bridge the cognitive gap found with another individual (Kirton, 2003). Kirton uses the term coping behavior to describe bridging a cognitive style gap and further elaborates that motivation initiates coping behavior.

It is necessary to note that Kirton's measure of cognitive style is distinct from motivation. However, authors of other learning style instruments integrate aspects of motivation and cognitive style into one measure of how individuals approach learning (Apter, 2001; Dunn, 1984; Entwistle, 1978; Herrmann, 1989; Vermunt, 1992). The note was not made to argue for or against motivational factors as a determinant of a preferred style of learning. Rather the pure and distinct measure of learning style separated from motivation allows for a more precise measure of motivation (Kirton, 2003), which in turn permits the study of motivation as it relates to dissimilar learning styles and to learning. The literature provides evidence that student motivation is necessary for learning (Schunk, 1991) and student engagement (McKeachie, Pintrich, Lin & Smith, 1986) making Kirton's measure of cognitive style particularly valuable.

Kirton's A-I theory provides a theoretical framework to incorporate the interaction of dissimilar learning styles in the production of new products and ideas. Adaption-Innovation theory was chosen for this study, because of its ability to separate cognitive style from cognitive level while giving attention to motivation, stress, and learning. Distinction between cognitive style and cognitive level may provide insight to the literature which asserts a confused meshing of the two in explaining student achievement. A reference point is also established to examine the relationships of variables found in the educational classroom such as student engagement, motivation and stress. The KAI has been determined as psychometrically reliable and valid (Kirton, 1999); as opposed to many other learning style assessments (Coffield et al., 2004; Curry, 1990). Given the above discussion of A-I theory, the researcher used Kirton (2003) to operationalize learning style. Chapter 2 further elaborates on Kirton's A-I theory and measure of cognitive style.

The Need for Student Engagement

Involvement in Learning (Study Group on the Conditions of Excellence in American Higher Education, 1984), a report proposing the reform of higher education, stated a quality education was more dependent on student engagement and less on the reputation and resources of the academic institution. Suddenly faculty members of colleges and universities were asked to be accountable for undergraduate student achievement. To assist faculty members with their new challenge, Chickering and Gameson (1987) developed a set of engagement indicators known as the *Seven Principles of Good Practice in Undergraduate Education*. They include:

1. Encourages contact between students and faculty,
2. Develops reciprocity and cooperation among students,
3. Encourages active learning,
4. Gives prompt feedback,
5. Emphasizes time on task,
6. Communicates high expectations, and
7. Respects diverse talents and ways of learning. (p. 5)

The *Seven Principles of Good Practice in Undergraduate Education* are widely accepted by the American Association of Higher Education (AAHE) as research based process standards that can be applied and measured in undergraduate classrooms.

In a longitudinal, multi-institutional study, Astin (1993) used 82 student outcome measures, 140 student characteristics, 190 environmental characteristics and 57 types of student involvement and found that academic involvement, faculty involvement and student peer group involvement were the largest indicators of enhancing student learning and personal development of undergraduate students. Koljatic and Kuh (2001) conducted a study to determine if cooperation among students, active learning, and faculty contact with students has improved since 1983 and found the degree of student engagement in these three areas has not improved. Furthermore, 20% of freshman and seniors in colleges and universities across the nation were identified as disengaged (Kuh, 2003). Even though the literature has addressed the need for student engagement, it seems that faculty members' instructional techniques still do not encourage undergraduate students' classroom engagement. In colleges of agriculture, Whittington (1998) found almost 80% of faculty members' instructional discourse to be low at cognitive level. Is student engagement explained by cognitive level, cognitive style, or both? Does cognitive style gap between faculty members and students matter?

Problem Statement

Trends in undergraduate education are moving from teacher-centered classrooms to student-centered classrooms for the improvement of student engagement (Acharya, 2002). From classroom teaching experiences, most faculty members concur that students learn differently. This has increased the application of learning styles in the classroom as faculty members struggle to develop instructional techniques to engage student learning. Advocating the awareness of differing learning styles is commendable. However, further implications for education practitioners are limited as studies examining instructional discourse provided to students in similar learning styles have conflicting results (Smith, Sekar & Townsend, 2002). Many learning styles measures are psychometrically weak (Curry, 1990) and offer small explanation to the variance of student achievement

(Coffield et al., 2004). Simply stated, future research must be able to accurately determine students' learning styles and provide theoretical and empirical evidence that learning styles contribute to student learning.

The literature comprising the investigation of learning styles is vast with little agreement or collaboration to find agreement among the respective theorists (Coffield et al.). Little attention has been given to how dissimilar learning styles between students and faculty members contribute to any measure of academic success (Coffield et al.). Furthermore, the literature has been consistently unclear concerning the separation of learning style from learning capability (Kirton, 2003). Research conducted to explain student achievement by measures of inherent learning styles without controlling for other variables, such as motivation, stress and intelligence, tend to support beliefs of academic superiority (Hargreaves, 2005). However, if students learn best in their preferred learning style and instructional discourse is only provided in that learning style, academic superiority may be an outcome. Investigating how dissimilar learning styles contribute to academic success is necessary. Also, the separation of learning style from learning level is warranted to allow for the distinct relationship and accurate measure of other classroom variables that facilitate student engagement in the classroom and promote academic achievement. That is, if dissimilar learning style is not found to be a large contributor to student engagement, perhaps learning level is a superseding variable.

Faculties of colleges of agriculture and life sciences have been reliant on scholars in agricultural education to examine teaching and learning models that promote student engagement. Nevertheless, studies conducted in agricultural education have made few attempts to identify relationships among student characteristics, thinking skills and motivations that increase student engagement (Rudd, Baker & Hoover, 2000). Kirton's A-I theory provides a framework to examine how motivation may overcome the strain of students and faculty members with dissimilar cognitive styles. Adaption-Innovation theory has been applied as a model to problem solving in business management, consumer marketing and aspects of change; however, little research has been done to apply A-I theory to the context of undergraduate education. As A-I theory is not context specific (Kirton, 1994), the theory should also apply in the undergraduate classroom.

Faculty members are increasingly faced with more accountability for increasing student achievement. As student engagement is closely related to academic achievement (Kuh, 2001), faculty members need to utilize instructional strategies and curricula to increase student engagement to foster student learning. Research is needed to determine if cognitive style contributes to the explanation of student engagement. Does the cognitive style gap between students' preferred cognitive style and faculties' preferred cognitive style impair student engagement? Are students able to overcome cognitive style gap as the faculty member engages the learner? What are the implications of Kirton's A-I theory as applied within the context of the undergraduate classroom?

Significance

The goal of many university faculties is to help students learn the content of the course in order to prepare them for graduate school, professional school or a successful career. The goals of many university students mirror the faculty members' goals. Increasing student engagement in the classroom will facilitate the successful achievement of these same goals. Often there are impediments that restrain student engagement. Dissimilar cognitive style may be one impediment.

This study can improve undergraduate instruction in colleges of agriculture and life sciences by providing evidence of the educational impact of dissimilar cognitive style. Given this finding, faculty members can better develop programs and curricula to increase student engagement by reducing cognitive gap caused by dissimilar styles. Departments of agricultural education can help faculty members in colleges of agriculture and life sciences better prepare for teaching students with dissimilar cognitive styles. Also, university faculty can gain valuable knowledge concerning how learning style, not learning level, dictates how students view problems.

This study contributed to the knowledge base of learning styles by providing data concerning the relationships between dissimilar cognitive styles, student stress, motivation and engagement in the undergraduate classroom. Furthermore, collaborative research among learning style authors may be initiated to determine if they also can contribute to improving student engagement.

Purpose of the Study

The purpose of this study was to determine if significant relationships exist between cognitive style gap, student stress, student motivation, student engagement and selected demographic variables of undergraduate students at the University of Florida in the College of Agriculture and Life Sciences. The specific objectives of this study were to:

1. Describe selected faculty and students according to their selected demographic variables;
2. Determine the cognitive style, student stress, student motivation, and student engagement of undergraduate students;
3. Determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students;
4. Explain undergraduate student stress and student motivation based on cognitive style gap and selected student demographic variables;

5. Explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected student demographic variables.

Assumptions

Basic assumptions of this study were as follows:

- Student engagement is desired by faculty members in colleges of agriculture and life sciences.
- Faculty members teach in their preferred cognitive style.
- Problem solving learning exists in the undergraduate classroom.

Limitations

Conclusions and implications derived from this study were subject to the following limitations. Undergraduate courses are self-selected groups with students having individual differences prior to data collection. It was anticipated that group differences existed between classes with regard to mean scores and demographic variables. Therefore, data were limited to this population of faculty members teaching undergraduate courses in the College of Agricultural and Life Sciences at the University of Florida. Applications of the results of this study to other college classrooms were limited to the degree of similarity they have with courses used in this study.

The researcher worked with the conditions allowed by the faculty member to collect data from their course. All instruments were administered in the same manner, but some students completed instruments in class and other students completed instruments outside of class. As the faculty member made choices regarding students' completion of the instrument, method of completion was confounded with the faculty member and therefore provided no way to conclude there was a method of completion effect on instrument scores. Even if courses were compared, self-selected courses have preexisting differences with no way to statistically determine causality of these differences.

Faculty members volunteered students in their courses to participate in this study. Although extra-credit points were often given as an incentive to increase response rate, some students still chose not to respond. In this study, non-responding students included students who were administered instruments and chose not to respond, and students who never attended class the day of instrument administration. This study is subject to non-response error as there was no data collected on non-responders.

Instruments used in the study were self-reported which may affect the accuracy of the data. The halo effect is a common problem among student self-reports as students tend to inflate variables such as grades and effort. However, Pike (1999) found that the halo effect was relatively constant across different student groups and schools giving evidence that comparisons can be made without disadvantaging a group. However, a halo effect on the KAI presents an unusable cognitive style score thus increasing mortality rate of the instrument. Removing unusable scores from the data may have influenced findings in this study, especially if unusable cognitive style score is related to anxiety (Kirton, 1999).

Other confounding variables that may affect this study include coping behavior (Kirton, 2003) of the faculty, competence of the faculty, motivation of the faculty, availability of teaching resources, class sizes, and classroom environment.

Definitions

The following definitions are used in this study.

Adaptive. A preference of cognitive style which produces fewer ideas within a narrower perspective while tending to utilize given rules. Adaptive cognitive style contrasts with an innovative cognitive style (Kirton, 2003).

Behavior. An individual's actions and reactions while operating in an environment (Bandura, 1986). Many factors contribute to an individual's behavior, but one factor is preferred cognitive style blended with coping behavior (Kirton, 2003).

Cognitive affect. The source of problem selection with a degree of priority placed on the search for a solution by means of motivation (Eccles, 1983; Kirton, 2003; Schunk, 2000).

Cognitive climate. The mode preferred cognitive style held by a group of individuals working together to solve problems (Kirton, 2003).

Cognitive effect. A part of cognitive function incorporating both cognitive style, which influences behavior, and cognitive level which limits behavior by means of cognitive process (Kirton, 2003).

Cognitive function. The controlling influence on behavior through the interaction of three components: cognitive effect, cognitive affect and cognitive resource (Kirton, 2003).

Cognitive level. The aptitude, scope or expertise an individual has in solving a problem. It can be expressed as intelligence or level of creativity, but is not correlated with cognitive style (Ericsson, Krampe & Tesch-Romer, 1993; Guilford, 1975; Kirton, 2003).

Cognitive process. An operation through a theoretical structure of thinking which one advances step by step through the stages assumed to be the operations of the brain. Cognitive process is distinguished from cognitive level and cognitive style, but utilizes both in problem solving (Kirton, 2003; Kolb. 1984; Wallas, 1926).

Cognitive resource. The storage of learned information (memory) manifested through constructs of knowledge, experiences, and skills (Kirton, 2003).

Cognitive style. The consistent individual differences found in ways of organizing and processing information and experience (Messick, 1984). This study uses cognitive style synonymously with learning style (Claxton & Ralston, 1978). Cognitive style was operationalized by the Kirton Adaption-Innovation (KAI) Inventory with constructs of sufficiency of originality, efficiency, and rule/group conformity with tendencies to be more adaptive or more innovative within these constructs (Kirton, 2003).

Cognitive style gap. A degree of separation between cognitive styles of two individuals or between an individual solving a problem and the cognitive style required to solve a specific problem. (Kirton, 2003). Operationalized by subtracting a faculty member’s cognitive style score from a student’s cognitive style score.

Cognitive technique. A learned skill an individual may utilize to increase cognitive level or avert from a preferred cognitive style (Kirton, 2003).

Coping behavior. A learned skill that is initiated with motivation and used to perform in a cognitive style that is different from one’s preferred cognitive style. Coping behavior can only last for a duration and intensity (Kirton, 2003). Coping behavior in this study is not to be confused with coping behavior as a reaction to stress which is defined as a conscious effort to deal with an event to which an individual has not yet developed automatic patterns of response (Shields, 2001).

Engagement. The extent that students invest their time and psychological energy in empirically derived good educational practices. (Astin, 1996, Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). Engagement was operationalized with the use of the National Survey for Student Engagement (NSSE) (2005) with constructs of academic challenge, active learning, and student-faculty interaction.

Environment. The social context individuals interact with during the problem solving process (Kirton, 2003). Within the classroom these variables include: personalization, involvement, student cohesiveness, satisfaction, competition, task orientation, and rule clarity (Fraser, 1998).

Faculty Member. An individual responsible for presenting instructional discourse, providing problem sets for student completion and assigning the final course grade.

Innovative. A preference of cognitive style to produce a larger number of ideas with a wider variety of perspectives to make a product different while tending to alter rules when solving problems. Innovative cognitive style contrasts with adaptive cognitive style. (Kirton, 2003).

Learning style. A consistent way an individual responds to, and uses stimuli in the context of learning. (Claxton and Ralston, 1978). This study uses cognitive style synonymously with cognitive style (Messick, 1984). Learning style was operationalized by the Kirton Adaption-Innovation (KAI) Inventory with constructs of sufficiency of originality, efficiency, and rule/group conformity with tendencies to be more adaptive or more innovative within these constructs (Kirton, 2003).

Motivation. A process that includes both initiating and maintaining a goal-directed activity (Pintrich & Schunk, 2002). Comprises of three different components: expectancy–a student's belief about their ability to perform a task, value–a student's goal and belief concerning the importance and interest of the task and affective–a student's emotional reactions to the task (Pintrich & De Groot, 1990). Motivation was operationalized with use of the Motivated Strategies for Learning Questionnaire (MSLQ) with constructs of intrinsic motivation, extrinsic motivation, task value, control of learning belief, self-efficacy for learning and test anxiety.

Problem. A desire or felt need for a solution, but not immediately knowing the mental operations to arrive at the solution (Soden, 1994).

Products and ideas. A solution to a problem fitted to the degree of structure preferred by the problem-solver. A more adaptive person will prefer more structure in the generation of ideas recognizing boundaries of the relevant paradigm and a more innovative person will prefer less structure in the generation of ideas disregarding the boundaries of the relevant paradigm (Kirton, 2003).

Stress. The perception of a stimulus in the form of an event or condition and requires an individual to adjust from normal life. Stressors can be positive or negative depending on the individual's reaction to the experience (Gadzella, 1994; Romano, 1992). Stress was operationalized with use of the Student-life Stress Inventory (SSI) with constructs of frustrations, conflicts, pressures, changes and self-imposed stress.

Summary

In summary, learning styles theory has become popular as pragmatic educators can easily see its existence in the classroom. However, many learning style instruments have proven to be unreliable and invalid. There is little empirical evidence that dissimilar learning styles contribute to understanding stress, motivation, and engagement; these are common variables found in the undergraduate classroom. Kirton's theory of A-I provides a framework to distinguish cognitive style from cognitive level to help understand the influences of the aforementioned variables. As faculty members become more accountable for student engagement and look for instructional methods to promote learning, evidence is needed to determine the importance of learning styles in student engagement. Kirton's definition of cognitive style and psychometrically sound instrument to measure cognitive style may be of particular use.

CHAPTER 2
REVIEW OF LITERATURE

The purpose of this study was to determine if significant relationships exist between cognitive style gap, student stress, student motivation, student engagement and selected demographic of undergraduate students in the College of Agriculture and Life Sciences at the University of Florida. The specific objectives of this study were to: 1) describe selected faculty and students according to their selected demographic variables; 2) determine the cognitive style, student stress, student motivation, and student engagement of undergraduate students; 3) determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students; 4) explain undergraduate student stress and student motivation based on cognitive style gap and selected student demographic variables; and 5) explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected student demographic variables.

This chapter summarizes pertinent literature concerned with learning styles, stress, motivation and engagement. Special attention will be given to Kirton's cognitive style (Kirton, 2003) as applied to the context of the undergraduate classroom, thus providing the theoretical framework for the study. Also a discussion of empirical research conducted to examine learning style, stress, motivation, and engagement, is presented to determine relationships between these variables.

Within this chapter are the following major sections: theoretical framework, learning and learning styles, learning and stress, learning and motivation, and learning and engagement.

Theoretical Framework

Literature concerning learning styles includes a wide variety of published sources consisting of empirical research found in refereed journals, pedagogical recommendations found in teacher newsletters, and books advocating the use of a specific learning style inventory (Coffield, Moseley, Hall & Ecclestone, 2004). Said differently, the scope of learning styles research is based on instrument development, adding to theory, classroom improvement, and commercial use. Kirton's A-I theory (1976) is a theoretical response to the literature stating that all people can be creative in problem solving in their own cognitive style, thus distinguishing between cognitive style and cognitive level (Kirton, 1978). Kirton's A-I theory provided the theoretical framework of this study.

The most detailed explanation of A-I theory is given by Kirton (2003) in *Adaption-Innovtion: In the context of diversity and change*, with illustration of cognitive function, behavior and environment in relation to idea formation (p. 37). Within the theoretical model, cognitive style and cognitive level are components of cognitive effect. Cognitive effect is defined as a part of cognitive function incorporating both cognitive style and cognitive level, both of which are employed by the individual to complete the cognitive process (Kirton). The strength of A-I theory is the separation and independent measure of cognitive style from cognitive level. Cognitive style is defined by Kirton (2003) as "a strategic, stable characteristic–the preferred way in which people respond to and seek to bring about change" (p.43). Kirton's definition of cognitive style regarding adaptiveness and innovativeness will be explained further in subsequent sections of this chapter. Examples of cognitive level include measures of capacity or ability such as intelligence. However in problem solving, both style and level are required to complete a cognitive process. Cognitive processes can be described as the “steps of how I operate” and “not measured, but validated to provide information of where we are” (p.38) in solving a problem. Examples of cognitive process include Kolb’s cycle of Experiential Learning (de Ciantis & Kirton, 1996; Kolb, 1984) and the stages of problem solving (Wallas, 1926). Each stage of a cognitive process can be completed at a high cognitive level or low cognitive level and through the use of different cognitive styles. The outcome of cognitive process is knowledge (learning) stored in cognitive resource (Kirton, 2003). The cognitive process can also be accomplished with low motivation or high motivation as determined by cognitive affect (p. 89). Cognitive affect is defined as the motivation and value placed on the search for a solution to a problem (Kirton). Ultimately, cognitive affect, cognitive resource and cognitive effect are three distinct and uncorrelated components of cognitive function (Kirton) and employed by the individual to solve problems.

This study examined cognitive style gap between the teacher and the student and its relationship with stress, motivation and engagement. Other gaps exist between the cognitive function of teacher and student including: cognitive gap of level–a difference of intelligence, cognitive gap of affect–a difference of motivation or value and cognitive gap of resource–a difference of knowledge or skill (Kirton, 2003). These cognitive gaps influence the interaction between two individuals, but the separation of cognitive style from cognitive level, cognitive affect and cognitive resource allows for a more precise measure of dissimilar cognitive style and its relationship with classroom engagement.

In the effort of solving a problem, individual differences become apparent at the realization of cognitive gaps. Nevertheless, if the motivation is great enough for teacher and student, both will be engaged in the process of learning (Kirton, 2003). Ideas and solutions may come from both student and teacher. Although students are responsible for engaging in learning activities, the teacher facilitates learning and therefore accountable for student engagement. Student engagement includes constructs of academic challenge, active learning and student-faculty interaction (Kuh, 2001). Teacher engagement facilitates student engagement and can be measured by the teacher's knowledge of the learning process, intrinsic motivation for teaching, and self-efficacy toward teaching (Knowles, 1999).

Kirton (2003) defines the environment as the social context in which individuals interact during the problem solving process. An individual's interaction with the environment manifests as people work together in the environment to solve problems and react to the feedback provided by others (Kirton). In the undergraduate classroom, students interact with fellow students and the faculty member through discussions, activities, assignments and projects; all of which provide student feedback either by fellow students or the faculty member. In a review of instruments measuring factors influencing the undergraduate classroom environment, Fraser (1998) categorized seven scales: personalization, involvement, student cohesiveness, satisfaction, competition, task orientation, and rule clarity. However, Fraser further discussed that this list may not be conclusive as little research has been conducted regarding the environment of undergraduate classrooms.

Finally, student academic achievement results from the faculty member and students engaged in the classroom environment for the purpose of learning. Academic achievement can be measured regarding a specific assignment or a cumulative total provided by the faculty member with values represented as either a percentile or a letter grade. Figure 2-1 displays Kirton's A-I theory in the context of a teacher and student engaging in idea formation.

For the individual, coping behavior is used when the rewards gained from solving the problem are greater than the effort exerted to operate outside of an individual's preferred style (Kirton, 2003). Said differently, cognitive style gap causes stress and motivation is needed to overcome this stress and bridge the cognitive style gap between two individuals. Researchers have investigated the relationship cognitive style gap has with stress. McCarthy (1988) found that women managers' stress increased as the size of the cognitive style gap increased. Furthermore, the threshold at which stress became apparent was at a cognitive style gap of 20 points. Another study conducted by Kubes and Spillerova (1992) had concurring results with a large cognitive style gap influencing the construct aggravation within a working group. However, both of these studies were conducted in the context of business. Little is known if A-I theory is appropriate for the undergraduate classroom and if these relationships between dissimilar cognitive style and student stress also apply.

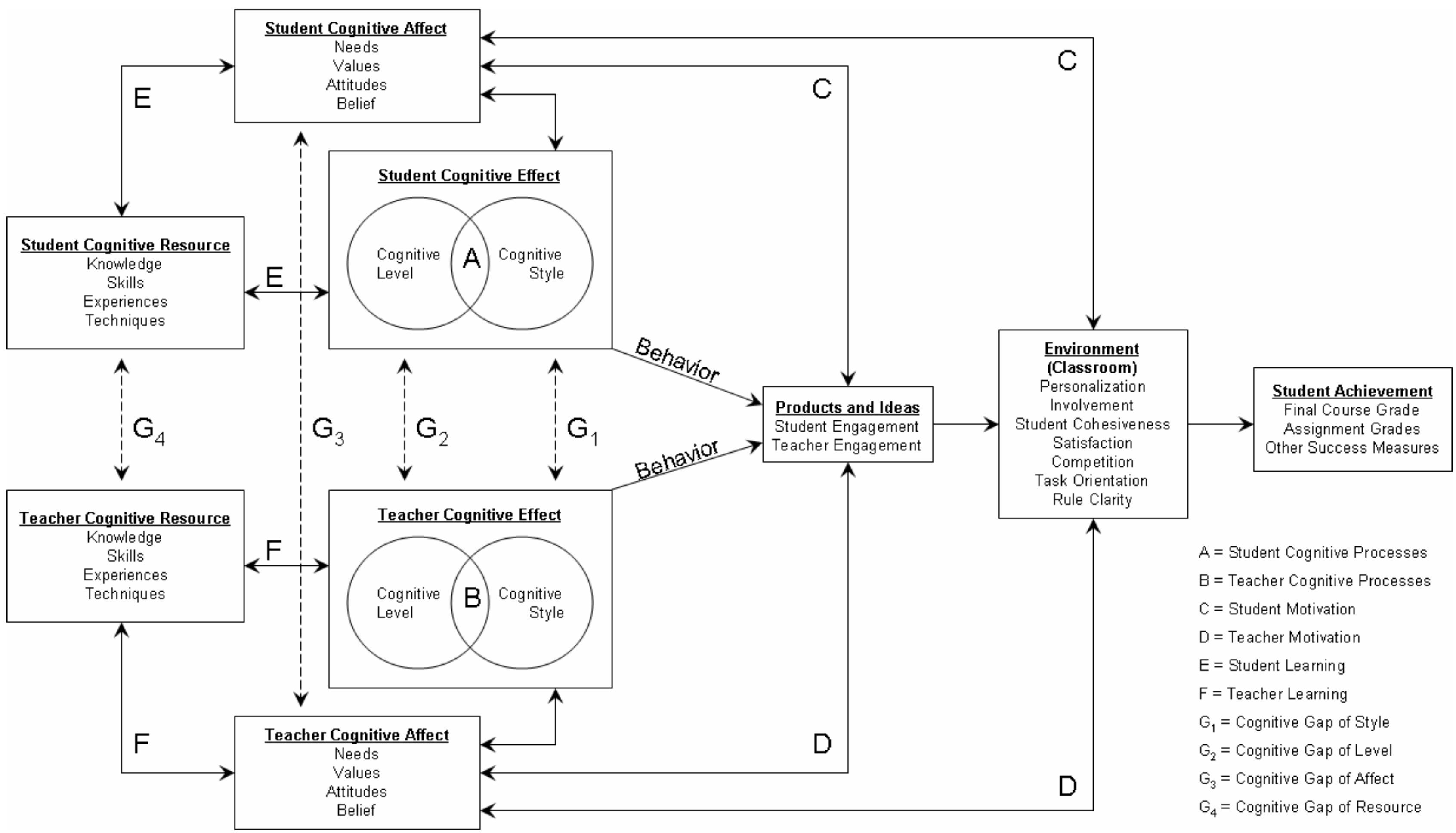

Figure 2-1. Kirton's theoretical model of adaption and innovation applied to the undergraduate classroom (Kirton, 2003)

Both intrinsic and extrinsic motivation can be driving forces for increasing engagement in the problem solving process (Hennessey & Amabile, 1993). In the event that a course is taught by a faculty member with a dissimilar cognitive style, a student may be motivated to cope outside of a preferred cognitive style in effort to interact more with the faculty member and improve student engagement (Kuh, 2001). Motivation is not a result of cognitive gap, but is a driving force for using a cognitive style that is not the individual's preferred style. Specifically, motivation is a factor of coping behavior (Kirton, 2003); if motivation can be partially explained by cognitive style gap, then there is evidence that students are coping. Motivation is a component of cognitive affect and therefore independent of cognitive style, a component of cognitive effect.

Utilizing the framework provided by A-I theory, student engagement was determined to be an outcome of problem solving and idea formation. Student engagement was used instead of academic achievement in this study to provide a better measurement of the interaction between faculty member and student.

Kirton (2003) asserts that adaptive and innovative individuals prefer different amounts of structure while completing the problem solving process. Whereas more adaptive individuals tend to solve problems favoring structure, more innovative individuals tend to solve problems unbound by structure. Adaptive individuals tend to have fewer ideas making the solution more efficient; innovative individuals prefer to have a wide range of ideas with the knowledge that many of the ideas are improbable (Kirton, 1994). The difference between two styles of problem solving is often evident by the differences of perception and communication of the solution. That is, a gap between two dissimilar cognitive styles tends to inhibit effective communication. This failure of communication can often lead the two individuals to focus on the new problem of ineffective communication and not the problem at hand which is completing course projects and assignments (Kirton). If this occurs in the undergraduate classroom, students may dwell on the inefficiencies of communication with the faculty member instructing the course and may not be motivated enough to engage in learning. The constructs of student engagement include level of academic challenge, active and collaborative learning, and student interaction with the faculty member, (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001), all of which require communication between the faculty member and the student to be achieved (Umbach & Wawrzynski, 2005). In summary, the faculty member determines the amount of structure used in the course, but students may prefer different amounts of structure and find themselves unmotivated to effectively communicate with the faculty member, thus impacting the level of student engagement.

Kirton's (2003) A-I theory may contribute to the explanation of student engagement by identifying the relationships between cognitive style gap, stress and motivation. An increase in cognitive style gap between the student and the faculty member causes stress through working together in solving problems or engaging in learning. If the student is motivated, coping behavior is used to operate outside of a preferred cognitive style and employ a cognitive style closer to that of the faculty member (Kirton). As a result, student and faculty member are operating in the same cognitive style which may increase student engagement. However, student motivation supplied to coping behavior only last for a period of time and at a limited level (Kirton). Consequently the student reverts back to a preferred cognitive style which may be detrimental to student engagement. For the student to be successfully engaged the reward for learning must be greater than the stress imposed by cognitive style gap from the faculty member (Kirton). Figure 2-2 portrays the interaction of student stress and motivation in explaining student engagement.

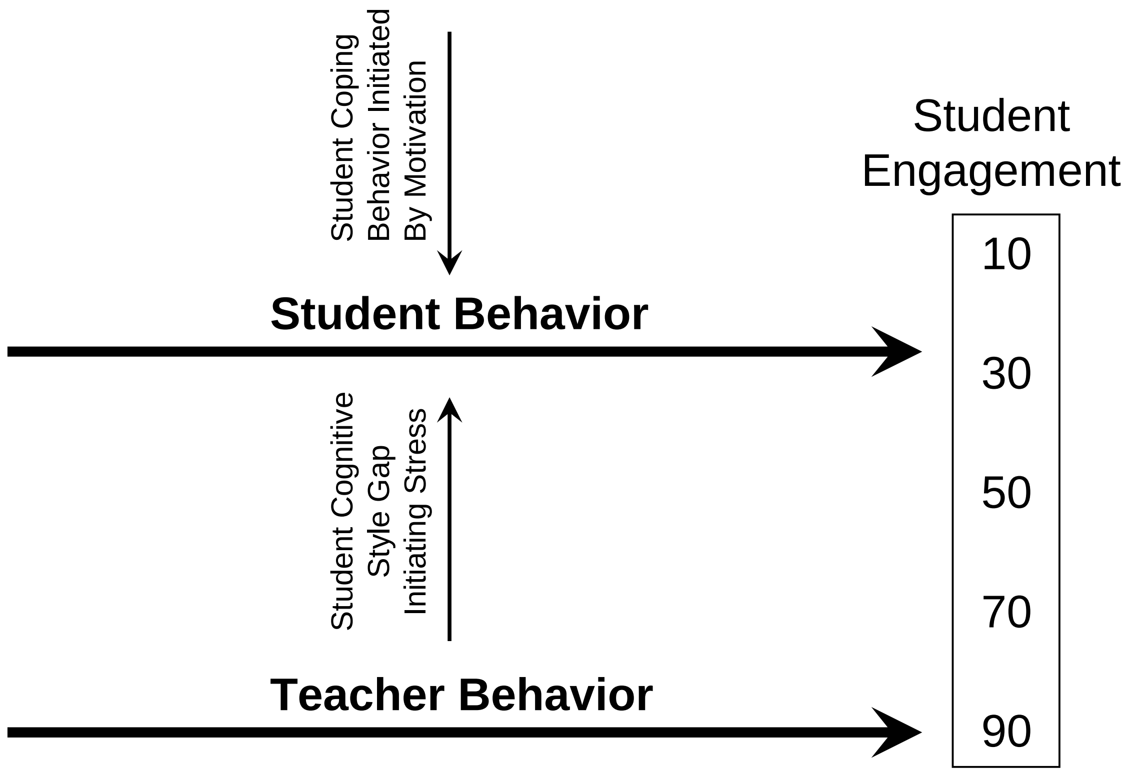

Figure 2-2. Interaction of cognitive style gap, stress, motivation and engagement (Kirton, 2003)

Other variables that influence student engagement include faculty member behavior (Umbach & Wawrzynski, 2005), class size (Ehrenberg, Brewer, Gamoran & Willms, 2001), use of teaching methods (Marzano, Pickering & Pollock, 2001), gender, ethnicity, full-time student status, organizational involvement and discipline of study (Pike, 2004).

There were other confounding variables but were considered outside the objectives of the study. They included teaching effectiveness, teacher engagement, classroom environment and student's previous knowledge. Furthermore, it was impossible to determine the variables outside of the classroom that inadvertently effect student engagement. These included but were not limited to sickness, family crisis and lack of time devoted to study.

Kirton (1994) offers the following anecdote to teachers and students in reference to A-I theory:

> We all teach children to be more adaptive: before answering the question, please read it; be more methodical; present your work more neatly; nice essay, pity it is not on the topic I set; and so on. The best teachers taught most of us a lot of technique, but changed us (our preferred cognitive style) not at all. In the process they found some of us (adaptors) more receptive to working more closely within structure than others (innovators). Lesser teachers, especially when faced with the less motivated innovators, got even less far. Of course, despite the groans in the literature, not all teachers are or ever were, adaptors. The highly innovative ones delighted most of us, whether we always understood them or not; some of us (the higher adaptors) were just confused. As the saying goes, "You just can't win 'em all'." The best teachers win more than most.
>
> (p. xxiii).

The undergraduate classroom offers a new context for A-I theory as well as the introduction of new variables. Although these variables were not discounted by A-I theory, up to this point, they had not been fully explored.

Given the previous description of A-I theory, the researcher found two studies of interest. First considering the undergraduate classroom, Puccio, Talbot and Joniak, (1993) found that students' stress increased with the perceived adaptiveness of the course. Specifically, the rule/group conformity construct of the KAI was most important in determining the relationship between cognitive style and stress. It seems logical that an innovative student would find an adaptive course stressful, but why would an adaptive student find an adaptive course stressful? The researcher found the study conducted by Puccio, Talbot and Joniak one of the few investigations regarding Kirton's A-I theory applied to the undergraduate classroom.

In the second study, Barnhart (2002) set out to determine if increased cognitive gap led to aviation flight instruction inefficiencies. No significant differences in effectiveness were found between total cognitive style gap between students and flight instructors, however significant effects were found by analyzing KAI construct gaps. Specifically, a significant weak negative correlation of the efficiency cognitive style gap and time spent preparing for the first solo flight ($r=-.23$, $p<.05$) and time spent preparing for certification ($r=-.26$, $p<.05$). Furthermore, there was a weak negative correlation of rule/group conformity style gap and time spent preparing for certification ($r=-.29$, $p<.05$) (Barnhart). Although these correlations were considered low (Miller, 1998), one would expect a positive correlation in this study. That is, cognitive style gap should increase with the amount of time spent preparing for the first solo flight and certification.

Both studies previously mentioned found low negative correlations between cognitive style gap and measures of stress and effort. Although these findings contradict with the theoretical model of this study, it is important to recognize them as two of the few published studies found by the researcher that applied A-I theory to the context of the learning environment.

Learning and Learning Styles

To understand learning styles, it is not only necessary to define learning, but also to provide learning theory to give evidence of different learning types, processes and styles. Gagne (1965) proposed eight types of learning: 1) signal learning; 2) stimulus-response learning; 3) chaining; 4) verbal-associate learning; 5) multiple discrimination; 6) concept learning; 7) principle learning; and 8) problem solving (p. 33). The types of learning are hierarchical as the latter is a prerequisite of the former for a type of learning to take place (p. 60). Additionally, learning can be any one of these eight types which delineates the learning process of a situation and giving reason for a learner to exhibit a preferred style and a chosen level (Gange).

Research conducted in the domain of learning styles was categorized by Curry (1987) into four dimensions which formed the "onion" model. Personality trait types of learning styles were categorized at the core of the onion, as they were found the most stable within a learner. The second layer of learning styles represents information processing, while the third layer includes the social and situational interactions of the learner. The most unstable category of learning styles includes the preference of instructional methods, found on the outside layer of the "onion." Curry placed Kirton's measure of learning style at the core of the onion. An individual's cognitive style defined by Kirton (2003) does not change as a person ages, and is correlated with many measures of personality (Kirton, 1999). Nor does it change as the individual solves any particular type problem. However, in problem solving, an individual may cope outside of one's cognitive style as the situation requires.

Shuell (1986; as cited in Schunk, 2000) defines learning as "an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience" (p. 2). It is plausible that each of the eight types of learning provided by Gagne (1965) is fitting with this definition. That is, each type of learning may result from an experience and produce a behavioral change. Evidence of this may be found by examining a type of learning process. Using stimulus-response learning as an example, a student may be stimulated to increase focus during independent study time. The discriminating stimulus is the allowance to use background music during independent study time. This stimulus triggers a student response to either use or not use background music. If the student uses background music to help focus during independent study time, another stimulus (praise) is utilized to reinforce the behavior (Skinner, 1953). Using problem solving learning as an example, a student is stimulated by a felt need to solve a problem of completing all homework assignments before the end of the night. The student knows he may use independent study time, but it is hard for him to focus. He generates solutions to solve his problem of lack of focus by playing music in the background and executes a plan of action (Wallas, 1926). For both types of learning, the increase of these experiences (practice) results in a changed behavior (increasing focus).

Given the definition of learning used in this study, it seems paradoxical that one would have a preferred learning style that is evident by a stable and innate behavior not altered by instruction (Kirton, 2003). However, learning styles are a preferred approach to learning, or a perception of the learning environment to which the learner has a preference. Claxton and Ralston (1978, p. 7) define learning style as "a consistent way an individual responds to, and uses stimuli in the context of learning," which is similar to Messick's (1984) definition of cognitive style. Furthermore, a person may cope outside of a preferred learning style given a different situation, adequate motivation, and learned techniques (Jones, Reichard & Mokharti, 2003; Kirton, 2003; Kolb, 1984).

Ford and Chen (2001) found that matching a student's learning style with a faculty member's learning style improved student learning. However, Ford and Chen also recognized that type of learning and other variables interact with the matching of similar learning styles. Jensen (2000) connected scientific studies of the brain to teaching and learning and wrote, "The whole notion of learning styles becomes irrelevant when we consider how much variety the brain thrives on" (p.138). However, Jensen further wrote that learners do have preferences of many learning styles and operate in those styles at different levels. It is useful to understand aspects of a preferred style in order that learning differences are realized.

This belief is concurrent with the most complete and thorough literature review concerning learning styles to date (Coffield, Moseley, Hall & Ecclestone, 2004). In this literature review, 71 learning styles were held up to criteria of psychometric properties, theoretical backing and practical usage in the classroom. The authors agreed that even though most learning style measures fall short of these criteria, each have strengths and weaknesses. Realizing the complex nature of the brain, it is conceivable that more than 71 different learning styles do exist and further research will bring greater understanding as to how these styles associate with learning. It is interesting to note that of the 71 learning styles reviewed by Coffield, Moseley, Hall and Ecclestone, only a number of authors relied on related theories and concepts of learning and all used different terminology, yet the term learning style and cognitive style encompass all measures of preferred behaviors in learning. Coffield, Moseley, Hall and Ecclestone argue for more collaborative research between learning style authors as findings may bring greater understanding to the process of learning and student engagement.

It may be possible that a specific learning style is congruent with one of the eight types of learning noted above by Gange (1965). For example, Kolb's (1984) measure of learning style and process is harmonious with the learning of a principle. To learn a principle a learner engages in a concrete experience, followed by self-reflection and abstract conceptualization and ending with experimentation of that principle.

Furthermore, Kirton's (1976) measure of learning style is harmonious with learning from problem solving. To learn from problem solving, a learner manipulates a principle and interprets the meaning from the manipulation. For effective learning from a problem, Pask (1976) claims the learner must use both holist and serialist cognitive styles. Although Pask and Kirton measure cognitive style differently, they are much the same when considering description and categorization (Cassidy, 2004). Both of these measures of cognitive style are representative of problem solving style.

Other types of learning defined by Gange (1965) may be compatible with specific learning styles. For example, the Group Embedded Figures Test (GEFT) (Witkin, Oltman, Raskin & Karp, 1971) measures whether an individual is either field independent or field dependent by the individual's ability to identify embedded figures within geometric shapes. The cognitive processes used to complete the GEFT gives some evidence that field independence and field dependence is a style of concept learning (Gange, 1965). Concept learning is defined as comparing and distinguishing properties of similar items based on knowledge of those items (Gange). However, Witkin (1973) has found that his measure of learning style does have implications for problem solving with regards to the need for structure. Field dependent learners tend to prefer more structure in learning while field independent learners prefer less structure. This corresponds to Kirton's (2003) adaptive individuals who favor structure and innovative individuals who prefer less structure in the effort of problem solving.

Learning Style and Learning Process

Most psychologists concur that learning occurs through a process or cycle. Research of the brain has found five stages for effective learning (Jensen, 2000), including preparation–background recall of information, acquisition–inputting information, elaboration–experimentation and feedback, memory formation–encoding through emotion and context, and functional integration–application of knowledge (Jensen). It is easy to see these stages within other learning processes. Kolb (1984) defines the process of learning a principle as a concrete experience with the principle to be learned, followed by self-reflection and abstract conceptualization and ending with active experimentation of that principle. Teaching and learning the problem solving process includes the stages of problem identification, idea generation, idea evaluation and implementation (Swartz & Perkins, 1990). Still, the process the student uses to gather information dictates how the information is stored (Jensen, 2000; Piaget, 1970). That is, a learner studying a principle will acquire knowledge of the principle, but not how to manipulate the principle to solve a problem; knowledge to solve a problem must be acquired from the process of problem solving learning.

Kirton (2003) argues that learning style is independent from the learning process, a contradiction of Kolb's experiential learning theory and Kolb's measure of learning style. Kirton empirically tested (de Ciantis & Kirton, 1996) his claim by conducting a factor analysis on the Learning Style Questionnaire (Honey & Mumford, 1992), a learning style measure congruent with principle learning. The Learning Style Questionnaire was found as a more reliable version of Kolb's Learning Style Inventory. Following factor analysis, comparisons were made with Kirton's Adaption-Innovation Inventory to make the argument of independence between style and process. However, it may not be sensible to compare a learning style of principle and a learning style of problem solving as the two are of different learning processes. That is, a learning style of problem solving may be independent of principle learning, but not independent of problem solving learning. Furthermore, Kirton (2003) claims that adaptive learners have preferences of inductive thinking methods leading to better problem representation, while innovative learners tend to use deductive thinking methods to proliferate more ideas (p. 172). Again, both problem representation and idea generation are components of the problem solving process. The process of learning and learning style may not be completely independent as Kirton suggests. In addition to this, effective learning from problem solving requires the learner to use cognitive techniques that correspond with adaptiveness and innovativeness (Pask, 1976) while manipulating a principle to solve a problem. If coping behavior is required for an individual to be more adaptive or innovative, there is theoretical evidence that in problem solving learning stress is inevitable and motivation is needed to complete the problem solving learning process.

Learning Style and Learning Level

Kirton (1994) further separates problem solving in terms of cognitive level and cognitive style. Whereas cognitive style is fixed, innate and guides preferences of structure for solving problems, cognitive level is the capability to solve problems at a degree of complexity (Kirton). Examples of cognitive level include intelligence, creativity, academic achievement, etc. Again, the separation of cognitive style from cognitive level is the strength of A-I theory. The distinction and accurate measurement of cognitive style allows for the precise measure of other variables such as student intelligence, engagement, and motivation.

According to A-I theory, all people can creatively solve problems and have original ideas (Goldsmith, 1994). However when solving problems, people who are more adaptive tend to produce a smaller number of ideas with a narrower perspective that tend to be more relevant, sound and useful while utilizing given rules. People who are more innovative generate a larger number of original ideas of which many are different with widely changing perspectives and tendencies to alter rules (Kirton, 1994). Both adaptive and innovative people can adequately solve any problem, just within their own style.

Kirton's Cognitive Style

From the definitions of learning style (Claxton and Ralston, 1978) and cognitive style (Messick, 1984) used in this study, Kirton's cognitive style was determined as a style of learning. Additionally, Kirton's Adaption-Innovation Inventory (KAI) simply measures style of problem solving and is not convoluted with factors of cognitive level, cognitive affect or other types of learning (Gange, 1965). Three factors located on a continuum of more adaptive to more innovative have been identified and determined as preferential behaviors of an individual. Table 2-1 displays the factor traits of adaptors and innovators.

Table 2-1. Factor Traits of Adaptors and Innovators

Construct	Adaptor	Innovator
Sufficiency of originality	Tendency to produce fewer ideas aimed at being sound, useful and relevant to solving the problem.	Tendency to produce more ideas that are both relevant and irrelevant to the problem with knowledge that some ideas are inappropriate.
Efficiency	Preference for attention to detail to further develop ideas while narrowly focused on improving.	Preference for discontinuous thought to modify the problem with broad approaches to make different.
Rules/Group conformity	Often applies group accepted rules in idea formation to solve problems.	Often challenges group accepted rules in idea formation to solve problems.

Note. Source: Kirton, 2003, p. 58-60.

The factor traits of A-I theory are "innate, fixed and reliably measured" (Kirton, 2003, p. 76). Each of the three factor traits lends to a perceived structure of the problem at hand which determines the approach needed to solve the problem. The more adaptive tend to work within the frame of structure. A more adaptive cognitive style rarely challenges the boundaries of structure and solutions to the problem are focused with detail to derive a better solution that improves efficiency. A more innovative cognitive style breaks boundaries as if they never existed and solutions generated are often unrelated in an effort to derive a different solution that transforms the structure itself (Kirton). The perception of the structure from the framed problem determines the response of the learner, providing for the use of a preferred cognitive style.

The Scale of Adaption and Innovation

A benefit of A-I theory and the KAI is the interval measure of difference between two cognitive styles, providing a specific degree of separation between an individual's cognitive style from another individual's cognitive style. This is opposed to a learning style measured nominally and determined as categorically different; a model for many learning style inventories. The KAI measures cognitive style by scoring adaptiveness and innovativeness along a continuum (Kirton, 2003). Anchoring the more adaptive on the left and the more innovative on the right of the continuum, an interval scale is created amid a theoretical range of 32 to 160 (Kirton). However, the actual range is approximately 45 to 145 with a mean of 95 (Kirton).

It is important to note that the terms adaptors and innovators are used only to distinguish two differing cognitive styles, when in actuality, cognitive styles refer to being more adaptive or more innovative in the context of a situation (Kirton). For example, an individual may have a cognitive score of 125 distinguishing them as more innovative, but this individual will be perceived as adaptive to an individual with a score of 140.

Kirton (2003) suggests that a 10-point difference in score between two individual's cognitive style, as measured by the KAI, develops a "noticeable difference" when working together on a problem. The difference found between the two cognitive styles is defined as cognitive style gap (Kirton). A 20-point cognitive style gap leads to difficulties in mutual understanding and collaboration which may have a definitive effect on communication when problem solving (Kirton). For an individual with this amount of cognitive gap between one's preferred cognitive style and the style required to work with a problem or another problem solver, coping behavior is needed and can exist in both intensity and duration (Kirton). Coping behavior requires motivation (Walling, 1987) and is psychologically expensive (Kirton, 2003).

When solving a problem, more adaptive individuals can use techniques such as brainstorming which can be taught, however, they are not preferred and less likely to use it in their natural environment. Innovative individuals, likewise can be taught to master details and operate within rules, but would prefer the unstructured situation. Kirton further suggests that practice of coping behavior does not make coping easier for that person (Kirton, 2003, p. 255). This suggestion does limit the definition of learning used in this study; however the suggestion is supported in the creativity literature. Few researchers have been able to provide hard evidence that an individual can be taught to be more innovative or more adaptive (Nickerson, 1999). Furthermore, there is evidence that teaching an individual to use different problem solving techniques has little long term effect (Nickerson). Cognitive style (Kirton, 2003) is fixed, innate, and determines an individual's preference for structure within problem solving. There is no association with cognitive style and nationality or age, however females tend to be five points more adaptive then the general population mean (Kirton).

Summary of Learning and Learning Styles

Gange (1965) described eight different types of learning that are hierarchical in nature. Of the eight types, learning from problem solving is the highest form of learning with evidence of a problem solving process and problem solving style or cognitive style. Kirton's measure of cognitive style is a preferred approach to solve problems and independent from cognitive level (Goldsmith, 1994). However, both cognitive style and cognitive level are utilized to complete the problem solving process. There is evidence that other measures of learning style are specific to other types of learning defined by Gange (1965) with evidence found in the learning process.

Coffield, Mosley, Hall and Ecclestone (2004) identified 71 different types of cognitive styles with varying degrees of reliability and validity. Kirton's measure of cognitive style was determined a reliable and valid measure of cognitive style (Kirton, 1999). Furthermore, the measure was found independent from measures of motivation and capability (Kirton). Kirton's cognitive style determines if a person is more adaptive or more innovative in one's preference to solve problems and is stable characteristics of the individual. Along a continuum of adaption anchoring the left and innovation anchoring the right an individual's cognitive style score is placed in a theoretical range of 32 to 160 (Kirton). Dissimilarity between the cognitive styles of two individuals is determined by calculating the difference between two cognitive style scores. This cognitive style gap indicates differences between preferred methods of solving problems with stress as a consequence. Motivation may be utilized by the student to operate in a different cognitive style than preferred and bridge cognitive gap (Kirton, 2003). A cognitive gap larger than 20 points may inhibit communication (Kirton) between the student and faculty member and may explain lack of student engagement.

Learning and Stress

College students may be influenced by stress positively or negatively (Sandler, 2000). That is, stress as a stimulus can provoke a negative or positive reaction to the situation at hand. If a student has a positive reaction it is the fear of failure that motivates this student to succeed, but a negative reaction will likely be detrimental to classroom success. Given this variability of outcome from stress, little research has been conducted with attention to stress associated specifically concerning the undergraduate classroom.

A word of caution is given regarding terminology and definition in discussing stress. Coping behavior specific to the reaction to a stressor can be defined as a conscious effort to deal with an event to which an individual has not yet developed automatic patterns of response (Shields, 2001). In this document, reaction is used instead of the word coping so that the reader does not confuse coping as a reaction to stress with coping behavior defined by Kirton (2003).

A student's reaction to the stressor may determine if the stress is beneficial or detrimental to the academic achievement of the student. In a study conducted to examine this hypothesis, Aspinwall and Taylor (1992) surveyed 672 freshman undergraduates. Their findings provide evidence that a positive mood, higher optimism and an active reaction to stress orientation had positive effects on adjusting to new college experiences. Furthermore, the reaction to stress construct avoidance had detrimental effects on the adjustment to new college experiences. Hockey (1979) considered the role of stress in aiding the selectivity of attention and response in performing a cognitive task. Hockey elaborated that there may be an optimal level of stress for cognitive function although determining this level is dependent on the components of the task.

Researchers have studied the detrimental effects of anxiety, a correlate of academic stress (Misra and McKean, 2000). In countless studies, test anxiety has been found to be detrimental to academic achievement and self-esteem (Pintrich & Schunk, 2002). Specifically, worry is a factor of anxiety that causes distractions resulting in time lost being able to perform at the level the student is capable of achieving. Most of the literature concerning anxiety focuses on this worry component and its influence on students' attention and time on task in completing an assignment or test. Like stress, anxiety is an affective component of Kirton's A-I theory.

Undergraduate students face many stress-causing experiences throughout the time spent in completing a bachelor's degree. Among these experiences are moving away from home, academics, finances and work and relationships (Pfeiffer, 2001). The experiences themselves do not cause stress, but the student's perception and reaction turns the experience into a stressor (Romano, 1992).

Studies have been conducted to determine the effects of specific interventions of student stress, such as better time management. Again, none of the studies found by the researcher dealt with techniques specifically used to improve academics or students' relationships with faculty members.

Stress in the Classroom

The college environment is much different than the work environment, making the study of college stress unique in the literature. Research of undergraduate student stress has been conducted concerning the global stress of a college student as well as academic stress restricted to the classroom. Academic stressors for undergraduate students may include homework, unclear assignments, uncomfortable classrooms and time pressure set by the faculty member (Ross, Niebling & Heckert, 1999). The most common stressors of college students may be intrapersonal, including the change in sleeping habits, change in eating habits and new responsibilities (p.317). However, changes in the environment may also change types of stressors. That is, measuring stress at different times during the year and at different times leading to the completion of a degree may find different levels of stressors. Shields (2001) found that stress had detrimental effects on grade point average during the fall semester, but not the winter semester. Shields postulates that the effects of a stressor diminishes once students begin to activate positive reactions to the stressor. Regarding academic stress, Ross, Niebling and Heckert (1999) found that increased class workload and lower grades than anticipated were the two most frequent reported stressors among undergraduate students. Pfeiffer (2001) believes that these academic stressors can cause depression and low self-confidence (p. 13).

In a study conducted to find the relationship between stressors, learning strategies and test anxiety, Gadzella, Masten, and Stacks (1998) found that frustration was negatively correlated ($r=-.20$, $p<.05$) with the learning strategy deep processing (Schmeck, Ribich, Ramanaiah, 1977). That is, students do not become as frustrated when they become more organized (Gadzella, Masten & Stacks, 1998). Surprisingly, this study found no significant correlations with factors of stressors and test anxiety.

Using Gadzella's Student-Life Stress Inventory (SSI), Misra and McKean (2000) found that practices of time management lowered college student stress levels. However, the Misra and McKean study contradicted the previously mentioned study by Gadzella, Masten and Stacks (1998) and found significant positive correlations ($p<.05$) among constructs of stress and general anxiety among the population of full-time undergraduate students. Correlations between stress and anxiety should be positive as they both have a worry component (Misra and McKean, 2000).

Felsten and Wilcox (1992) conducted a study to find the impact of stress on 146 college male's academic performance. After analysis they found that stress was a detrimental effect on male's grade point average.

Shields (2001) conducted a study to examine the effects of stress and reactions to stress among persisting and non-persisting undergraduate students. A persister is defined as a full-time student enrolled in fall and winter semesters, while a non-persisting student is one that enrolls in the fall semester but not the subsequent winter semester. The group of study consisted of 220 persisters and 110 non-persisters and findings found that persisters had significantly higher levels of stress than nonpersistors with no gender difference. Stress was positively associated with reactive efforts to stress, and age among persistors, but not nonpersisters. This gives evidence that full-time status or traditional students have developed reactive efforts to stressors, but non-traditional students do not develop these same reactive efforts (Shields). Finally with the use of regression, stress, age and number of credit hours taken in the semester each had significant explanation of student reaction to stress (Shields). Recognizing that stress affects students in the classroom, it is necessary to examine the demographic variables related to stress.

Demographic Variables Related to Stress

Gadzella and Guthrie (1993) found that women undergraduate students tend to have significantly higher levels in experiencing stress of both pressure and change. Considering age, self-imposed stress was found to be highest among younger students

(16 to 18 years-old) and lowest in older students (31 to 57 years old) (Gadzella & Fullwood, 1992). Moreover, young women experienced more self-imposed stress and pressure than any age and gender combination (Gadzella & Fullwood).

Measurement of Stress

In the task of measuring stress, two types of instruments were found in the literature. The first type lists possible stressors relevant to the situation of the student and provides the research with either a count of stressors, or an indexed stress score with certain stressors weighted more than others. Although this measure of stress objectively attributes stress to the specific stressor, it ignores the interaction of the student with the environment (Cohen, Kamarck & Mermelsein, 1983). That is, students may attribute stress to a stressor without considering available resources to react to the stress. Furthermore, for this type of stress instrument to be accurate a list of all possible stressors must be presented to the student.

The second type of stress instruments measure perceived stress with regards to the stressor, situation and ability to react to the stressor. This type of measure broadly accounts for all stressors and provides a behavioral construct. However, perceived stress instruments are limited as they may inadvertently measure chronic stress, or other sources of stress (Cohen et al.). Research concerning perception of stress has found evidence that "students often misattribute stress to the appropriate stressor" (p. 387). Given this limitation, the measure of perceived stress is congruent with the definition of stress used in this study. Again, stress is not a corollary of a particular stressor, but a result of the student's perception and reaction to an experience (Romano, 1992).

To meet the objectives of this study, stress was measured specific only to the classroom environment to which the instrument was administered. Again, the classroom environment for problem solving is described as the social context to which individuals interact with during the problem solving process (Kirton, 2003). This gave reason to use an instrument that measured stress as perceived by the student and experienced in the environment.

The researcher found that Gadzella's Student Life Stress Inventory (SSI) a valid and reliable measure (Gadzella & Baloglu, 2001) of an undergraduate's perceived classroom stress that could be adopted for use in this study. The theoretical framework for the SSI comes from Morris (1990) and treats stress as a student experience, not just stressor variables affecting students (Gadzella & Masten, 2005). Five stressors were identified as experiential to undergraduate students and used in the SSI including: 1) frustration–delays and failures in reaching academic goals, social acceptance and disappointing grades, 2) conflict–one's choices among desirable and undesirable outcomes in goal setting, 3) pressure–assessing class competition, deadlines, and overload of assignments, 4) changes–unpleasant experiences and disruptive schedule changes and 5) self-imposed–desire to compete, be loved by all, procrastinate finishing assignments and anxiety during tests (p. 4). Each stressor forms a construct with items using a five point Likert scale with one signifying never and five signifying most of the time. Each stressor construct can be used individually or cumulatively for determining total stress of the student. Chapter 3 further discusses how the SSI was modified to meet the needs of the objectives for this study.

Summary of Learning and Stress

Stress is defined as an individual's perception and reaction to an experience that requires an adjustment from normal life (Romano, 1992). Undergraduate students have many unique stressors including moving away from home, academics, finances, work and new relationships (Pfeiffer, 2001). Common academic stressors include increased workload in a course and lower than expected grades received in a course (Ross, Niebling and Heckert, 1999). Although stress in the form of anxiety was found to be detrimental to academic achievement, an optimistic attitude may allow students to positively react to stress (Aspinwall & Taylor, 1992). Evidence was also found that young women undergraduate students tend to experience more stress than other undergraduate students (Gadzella & Fullwood, 1992).

The measurement of stress can be categorized by instruments measuring a count of stressors or a perceived experience which accounts for the reaction to a situation. Both types of measurement have strengths and limitations (Cohen et al.). This study utilized the SSI (Gadzella & Baloglu, 2001), a perceived measure of stress which is limited in ability to determine source of stress but provides a measured level of stress in the form of a behavioral construct (Gadzella & Baloglu). The measurement of stress as an experience rather than a specific stressor was found to be more compatible with Kirton's A-I theory.

Learning and Motivation

Concerning Kirton's (2003) theoretical framework applied to the undergraduate classroom, motivation is identified as part of cognitive affect. Motivation and its influence on learning is a well-researched phenomena with many more questions still unanswered. Research has found that learning is dependent on motivation, but interestingly the achievement of learning goals increases motivation to learn more (Schunk, 1991). Pace (1980) found that knowledge gained from a course was positively correlated with the amount of effort students provided for learning. Theories of motivation in education that are considered prominent at the time of this writing can be grouped by expectancy-value theories, attribution theories, social cognitive theories, goal theories, and intrinsic-extrinsic theories, (Pintrich & Schunk, 2002). Although, these theories each have their strengths, this study used an expectancy-value theory for the motivation theoretical framework (Eccles, 1983). Expectancy-value theory was found to be compatible with Kirton's (2003) definition of the environment. For example, a student may perceive himself as capable (expectancy) of solving a problem and receive some kind of reward (value) from execution of the solution. However, the faculty member also provides feedback on the student's effort and solution to which the student will react. If the student's perceived ability and reward are great enough, the student will be able to solve a problem despite cognitive style gap (Kirton, 2003). Furthermore, there is evidence that expectancy beliefs are related to student engagement and value beliefs are related to opportunities of future student engagement (Pintrich & Schunk, 2002). The following is a short description of the expectancy-value theory with empirical studies to support its importance to learning.

Expectancy-Value Theory

Current expectancy-value models have been adapted from Atkinson's (1957) expectancy-value theory of achievement motivation and now provide the clearest explanation to students' motivation in the classroom (Pintrich & Schunk, 2002). However, much is still to be learned about motivation as no motivation theory has been universally accepted by educational psychologists. The premise of expectancy-value theory is that the learner is motivated by two components: 1) their perceived ability and effort expected to be needed in accomplishing a goal (expectancy) and 2) the amount of value or reward the learner places on attaining the same goal (value). These two components will be further broken down and discussed theoretically and empirically.

The expectancy component

In this study the expectancy component consists of control of learning beliefs and self-efficacy. The belief is that a positive increase of an expectancy component will promote learning. A student's belief of their control in learning, or locus of control, is a main component of many expectancy-value theories. Students who believe they are in control (internal) of the learning succeed over students who explain away their control (external) of learning to other factors (Eccles & Wigfield, 2002). Research has found some evidence that control of learning beliefs change from externally to internally while attending college, with the greatest change found in students involved in honors programs (Pascarella & Terenzini, 1991). Research conducted to understand control of learning beliefs was prominent between the 1960's and 1970's. After this period of time authors moved on to answer other questions concerning motivation. Still, control of learning belief is an important part of many expectancy-value theories and the measurement of motivation.

Self-efficacy (Bandura, 1977) is accepting one has the capability to complete a task or goal. Bandura (1994) states the four sources of self-efficacy include mastery of challenging experiences, vicarious observation of a peer, verbal praise and reducing stress. As it relates to social-cognitive theory (Bandura, 1986), self-efficacy affects behavior and environment, but is also an effect of behavior and environment. Furthermore, there is evidence that self-efficacy may influence the student's choice of which problem to solve (Schunk, 2000). Referring to expectancy-value motivation in the context of student engagement, student self-efficacy may affect a student's choice to solve a problem while expectations of the student and the teacher raise the value placed on the solution.

Research has shown that higher levels of self-efficacy have a significant effect on students' persistence in completing a challenging task, academic performance and self-regulated learning (Zimmerman, 2000). Linnenbrink and Pintrich (2003) reviewed several studies regarding self-efficacy and claim a student with high self-efficacy will be more cognitively engaged through the use of higher order thinking skills and metacognitive strategies. In other research, Abouserie's (1994) findings supported the negative relationship between self-esteem and the variables of stress and anxiety. He elaborated that the major cause of test anxiety is the possibility of being found incompetent; a bash to a learner's self-efficacy.

The literature indicates there is a domain specific nature to students' self-efficacy. For example, academic self-efficacy was found to account for 21% of the variance in predicting students' course grades (Choi, 2005); however global self-efficacy was not found to be a significant predictor of academic achievement (p. 202).

Many authors have examined self-efficacy, self-esteem, and locus of control and implications these traits have on learning. Though each of these expectancy components have their own attributes (Ajzen, 2002) they have many of the same core constructs and may be more alike than different (Judge, Erez, Bono & Thoresen, 2002).

The value component

The value components of expectancy-value theory consists of intrinsic motivation, extrinsic motivation and task value constructs, all of which assign reward on attainment of a goal. The belief regarding the relationship between these value components and learning is simply that an increase of value in completing a learning goal leads to an increase in learning.

Intrinsic motivation is defined as accomplishing a task for no reward except for internal feelings that result from completing a task (Deci, 1975). Extrinsic motivation is accomplishing a task for the benefit gained from a separate outcome (Deci & Ryan, 1985). Although intrinsic and extrinsic motivation is separate and distinct there is some evidence that the two operate on a continuum. For example, a young boy may be extrinsically motivated to learn how to play the violin as his music teacher rewards successful learning with grades, extra-credit points or time off from their regularly scheduled practice. As time moves on, the boy starts to find enjoyment in playing the violin and will play more just for the sake of playing. The boy moved from being extrinsically motivated to intrinsically motivated. This was empirically tested by Ryan and Connell (1989) and concluded that this continuum does exist by examining relationships among different types of extrinsic motivation and change in specific attitudes.

Generally in the literature extrinsic motivation has been considered detrimental to learning and the level to which students solve problems. However, extrinsic motivation can be beneficial to learning if used in the correct manner. For example in problem solving, if a student is told how a solution will be evaluated and rewarded, extrinsic motivation positively influences engagement in the problem solving process (Collins & Amabile, 1999). Furthermore, an extrinsic reward offered to a student before beginning the problem solving process may increase level of problem solving if there is no contingency contract (Collins & Amabile). In another study, Hennessey and Zbikowski (1993) attempted to educate students about the negative effects of extrinsic motivation. The results found that after these students were extrinsically rewarded to solve a problem, there was no negative influence from the extrinsic reward. More research is needed to understand the positive influences of extrinsic motivation, especially if students are often motivated extrinsically and gradually become more intrinsically motivated over time.

A review of the literature finds disagreement in the definition of task value motivation and how it is utilized in different expectancy-value motivation models. Task value motivation sometimes incorporates intrinsic and extrinsic interests and is sometimes referred to as incentive motivation (Pintrich & Schunk, 2002). Other researchers refer to task value as a level of importance placed on a task (Battle, 1965) which is how task value is defined in this study. Considering the importance of task value to learning, Feather (1988) found task value to be specific to a college student's academic major. For example, a student with a high task value in math had higher perceptions of their ability in math, as well as an increase of personal values concerning achievement in math.

Affective motivation

Affective motivation is not a component of expectancy value theory, but is becoming more common in recent models of motivation as researchers explore the role of emotion in motivating students. It is included here because the measure of motivation chosen by the researcher included an affective component identified as test anxiety. Throughout the literature, there is evidence that test anxiety is detrimental to academic achievement and learning (Pintrich, Smith, Garcia & McKeachie, 1991). The two main components of test anxiety are worry and emotion. Some evidence suggests that emotions cause worry making test anxiety a behavioral construct (Hembree, 1988). Treatment of students' test anxiety is best provided by reducing worry and the emotionality associated with the test. This has shown to increase academic performance (Hembree).

Demographic Variables Related to Motivation

Motivation is an unstable consequence of the situation perceived by the individual and therefore considered contextual or situational (Paris & Turner, 1994). Motivation continues to change as a learner assesses and reassesses their ability to accomplish the task and the value of the reward upon accomplishing the task. Demographic variables such as age, gender, ethnicity, etc. are always factored in the individual's assessment of the situation and their capability of success in the situation. The environment of the classroom does allow for all learners to be in the same situation, but the learner continually constructs motivation (Paris & Turner) making motivation highly individualized and difficult to generalize to specific demographics.

Measurement of Motivation

The wide variety of motivational theories has led to the development of many instruments to measure motivation. To meet the objectives of this study and to remain consistent with expectancy-value theory, the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia & McKeachie, 1991) was used to determine motivation of each student specific to the class to which the instrument was administered.

The MSLQ was designed specifically to measure undergraduate student motivation for self-regulated learning. The three components of the instrument include an expectancy component with items related to student beliefs of ability in performing a task, a value component with items concerning goals and reasons for completing a task, and an affective component which includes items regarding emotional reactions to the task (Pintrich & De Groot, 1990).

The three components of the MSLQ can be further broken down into six scales of motivation that can be used independently or cumulatively (Pintrich, Smith, Garcia, McKeachie, 1991). The value component comprises three scales: intrinsic goal orientation–participating in a task for reasons of challenge, curiosity or mastery, extrinsic motivation–participating in a task for good grades, rewards or competition and task value–an evaluation of the importance of the task (Pintrich et al.). The expectancy component of the MSLQ has two scales which include control of learning beliefs–a belief that results hinge on self and effort will provide positive results, and self-efficacy for learning and performance–an appraisal and judgment of ability to complete a task (Pintrich et al.). The affective component has one scale identified as test anxiety which includes student performance and the resulting emotion (Pintrich et al.). It is important to note that the MSLQ includes an affective component in measuring student motivation, but there is no affective component in expectancy-value theory. Affective motivation, the motivation scales that identify emotions, has increasingly been recognized in the literature during the last 20 years and found to be incorporated into more cognitive motivation models. More research is needed to understand how emotions play a part in student motivation to learn.

In a study conducted to determine how the components of the MSLQ relate to cognitive engagement of students, Pintrich and De Groot (1990) found that self-efficacy and intrinsic orientation were both positively correlated with cognitive engagement and academic performance. Test anxiety was not found to be correlated with cognitive engagement, but did have a significant negative correlation with self-efficacy. The affective scale of test anxiety was found to be either detrimental or show no relationship with effort given to the task at hand (Pintrich & De Groot). Given that test anxiety is composed of worry and resulting emotion, one can easily see the similarities between stress and test anxiety. Furthermore, positive reactions to test anxiety may have the same effect that they have on student stressors. Chapter 3 gives more detail as to how the MSLQ was used to meet the objectives of this study.

Summary of Learning and Motivation

Expectancy value theories of motivation provide insight to how students are motivated to achieve academic success (Pintrich & Schunk, 2002). This theory of motivation was established as compatible with Kirton's (2003) cognitive affect as it relates to the environment in which individuals interact and react during the problem solving process. The expectancy component of the motivation theory refers to a perceived ability in accomplishing a learning goal while the value component refers to the reward placed on accomplishing the same goal (Eccles, 1983). As a student consistently assesses and reassesses the ability to accomplish this goal and the value placed on achieving success, motivation becomes situational and individualized (Paris & Turner, 1994).

Evidence supports the assertion that motivation is necessary for learning and motivation increases after a learning goal is achieved (Schunk, 1991). Research has indicated that student engagement was positively correlated with measures of self-efficacy and intrinsic motivation (Pintrich & De Groot, 1990). Although extrinsic motivation was considered in the literature as detrimental to learning and student engagement, extrinsic motivation was found to positively influence engagement in the problem solving process when used without a contingency contract (Collins & Amabile, 1999). More research is warranted to distinguish between the harmful and useful practices of providing extrinsic motivation to facilitate student engagement.

This study measured student motivation with the MSLQ (Pintrich, Smith, Garcia & McKeachie, 1991) which included the following motivation scales: control of learning, self-efficacy, intrinsic motivation, extrinsic motivation, task value and test anxiety. Although test anxiety was not part of expectancy-value theory, it was a scale found in the MSLQ and was included in the study given that affective motivational theories have been increasingly found in the literature.

Learning and Engagement

Astin (1984) developed a theory of student involvement to help guide future research in the area of student development and learning in completing an undergraduate degree. In his writing, Astin explained the tie between student engagement and motivation as “sharing a common psychological construct” (p. 522). Realizing the importance of motivation, he also discussed students’ time as a resource. Astin’s theory states that student effort and time are two resources required for student engagement in learning. That is, an increase in effort and time by the student to accomplish a learning goal will increase student learning. Astin concludes that “students’ time and effort are limited and exhausted” (p. 523) on activities related to college and also life. Astin’s theory also identifies contributors to student engagement, which guided the development of the National Survey for Student engagement (NSSE), the measure of student engagement in this study.

The roles that faculty members play as advisors and teachers have incredible influence on undergraduate students. Even in informal situations, faculty members can become positive role models for students, influencing attitudes and values (Pascarella, 1980). The importance of the faculty member cannot be denied in contributing to student engagement in the classroom and therefore facilitating academic success. The study of student engagement involves identifying the practices used by faculty members to increase learning and personal development and then surveying students to determine if those practices are being used. The following is a review of the literature regarding how the faculty member can influence learning.

The Influence of Faculty Members

Umbach and Wawrzynski (2005) conclude that "the single most important" factor in student development and classroom engagement is the faculty member. Whittington (1998) however, has found that faculty members in colleges of agriculture typically teach with methods that only require lower level thinking skills of the students and is detrimental to student classroom engagement. However, many colleges and universities now provide resources to help faculty members improve their instructional discourse. A replication of Whittington's study is needed to determine if faculty members still teach at lower cognitive levels.

In a study conducted to examine the relationship between student-faculty interaction and students' critical thinking skills, Smith's (1977) findings provide evidence that there is a positive relationship. Specifically, increases in critical thinking ability were positively correlated among variables of class participation with the faculty member as well as participation with other students in the class (Smith).

Increasing student engagement is more than just keeping students busy in the learning process. Schlechty (2002) claims that the amount of time a faculty member dedicates to improving the quality of assignments is directly related to student engagement. Many studies have been conducted examining different instructional techniques, distance education methods of instructional delivery, and uses of technology and their impact on student academic achievement and engagement while controlling for learning style. Most of these studies conclude that students have different styles of learning and that teachers should use a variety of teaching approaches to meet learning style needs of all students. As most good teachers incorporate a variety of instructional techniques already, the significance of learning style theory has found little practical application in the classroom (Coffield, Moseley, Hall & Ecclestone, 2004).

The literature revealed similar conclusions comparing the problem solving teaching approach to the content based approach. Dyer and Osborne (1996) examined the use of the two teaching approaches in a quasi-experimental design studying secondary students enrolled in agriculture. Using the Group Embedded Figures Test (Witkin, Oltman, Raskin & Karp, 1971) to measure learning style, they found that controlling for teaching approach, neither field independent or field dependent students had significantly higher achievement scores. However, they also found that field independent learners had higher problem solving scores on non-agriculturally based problems. Though their findings were limited, they also concluded that different instructional strategies should be used to facilitate the learning of all students (Witkin et al.).

Pascarella and Terenzini (1991) summarize teacher/teaching attributes that are effective for student learning. They include: command of subject matter, enthusiasm of subject, clear explanation of concepts, efficient structure of class time, use of examples and analogies in presenting new concepts, avoiding vagueness, and having good rapport with students (Pascarella and Terenzini).

Realizing the tie between motivation and student engagement, Paris and Turner (1994) identified four teaching techniques to increase student motivation to learn, which include: allowing students to choose a course of action, providing academic challenge, giving students control of achieving the learning objective, and allowing students to collaborate in the problem solving process.

Demographic variables related to engagement

Pascarella and Terenzini (1978) conducted a study to examine the academic performance and social development of student-faculty informal interaction (N=528). Concerning the relationship between gender, academic major, ethnicity and parents' level of education, no significant correlations were found among measures of academic performance, personal development and intellectual development. The study was replicated in 1980 and conclusions were consistent (Terenzini and Pascarella, 1980). However, there is evidence that student engagement may be related to student demographics. For example, a female student may be more influenced by a woman faculty member than by a male faculty member (Pascarella & Terenzini, 1991). Pike (2004) measured engagement with the NSSE and found that females exhibit a higher level of academic challenge and students of different disciplines have different levels of engagement. Pike did not find students' age a correlate of student engagement when examining students over that age of 24. However, as students progress in attaining their degree, student engagement increases (Kuh, 2001). That is, as students' classification moves from freshman to senior, students tend to be more engaged in learning.

Measurement of Engagement

The operational framework of this study places student engagement as a product or end result of the interaction between student and faculty member behavior. Many studies of learning styles use final grade or academic achievement as the dependent variable in order to demonstrate the practical contribution that a specific learning style has in the classroom. However, as undergraduate classrooms become more student centered (Acharya, 2002; Lunde, Baker, Buelow & Hayes, 1995; Study Group on the Conditions of Excellence in American Higher Education, 1984), there is greater need to identify variables related to student engagement. Student engagement is often determined with constructs of academic challenge, collaborative learning and student-faculty interaction (Kuh, 2001). Each construct is dependent on the teaching practices of the faculty member and requires communication between the faculty member and student (Umbach & Wawrzynski, 2005). If a dissimilar learning style between the faculty member and the student inhibits communication during the process of learning, evidence should be found in the variance of student engagement scores. That is, a large cognitive style gap may explain why students do not show evidence of engagement in the classroom.

Also, if a faculty member uses subjective evaluations (rubrics) of student projects and assignments–which are commonly used to evaluate the solution to a problem–the final course grade is also subjective and biased. That is, a faculty member may prefer solutions to assigned problems that are congruent with their learning style. The researcher found no evidence in the literature concerning instructors' evaluation biases based on learning style, but that does not suggest that this may exist.

Finally, the use of academic achievement as a dependant variable, whether in the form of a percentile or letter grade assigned by the faculty member, may subject the study to measurement error. There is evidence that faculty members inflate students grades for the purpose of receiving tenure and promotion (Germain & Scandura, 2005). Furthermore, student engagement is highly correlated with grade point average and other measures of academic achievement (Kuh, 2001). Given the previous discussion, the researcher found student engagement a more objective and accurate measure of learning and interaction between the student and faculty member.

A remarkable increase in the study of student engagement in the undergraduate classroom came after the release of *Involvement in Learning* (Study Group on the Conditions of Excellence in American Higher Education, 1984), which called for the use of teaching strategies that increase student learning in higher education. Since then, researchers have sought to identify empirically based practices that impact learning and develop effective measures to determine students' level of engagement. The National Survey of Student Engagement (NSSE) was designed to assess student engagement among colleges across the nation. Scales of the NSSE form "benchmarks" in order that colleges can compare the teaching practices of their faculty members to the teaching practices of other faculty members across the nation (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). The instrument was found to be stable and psychometrically solid with evidence of validity and reliability (Kuh, 2001). Additionally, the NSSE has been positively correlated with undergraduate student grade point average, critical thinking, quality of learning and GRE scores (Kuh).

The NSSE was developed through an extensive literature review of classroom activities and teaching practices that lead to valuable student outcomes (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). Three of the five benchmarks measured by the NSSE were specific to learning and engagement in a classroom. They include academic challenge, active learning and student-faculty interaction. Two other benchmarks measured engagement relevant to the college, including enriching educational experiences and supportive campus environment. As the latter two benchmarks were relevant to the college and not the classroom, they were not utilized in this study. Said differently, they were not measuring engagement practices directly attributed to the student and the faculty member.

The NSSE benchmarks of interest are described as follows: level of academic challenge–time spent preparing for class, amount of reading and writing, and use of higher order thinking skills; active learning–participating in class and working collaboratively with other students inside and outside the classroom and student-faculty interaction–talking with the faculty member, discussing ideas outside of class with the faculty member, getting feedback from the faculty member, and conducting research with the faculty member (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001, p. 5). More detail of the NSSE is provided in Chapter 3.

Summary of Learning and Engagement

Student's have a limited amount of time and effort to apply in accomplishing a learning goal (Astin, 1984). However, faculty members may be the "single most important" factor in engaging the student to learn. Although the student is responsible for engaging in learning, the faculty member is accountable for facilitating student engagement. The study of student engagement primarily entails identifying teaching practices that increase student engagement and surveying students to determine if teaching practices are being used.

Many researchers have examined the relationship learning styles have with academic achievement. However, an emphasis on increasing student engagement (Lunde, Baker, Buelow & Hayes, 1995) gave reason to examine if dissimilar learning styles between faculty member and student can contribute to the literature regarding student engagement. Furthermore, student engagement as measured by the NSSE may serve as a more objective dependent variable than academic achievement. Student engagement is closely tied to learning and academic achievement (Kuh, 2001).

Summary

Chapter 2 explains Kirton's Adaption-Innovation theory as applied to the undergraduate classroom providing a theoretical framework for this study. The framework was derived from Kirton's Adaption-Innovation theory which may provide insight to how dissimilar cognitive styles explain student engagement. Other major sections of this chapter included: Learning and Learning Styles, Learning and Stress, Learning and Motivation, and Learning and Engagement.

This review of the literature found ties between problem solving learning and Kirton's measure of cognitive style. Although Kirton's cognitive style has been applied in many contexts including business and management of change, little research has been conducted to examine if it is appropriate in explaining student engagement in the undergraduate classroom.

There is a need for more research considering the variable stress as it relates to learning and student engagement in the undergraduate classroom. Specifically, why do more adaptive courses have higher levels of stress and how does this contribute to student engagement? However, research has consistently found motivation to significantly contribute to learning, yet few studies have examined both stress and motivation while controlling for an instructor with a dissimilar learning style from that of students.

Student engagement in a course is largely dependent on teaching practices of the faculty member. The amount of structure preferred by faculty members can be determined by identifying their cognitive style. However, students may have different cognitive styles than the faculty member and prefer either more or less structure in learning from problem solving. As student engagement is closely tied to students' academic success, it is critical to consider if dissimilar cognitive styles between students and the faculty member can explain variance in student engagement.

CHAPTER 3
METHODS

Chapter 1 introduced the theory of learning styles, the appropriateness of Kirton's Adaption-Innovation (A-I) theory for the classroom, and the need for increasing student engagement in undergraduate classrooms. A point was also made that the literature contains many types of learning styles with varying degrees of reliability and validity. However, Kirton's (2003) measure of learning style is valid and reliable and distinct from cognitive level. Finally, definitions of key terms, purpose of the study, and objectives of the study were presented.

Chapter 2 presented the theoretical and conceptual frameworks of the study. Included were the following topics with attention given to theory and empirical evidence: a) learning and learning styles, b) learning and stress, c) learning and motivation, and d) learning and student engagement. Theoretical evidence was provided that Kirton's (2003) measure of learning style is compatible with problem solving learning (Gange, 1965) and may provide insight to why some students lack classroom engagement.

This chapter provides information concerning the methodology of the study. More specifically, details were given concerning the research design, target population, instrumentation, data collection procedures, and data analysis procedures.

The purpose of this study was to determine if relationships exist between cognitive style gap, student stress, student motivation, student engagement and selected demographic variables of undergraduate students at the University of Florida in the College of Agriculture and Life Sciences. The objectives of the study were to: 1)

Describe selected faculty and students according to their selected demographic variables; 2) Determine the cognitive style, student stress, student motivation, and student engagement of undergraduate students; 3) Determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students; 4) Explain undergraduate student stress and student motivation based on cognitive style gap and selected student demographic variables and 5) Explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected student demographic variables.

Research Design

The researcher used an *ex post facto* design one (Ary, Jacobs & Razavieh, 2002) to accomplish the objectives of the study. This design allows for the control and measure of the independent variable(s) to test hypotheses concerning variation in the dependent variable(s). Cognitive style is inherent, stable, and measurable as an interval score along a continuum allowing for the precise measure of dissimilarity between two individual's cognitive styles. The literature gave little guidance concerning A-I theory's application to the context of the undergraduate classroom concerning relationships with dependent variables. Thus, this empirical design was deemed most appropriate.

For objective one, student demographic variables were measured with items in the National Survey of Student Engagement 2005 (NSSE) (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001) and included: age, gender, major, college classification, full-time status, and number of classes taken with similar content as the class. Lastly, students were asked to give the number of problem sets that had taken more than an hour to complete during a typical week. This question was not used in data analysis, but was used to validate that problem solving does exist in the classes used in this study. Faculty members were asked questions regarding age, gender, years of teaching experience, and academic department. Faculty members also provided the researcher with syllabi and additional information to describe the course. Finally, participating faculty members were administered Kirton's Adaption-Innovation Inventory (KAI) (Kirton, 1999) to determine their cognitive style. Descriptive statistics were used to report determined values.

For objective two, four instruments were administered to nine undergraduate student classes to determine each student's cognitive style, stress, motivation and engagement in their respective course. The KAI provided a measure of each student's cognitive style. Level of student stress experienced in the classroom was determined using the Student-life Stress Inventory (SSI) (Gadzella & Baloglu, 2001). The Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia & McKeachie, 1991) was administered to measure student motivation in the classroom. The NSSE was used to determine student engagement. Descriptive statistics were used to report determined values.

For objective three, cognitive style gap was calculated by subtracting faculty members' cognitive style scores from each student's cognitive style scores as measured by the KAI. The same procedure was used to determine gaps within the constructs of cognitive style. These calculated values were used to find correlations with constructs of stress, motivation, engagement and selected student demographic variables. Objective three was accomplished using bivariate correlation.

For objective four, dependent variables including student stress, student motivation, and student engagement were each separately explained by the independent variables including cognitive style construct gaps and student demographic variables. Objective four was accomplished using backward stepwise multiple linear regression

For objective five, independent variables including cognitive style construct gaps, student motivation, student stress and selected student demographic variables were used to explain the dependent variable student engagement. Objective five was accomplished using backward stepwise multiple linear regression.

Population

This study utilized nine purposefully chosen class groups in the College of Agriculture and Life Sciences at the University of Florida. Since direction and degree of cognitive style gap was dependent on the cognitive style of the faculty member, courses were selected based on a faculty member's cognitive style: a) three faculty members with similar adaptive cognitive style scores, b) three faculty members with similar cognitive style score approximating 95, and c) three faculty members with similar innovative cognitive style scores.

Researchers have found little evidence that class size influences undergraduate student achievement (Williams, Cook, Quinn & Jensen, 1985). However, Cuseo (2004) found the optimum class size for student engagement at approximately 15 students with no evidence provided in the literature to support a linear or asymptotic relationship. The literature supports small class sizes for the retention of knowledge, student participation, and critical thinking (McKeachie, Chism, Menges, Svinicke & Weinstein, 1994), but there is no agreement on what number of students constitutes a small class. Most studies consider 50 or more students as a large class (Cuseo, 2004). A sample size of 46 is needed to attain a power of .70 (α=.05, R^2=.20) with the use of four independent variables (Ary, Jacobs & Razavieh, 2002). The researcher found from previous experience of administering the KAI to students at the University of Florida that mortality rate approximates 40%, which is lower than Kirton's (1999) estimated 20% mortality rate for this type of population. The researcher determined a cognitive style score as unusable using guidelines provided by Kirton (1999). Given the high mortality rate of the KAI, the researcher sought out classes with nearly 65 students. However the researcher found that many courses in the College of Agriculture and Life Sciences at the University of Florida were either below 50 students or approximated 100 students. Therefore the researcher chose classes that approximated 100 students realizing the limitations of large class sizes having less student engagement (McKeachie et al., 1994).

Finally, instructional techniques employed by the faculty members often promote student centered classrooms providing for student engagement (McKeachie et al.). For this reason, a review of prospective course syllabi and assignments was conducted by the researcher to purposefully select courses conducive for student engagement. Specifically, the researcher examined these documents for evidence that courses required students to attend class in order to be successful in the course. The researcher was not concerned with a percentage of the final grade requiring attendance, but examined if assignments and projects provided reason for students to attend class. Furthermore, since the KAI is a measure of problem solving style, courses selected for this study required the use of problem solving assignments. A problem was defined in this study as a desire or felt need for a solution, but not immediately knowing the mental operations to arrive at the solution (Soden, 1994).

Instrumentation

Four instruments were utilized to collect the data and complete the objectives of the study. The following is a description of the instrument and its constructs, as well as assessments of validity, and reliability.

Kirton Adaption-Innovation Inventory

The Kirton Adaption-Innovation Inventory (KAI) was developed by Kirton (1976) as a measure of cognitive style unrelated to cognitive ability and cognitive affect. Appendix D provides example items concerning the KAI and contact information to acquire permission to use the instrument. The KAI is a self-reported instrument consisting of 33 items, with one item not relevant in determining cognitive style. In distinguishing more adaptive individuals from more innovative individuals, items delineate a theoretical total range of 32 (highly adaptive) to 160 (highly innovative) (Kirton, 1999). However, the actual total range is approximately 45 to 145 with a general population mean of 95 (Kirton). For possible ranges of cognitive style construct scores, Kirton reported the following: sufficiency of originality (17 to 63), efficiency (7 to 33) and rule/group conformity (14 to 56).

Individuals taking the KAI were asked "How easy or difficult do you find it to present yourself, consistently, over a long period as:" followed by a list of personal characteristics. Individuals then mark an "X" on a continuum of "Very Hard" and "Very Easy". Construct scores were calculated by summing respective items and total scores were calculated by summing construct scores.

The KAI measured the cognitive style of the students and faculty members through the constructs of sufficiency of originality, efficiency, and rule/group conformity. Cognitive style gap was then calculated using the difference of total and construct cognitive style scores of the faculty member from the student. Reliability of the KAI was determined with Cronbach's alpha coefficient (Kirton, 1999). Validity of the KAI was established through correlations with personality assessments (criterion validity), lack of correlations with assessments of cognitive level (criterion validity), and factor analysis (construct validity) (Kirton). The researcher is a certified practitioner of the KAI. See Table 3-1 for construct and reliability information concerning the KAI.

Table 3-1. Construct Reliability of Kirton Adaption-Innovation Inventory

Construct	No. of items	Mean	SD	α
Sufficience of originality	13	41	9	.83
Efficiency	7	19	6	.76
Rule/Group conformity	12	35	9	.83
Total KAI	32	95	18	.88

Note. Source: (Kirton, 1999).

Student-life Stress Inventory

The second instrument administered to students was the Student-life Stress Inventory (SSI) developed by Gadzella (1994). Appendix E provides example items concerning the SSI and contact information to acquire permission to use the instrument. The SSI is a self-reported instrument designed for college students and comprised of two parts: perceived stress (5 scales, 23 items) and reactions to stress (4 scales, 28 items). Items were in the form of statements of which participants responded to five-point Likert scales with numbers signifying responses of “never”, “seldom”, “occasionally”, “often”, and “most of the time”. Construct scores of stressors were calculated by summing the items per each scale and include frustrations, conflicts, pressures, changes, and self-imposed. The total stress score had a possible range from 23 to 115 and possible ranges of constructs were frustration (7 to 35), conflicts (3 to 15), pressures (4 to 20), changes (3 to 15) and self-imposed (6 to 30). Total stress scores were calculated by summing constructs scores.

The researcher determined constructs related to reactions to stress including physiological, emotional, behavioral, and cognitive appraisal, unimportant for this study as they measured physical and psychological responses to stress and not level of stress. Therefore, these were removed from the instrument prior to data collection. Furthermore, item number six was removed from the frustration construct as it was not related to stress between the faculty member and the student. Stems of the items were altered to include the words “in this course” to facilitate the measurement of stress specific to the course of which the instrument was administered.

The SSI was used with permission. The SSI was assessed for reliability with Cronbach’s alpha coefficients and validity through confirmatory factor analysis (construct validity) (Gadzella & Baloglu, 2001). See Table 3-2 for descriptive information regarding constructs and reliability of the SSI.

Table 3-2. Construct Reliability of Student-life Stress Inventory

Construct	No. of items	Mean	SD	α
†Total Stressors	**23**	**70.09**	**11.53**	**.92**
†Frustrations	7	17.65	3.87	.70
†Conflicts	3	8.43	1.91	.68
†Pressures	4	14.08	2.83	.80
†Changes	3	8.03	2.39	.86
†Self-imposed	6	21.82	3.78	.63
Total Reactions to Stressors	**28**	**67.19**	**13.32**	**.75**
Physiological	14	31.07	8.32	.86
Emotional	4	12.17	3.51	.82
Behavioral	8	11.47	4.32	.71
Cognitive appraisal	2	6.01	1.98	.82
Total SSI	**51**	**137.28**	**20.98**	**.92**

Note. Source: (Gadzella & Baloglu, 2001). † Signifies construct was used for this study.

Motivated Strategies for Learning Questionnaire

The third instrument administered to students was the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich, Smith, Garcia, and McKeachie (1991). Appendix F provides example items concerning the MSLQ and contact information to acquire permission to use the instrument. The MSLQ is a self-reported instrument consisting of two components: motivation orientation (6 scales, 31 items) and use of learning strategies (9 scales, 50 items). Students taking the questionnaire are asked to rate themselves on seven point Likert scale items anchored by “not at all true of me” and “very true of me”. Constructs of the MSLQ motivation orientation included scales of value components, expectancy components, and affective components. The total possible range of the MSLQ motivational orientation was 6 to 42 with all construct scores ranging from 1 to 7. Scores were calculated by summing items related to the construct and dividing by the number of items.

Learning strategy scales of the MSLQ include cognitive and meta-cognitive strategies, and resource management strategies. The researcher determined that the learning strategy scales were unnecessary for this study and were removed from the instrument prior to data collection. The learning strategy scales were a measure of cognitive engagement (Pintrich et al.) which is highly correlated with student engagement. Furthermore, the researcher found the items biased towards being more adaptive in respect to A-I theory.

The MSLQ was specifically designed to be administered to college students enrolled in a college course and to be flexible to the needs of the researcher. The 15 scales of the MSLQ can be used either cumulatively or individually. It was developed over nine years with the developers assessing validity through factor analysis (construct validity) and correlations with other instruments and final grade scores (criterion validity) (Pintrich et al., 1991). Internal reliability was assessed by the developers with Chronbach's alpha coefficients (Pintrich et al.). The MSLQ was used with permission. See Table 3-3 for information describing the constructs and reliability of the MSLQ.

Table 3-3. Construct Reliability of Motivated Strategies for Learning Questionnaire

Construct	No. of items	Mean	SD	α
†Total Motivation Scale	**31**	**30.46**	*	*
Value				
†Intrinsic goal motivation	4	5.05	1.41	.74
†Extrinsic goal motivation	4	5.03	1.23	.62
†Task value	6	5.54	1.25	.90
Expectancy				
†Control of learning beliefs	4	5.74	0.98	.68
†Self-efficacy for learning	8	5.47	1.14	.93
Affective				
†Test anxiety	5	3.63	1.45	.80
Total Learning Strategies Scale	**50**	**39.13**	*	*
Cognitive and meta-cognitive strat.				
Rehearsal	4	4.53	1.35	.69
Elaboration	6	4.91	1.08	.76
Organization	4	4.14	1.33	.64
Critical thinking	5	4.16	1.28	.80
Meta-cognitive self regulation	12	4.54	0.90	.79
Resource management strategies				
Time and study environment	8	4.87	1.05	.76
Effort regulation	4	5.25	1.10	.69
Peer learning	3	2.89	1.53	.76
Help seeking	4	3.84	1.23	.52
Total MSLQ	**81**	**69.59**	*	*

Note. Source: (Pintrich, Smith, Garcia & McKeachie, 1991). † Signifies scale was used for this study. * Signifies value was not reported.

National Survey of Student Engagement

The fourth instrument administered to the students was the National Survey of Student Engagement 2005 (NSSE) developed by the National Center for Higher Education Management Systems (NCHEMS) (Kuh, 2001). Appendix G provides example items concerning the NSSE and contact information to acquire permission to use the instrument. The NSSE is a self-reported instrument consisting of 85 items measuring the constructs of college activities, educational and personal growth, opinions about your school, educational program characteristics and other measures of academic performance. An additional 15 items were designated to determine student demographic information. However, only 42 of the 85 construct items form "benchmarks of effective educational practice" (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001) from which academic institutions calculate yearly progress towards increasing student engagement. Benchmarks of the NSSE include academic challenge, active and collaborative learning, student faculty interaction, enriching educational experiences, and supportive campus environment.

Only three benchmarks were used as a measure of student engagement in this study, including academic challenge, active and collaborative learning, and student faculty interaction. The benchmarks of enriching educational experiences and supportive campus environment were not applicable to this study as many items were relevant to the campus and not the classroom. Stems of items were altered to include the words "in this course" in order that students answer items specific only to the class the instrument was administered. All items were four-point scale items except for one specific to the number of hours spent on homework; it was a seven-point scale and changed to a four-point scale to better determine the number of hours spent preparing specifically for the course used in this study. Anchors of the scale typically resembled "very often", "often", "sometimes", and "never", while other items were anchored with numbers representing frequencies of completing a specific task.

Possible benchmark ranges included academic challenge (11 to 44), active and collaborative learning (7 to 28) and student faculty interaction (6 to 24). Benchmark scores were calculated by summing items related to each construct. In this study these three benchmark scales were added to form a total possible engagement range of 24 to 96. However, since two NSSE benchmark scales were removed in this study, this total score range does not correspond with the total range reported by the NSSE.

Validity of the NSSE was assessed by the NSSE design team through well-defined items (face validity), research of the literature (content validity), factor analysis (construct validity), and review of the collected data (concurrent validity) (Kuh, 2001). Reliability was assessed utilizing Spearman's rho correlations between yearly tests (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). The NSSE was used with permission. See Table 3-4 for a description of constructs and reliability of the NSSE.

Table 3-4. Construct Reliability of National Survey of Student Engagement

Construct	No. of items	Mean	SD	Spearman's rho
†Academic challenge	11	33.18	*	.77
†Active and collaborative learning	7	17.92	*	.76
†Student-faculty interaction	6	12.64	*	.83
Enriching educational experiences	12	15.57	*	.89
Supportive campus environment	6	23.06	*	.85
Total NSSE	42	102.37	*	.83

Note. Source: (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). Values reported regarding the senior population of college students. † Signifies scale was used for this study. * Signifies value was not reported.

Data Collection Procedures

The Institutional Review Board (IRB) at the University of Florida conducted a formal review of the research proposal for ethical soundness. The research proposal was approved and assigned the IRB protocol number 2006-U-0078.

Before the administration of instruments to collect data, all participants received a letter of informed consent which was also read by the researcher. The letter of informed consent described the study, identified the researcher, addressed potential risks associated in the participation of the study and approximate amount of time expected to complete the instruments. Participants were informed of the voluntary nature of the study with the opportunity to quit the study at any time with no consequences. Individuals who volunteered to participate in the study signed the letter of informed consent as acceptance of the terms and returned the letter of informed consent with the completed instruments utilized in the study. Instruments were packaged together with corresponding codes to administer all instruments at the same time and ensure each instrument corresponded with the same student. Additionally, directions were given orally and in written form to students to complete the SSI, MSLQ and NSSE in regards to the specific class the students received the instrument and not to other classes enrolled in that semester. The students were also informed that these directions did not apply to the KAI as it measures their style of solving problems regardless of class.

Sixty-four faculty members in the College of Agriculture and Life Sciences at the University of Florida were contacted during February 2006 to participate in this study. Faculty members were identified by contacting individuals serving as undergraduate coordinator of each department in the college. Undergraduate coordinators provided the researcher with contact information of faculty members teaching courses that used problem solving assignments and had enough students enrolled in the course to meet the requirements of this study. Although many times the identified faculty members believed their course did not match the requirements of the study, they often provided contact information of another faculty member within the same department whose course better matched the requirements of this study. In the end, 21 faculty members were willing to participate in the study, but only 15 faculty members were administered the KAI as their courses were deemed suitable by the researcher. From this group, nine faculty members were chosen based on their cognitive style score. The selection of faculty members provided a range along the adaptive-innovative continuum as three faculty members had similar adaptive cognitive style scores, three faculty members had similar innovative cognitive style scores and three faculty members had similar cognitive style scores located in the middle of the adaptive-innovative continuum. Kirton (2003) states that total cognitive style scores less than 10 points are considered the same, between 10 and 19 points are considered similar and scores of 20 points or more are considered different.

Each of the nine faculty members' courses was coded with a letter to maintain confidentiality in data presentation. In order of adaptiveness to innovativeness faculty members were coded beginning with the letter "A" and ending with the letter "I". The grouping of classes by faculty member cognitive style resulted in an adaptive teacher group (Classes A, B and C), a middle score teacher group (Classes D, E and F) and an innovative teacher group (Classes G, H and I).

Student data were collected from each faculty members' class after midterm examinations during the spring 2006 semester, specifically March 27 to April 12, 2006. This time of administration was selected to ensure students had opportunity to interact with faculty members in the classroom as the interaction of dissimilar cognitive styles causes stress (Kirton, 2003). Students were administered the instruments during regularly scheduled class times, however, it was the faculty member's choice if the instruments were to be completed during class time. If not completed during class time, students completed the instruments outside of class and brought them back during the next scheduled class time. Specifically, students enrolled in Classes C, D, G and H were allowed to complete the instruments during regularly scheduled class time while students enrolled in Classes A, B, E, F and I took the questionnaires out of the classroom and brought them back completed the next regularly scheduled class meeting time.

Faculty members were given the choice to allow students to complete instruments during class time or outside of class time out of respect for the faculty members' instructional time with students. The estimated time for students to complete all four instruments was 40 minutes. Some faculty members were reluctant to give up this amount of time and would not have participated if instruments were required to be completed during class time. Authors of the instruments used in this study gave no indication that students must complete the instruments in the classroom.

Also, it was the faculty member's choice to offer an incentive of extra-credit to encourage student participation. This was done primarily to encourage students to come to class on the day instruments were administered and to prompt return of the instruments if students completed instruments outside of class. Only students enrolled in Class E were not given extra-credit for participating in this study, which may have influenced response rate.

A limitation of this study was the lack of control for method of administering instruments. Method of instrument administration is confounded with the faculty member giving no way to defend if either completion of instruments or use of extra-credit affected students' scores concerning cognitive style, stress, motivation or engagement.

Furthermore, differences of scores between classes were expected and supported by authors of the instruments. For example, Kirton (2003, p. 75) provides evidence that self-selected courses may be more adaptive or innovative depending on the nature of the course. If students in each course were disproportional regarding the number of young women, there may be higher levels of stress (Gadzella and Guthrie, 1993). Authors of the MSLQ (Pintrich, Smith, Garcia, McKeachie, 1991) claim that "responses to the questions might vary as a function of different courses" (p. 5). Finally, student engagement is an outcome of teaching practices and may vary with individual differences found among faculty members (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). Given the above reasons, the data were not analyzed to examine the effect of different types of instrument administration.

Data Analysis Procedures

Data were analyzed according to the following objectives and presented in chapter 4 with respect to study objectives and classes.

Research Objective One

Research objective one was to describe selected faculty and students according to their selected demographic variables. Student participants were asked demographic questions found on the NSSE including age, gender, college classification, full-time status, number of similar courses taken and major. Student participants were also asked how many problem sets were assigned during a typical week that took more than an hour to complete. Faculty participants were asked to respond to demographic items including age, gender, and years of teaching experience. To achieve objective one, data were entered into SPSS statistical software for Windows and analyzed using descriptive statistics (frequencies and measures of central tendency).

Research Objective Two

Research objective two was to determine student cognitive style, student stress, student motivation, and student engagement. Student participants were asked to respond to the four self-reported instruments: the KAI, the SSI, the MSLQ and the NSSE. All instruments were hand-scored by the researcher. To meet objective two, data were entered into SPSS statistical software for Windows. The researcher used descriptive statistics (frequencies and measures of central tendency) to analyze the data. For further analysis, tests of significance were used to compare groups.

Research Objective Three

Research objective three was to determine the cognitive style gap between faculty and students and explore relationships with undergraduate student stress, motivation, engagement and selected student demographic variables. Cognitive style gap was found by subtracting each faculty member's total cognitive style score from each of their student's total cognitive style score. Specific constructs of cognitive style gap scores were calculated in the same manner. Therefore, cognitive style gap described students in terms of being more adaptive or more innovative in relation to their faculty member. Utilizing SPSS statistical software, the researcher used Pearson's correlation coefficient to determine the strength and direction of the relationship between cognitive style gap with student stress, student motivation, student engagement and student demographic variables identified in objective one.

Research Objective Four

Research objective four was to explain both undergraduate student stress and student motivation based on cognitive style gap and student demographic variables identified in objective one. Using SPSS statistical software, backward stepwise multiple linear regression was used twice for each class to achieve objective four. Data were analyzed first to determine relationships between constructs of cognitive style gap (independent variable), student demographics (independent variable) and student stress (dependent variable); and second, to determine relationships of the same independent variables with student motivation (dependent variable). For further analysis, tests of significance were used to compare groups.

Research Objective Five

Research objective five was to explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected student demographic variables identified in objective one. Employing SPSS statistical software, backward stepwise multiple linear regression was used to explain the dependent variable student engagement based on independent variables including cognitive style gap, student stress, student motivation and student demographic variables identified in objective one. For further analysis, tests of significance were used to compare groups.

Summary

This chapter provided details of the methodology of this study with regards to research design, population, instrumentation, data collection, and data analysis. The study utilized an *ex post facto* Design 1 methodology to study the relationships of Kirton's cognitive gap with stress, motivation, engagement and selected student demographic variables. The population consisted of undergraduate students enrolled in the College of Agricultural and Life Sciences at the University of Florida. To ensure variance of students' cognitive style gap, both in size and direction, faculty members were selected based on their adaptiveness and innovativeness of cognitive style. From this group of faculty members, nine courses were purposefully selected to meet the objectives of this study.

Four instruments were utilized to collect data from the participants. They were the following: Kirton Adaption-Innovation Inventory (KAI) (Kirton, 1976), National Survey of Student Engagement 2005 (NSSE) with demographic questions (Kuh, 2001), Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, Smith, Garcia, and McKeachie, 1991), and Student-life Stress Inventory (SSI) (Gadzella, 1994). All instruments were assessed for validity and reliability prior to conducting the study. Post-hoc reliabilities for this study were presented in chapter 4.

In chapter 4, data were analyzed per class and organized by objectives. This study primarily used descriptive statistics, correlation statistics, and backward stepwise multiple linear regression.

CHAPTER 4
RESULTS

Chapter 1 provided the introduction of Kirton's Adaption-Innovation (A-I) theory as it applies to learning styles of undergraduate students in the classroom. Attention was also given to Kirton's separation of cognitive level from cognitive style. The chapter also presented a need for facilitating student engagement in the undergraduate classroom. A dissimilar learning style (cognitive gap) between the university faculty member and the student may give insight to why students are not engaged. The purpose of this study was to determine if significant relationships exist between cognitive style gap, student stress, student motivation, student engagement and selected student demographic variables of undergraduate students at the University of Florida in the College of Agriculture and Life Sciences. The specific objectives of this study were to: 1) describe selected faculty and students according to their selected demographic variables; 2) determine the cognitive style, student stress, student motivation, and student engagement of undergraduate students; 3) determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students; 4) explain undergraduate student stress and student motivation based on cognitive style gap and selected demographic variables; and 5) explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected demographic variables. Furthermore, chapter 1 listed definitions, basic assumptions, and cited limitations of the study.

Chapter 2 discussed the theoretical and conceptual framework of the study as well as reviewing the literature concerning cognitive style, stress, motivation, and engagement as they relate to learning. Special attention was given to Kirton's cognitive style as a measure of problem solving learning. Furthermore, dissimilar cognitive style, as measured by cognitive style gap, may cause faculty members and students to have difficulties communicating and working together in the classroom environment. The reliable and valid measure of cognitive style gap may explain why some students are not engaged in the course.

Chapter 3 provided the research methodology of this study with attention given to research design, population and instrumentation. Procedures were outlined for data collection and data analysis to complete the five objectives of this study.

This chapter presents the results of this study which are organized by the objectives listed previously.

Instrument Post-hoc Reliability

Cronbach's alpha was used to determine post-hoc reliability of the four instruments administered to participating students. Considering all students in this study, the total cognitive style score measured with Kirton's Adaption-Innovation Inventory (KAI) had an alpha coefficient of .85, which comprised of the constructs: sufficiency of originality (α=.80), efficiency (α=.66) and rules/group conformity (α=.76). Regarding the measurement of student stress, the Student-life Stress Inventory (SSI) had a total score alpha coefficient of .88 which included five constructs: frustrations (α=.80), conflicts (α=.84), pressures (α=.73), changes (α=.89) and self-imposed (α=.69). Motivation in this study was measured with the Motivated Strategies for Learning Questionnaire (MSLQ) which had a post-hoc total score alpha coefficient of .86 which included the constructs:

intrinsic (α=.70), extrinsic (α=.62), task value (α=.91), control of learning belief (α=.70), self-efficacy for learning (α=.91) and test anxiety (α=.83). The National Survey of Student Engagement (NSSE) was used to measure student engagement in the classroom and the total score alpha coefficient for this measure was .79. Three scales were used to determine student engagement: academic challenge (α=.70), active and collaborative learning (α=.62) and student-faculty interaction (α=.62).

Reliability coefficients are considered acceptable at a level above .70 (Schmitt, 1996). Although some construct scales presented previously had post-hoc alpha coefficients below .70, it should be noted that only total scores for stress, motivation and engagement were used in data analysis to meet the objectives of this study. However, the cognitive style construct efficiency was used despite its low post-hoc reliability. The efficiency construct is a measure of preferred method to solve problems (Kirton, 2003) and was expected to have relationships with stress and motivation (Barnhart, 2002). Furthermore, Kirton (1999) provided abundant evidence that all three constructs of cognitive style are reliably measured by the KAI.

Objective One

Describe selected faculty and students according to their selected demographic variables.

This study comprised nine faculty members each of whom taught a course of approximately 100 undergraduate students. Faculty members were asked questions regarding age, gender, years of teaching experience, and academic department. Faculty members also provided the researcher with syllabi and additional information to describe the course. Undergraduate students were asked demographic questions relevant to student engagement found on the National Survey for Student Engagement (NSSE) (Kuh, 2001) which included: age, gender, major, college classification, full-time status, and number of classes taken similar to the subject area of the course. Lastly, students were asked to give the number of problem sets that had taken more than an hour to complete during a typical week. The last question was not used in data analysis, but served to provide evidence that problem solving assignments did exist in the courses examined in this study and will be considered in the concluding discussion in chapter 5.

The data are presented with each faculty member's class separated as an intact group from the total group of respondents. Each class was coded by letter according to the faculty member's cognitive style score along the continuum of adaptiveness to innovativeness. Therefore, the most adaptive faculty member was assigned the letter "A" and the letter "I" was assigned to the most innovative faculty member. See Table 4-1 for a description of faculty members' cognitive style scores determined by Kirton's Adaption-Innovation Inventory (KAI).

Table 4-1. Listing of Classes designated by Faculty Members' Total Cognitive Style Score (N=9)

	Total Cognitive Style	Sufficiency of Originality	Efficiency	Rule/Group Conformity
Class A	64	29	10	25
Class B	68	25	19	24
Class C	83	40	12	31
Class D	94	48	15	31
Class E	95	41	18	36
Class F	103	51	9	43
Class G	116	49	21	46
Class H	132	53	29	50
Class I	134	60	20	54
All Faculty	98.78	44	17	37.78

Kirton (2003) states that total cognitive style scores less than 10 points are considered the same. Cognitive style scores between 10 and 19 points are considered similar and scores that are more than 20 points apart are considered different. Therefore from this group of faculty members an adaptive teacher group was formed from Classes A, B and C, a middle score teacher group was formed from Classes D, E and F and an innovative teacher group was formed out of Classes G, H and I. This allowed for further analysis of student variables based on similar cognitive styles of faculty members.

Class A

This three hour course concentrated on improving writing skills for academic settings and business applications. The course was practical in nature requiring students to prepare a resume and application packet, both of which were utilized in a mock job-interview. A research report was also developed as the faculty member led students through the process of conducting research. The course is not required for undergraduate students, but is suggested as a general writing course in the College of Agriculture and Life Sciences. The instructor of Class A was a 25 year-old female graduate assistant. She had three years of teaching experience at the college level, but no prior teaching experience in any other setting. The instructor chose to have instruments administered in class, completed outside of class, and then returned at the next normally scheduled class meeting. The instructor gave extra-credit points to students who returned instruments.

There were 100 students enrolled in Class A, of which 70 responded. All participating students were considered full-time (taking more than 12 credit hours). Of the respondents, 44.3% (n=31) were male and 55.7% (n=39) were female. For academic majors, 28 different majors represented the class. No specific major held a majority, but the three most predominant majors were family youth and consumer science (14.3%, n=10), nutritional science (11.4%, n=8), and food science and human nutrition (10%, n=7).

For Class A, the student mode age was 20 years old (32.9%, n=23). There were 20 students (28.6%) who reported their age as 21years of age and 10 students (14.3%) who were 19 years of age. Almost half of Class A were juniors (48.6%, n=34), while 30% (n=21) were seniors and 18.6% (n=13) were sophomores. There were only two (2.9%) freshman enrolled in the class that participated in this study.

Students were asked how many courses they had taken in the subject area similar to Class A. Respondents reported that 17.4% (n=12) had taken no courses, 68.1% (n=47) had taken one to two courses, 13.0% (n=9) had taken three to four courses and 1.4% (n=1) had taken more than four courses in the subject area. There was one student that did not answer this specific question.

Regarding the number of problem sets taking more than an hour to complete in a typical week 52.9% (n=37) student participants in Class A claimed that none of the assigned problem sets had taken more than an hour. However, 38.6% (n=27) claimed one or two problem sets and 8.6% (n=6) of the respondents claimed three to four problem sets assigned in class had taken more than an hour to complete.

Class B

Class B was a three hour course focused on the principles of quantitative genetics as applied to domesticated animals. Particular attention was given to farm animal industries including beef, dairy, equine and poultry. Although the final grade was calculated from exams and quizzes, mathematical problem sets were used throughout this course in the form of homework assignments. The course was required for students in the animal science department. The faculty member providing instruction for Class B was a male at 54 years of age. He had taught at the University of Florida for 29 years and had no other teaching experiences. Instruments were administered in class, but completed outside of class and then returned at the next normally scheduled class meeting. The instructor gave extra-credit points to students who returned instruments.

There were 100 students enrolled in Class B, of which 72 responded. Of the respondents, 95.7% (n=66) were full-time students while 4.3% (n=3) were part-time students. Three respondents did not complete the demographic questions. The majority of the respondents in Class B were female (81.2%, n=56). Male students comprised 18.8% of the respondents (n=13). Class B students were members of five different majors, of which 97.1% (n=67) were within the animal science department.

In Class B, the mode age was 21 years old (37.7%, n=26). There were 14 (20.3%) students that were 22 years of age and 9 (13.0%) students that were 20 years of age. There were only 3 (4.3%) students who were 19 years old. The class was only composed of juniors (50.7%, n=35) and seniors (49.3%, n=34). Again, three respondents did not answer the demographic questions.

Students were asked how many courses were taken in the subject area similar to Class B. Respondents reported 23.2% (n=16) had taken no courses, 37.7% (n=26) had taken one to two courses, 13.0% (n=9) had taken three to four courses and 26.1% (n=18) had taken more than four courses in the subject area. There were three students that did not answer this specific question.

For problem sets assigned in class that had taken students longer than an hour to complete in a typical week, 51.4% (n=36) claimed none, 44.3% (n=31) said one to two, 1.4% (n=1) said three to four and 2.9% (n=2) declared more than five problem sets. Two students did not answer the question describing number of problem sets taking longer than an hour.

Class C

This course consisted of three credit hours focusing on the study of food marketing. Four case studies were used to teach concepts of marketing, product development, distribution and pricing. Students were asked to identify issues, make decisions, and give recommendations based upon the information presented in the case study. The course was required for students majoring in food and resource economics.

The faculty member instructing Class C was a 36 year-old female. She had taught 12 years at the college level, but had no prior teaching experience. Instruments were administered and completed during class time. The faculty member provided extra-credit points for students that participated.

There were two sections of Class C, each taught by the faculty member with the same syllabus. Each section included 45 students. In the first section, 33 students participated, while 38 students participated in the second section. The two groups were combined to form Class C. Of the respondents, 98.6% (n=70) were full-time students. One student (1.4%) reported being a part-time student. The majority of the students in Class C were male (71.8%, n=51) with females making up 28.2% (n=20) of the group.

Respondents in Class C were working towards five different majors of which 93% (n=66) were food and resource economics, a major within the department. The remainder of the responding students majored in agriculture (2.8%, n=2), business administration (1.4%, n=1) and community recreation (1.4%, n=1).

The mode age of Class C was 22 years old (35.2%, n=25). There were 13 respondents (18.3%) reporting an age of 21 years and another 13 respondents (18.3%) reporting an age of 23 years. Class C comprised mostly of seniors (91.5%, n=65) with the remainder of the class being juniors (8.5%, n=6).

Students were asked how many courses were taken in the subject area similar to Class C. Of the respondents, 2.8% (n=2) had taken no courses, 23.9% (n=17) had taken one to two courses, 26.8% (n=19) had taken three to four courses and 46.5% (n=33) had taken more than four courses in the subject area.

Participating students also answered one item asking how many problem sets assigned in a typical week had taken more than an hour to complete. Of the student respondents in Class C, 19.7% (n=14) reported none, 63.4% (n=45) stated one to two problem sets, 14.1% (n=10) asserted three to four problem sets, and 2.8% (n=2) declared five or more problem sets assigned in a typical week had taken longer than an hour to complete.

Class D

Three credit hours were assigned to Class D, in which students learned about embryonic, prenatal and postnatal growth and development of domesticated animals. Even though the content learned was primarily lecture based, students were asked to analyze, synthesize and apply four journal articles of the student's choice. The purpose of the assignments were to give students the experience of finding specific journal articles and be able to apply the information to topics discussed in class and to their life. The course was required for students in the animal science department.

The faculty member for Class D was a 62 year-old male with 38 years of teaching experience at the college level. He had no prior teaching experience before becoming a university faculty member. Instruments were administered and completed during class time. The faculty member provided extra-credit points for students that participated.

Class D enrolled 116 students of which 108 participated in this study. In this course, 97.2% (n=103) were considered full-time students and 2.8% (n=3) were part-time students. Two students did not answer the question regarding full-time status. The majority (81.3%, n=87) were female while males consisted of 18.7% (n=20). One student did not complete the question specifying gender.

Students in Class D made up five different academic majors of which three majors offered within the department constituted 97.2% (n=104) of the group. The most predominant major in the course was animal science (67.3%, n=72). The academic major animal biology had the second highest number of students at 23.4% (n=25). The remaining academic majors were pre-veterinarian, wildlife conservation and biology which together accounted for 9% (n=10) of students in the class.

The mode age of Class D was 21 years old (36.4%, n=39). Students who were 20 years old numbered 28 (26.2%) with students reporting 19 years of age constituting 10.3% (n=11) of the class. One student reported being 17 years of age. One student did not answer the question specifying age. The college classification of students in Class D comprised 60.4% (n=64) juniors, 32.1% (n=34) seniors, 6.6% (n=7) sophomores, and one freshman. Two students did not answer the question regarding college classification.

Students were asked how many courses were taken in the subject area similar to Class D. Of the respondents, 5.7% (n=6) had taken no courses, 32.1% (n=34) had taken one to two courses, 28.3% (n=30) had taken three to four courses and 34.0% (n=36) had taken more than four courses in the subject area. There were two students that did not answer this specific question.

Concerning the number of problem sets that require more than hour to complete during a typical week, 83.3% (n=90) of student respondents asserted none, 15.7% (n=17) stated one to two problem sets and 0.9% (n=1) claimed three to four problem sets.

Class E

Class E was a two-hour, stand-alone laboratory class in which students participated in laboratory exercises. Content of the course entailed structure, nutrition and growth of microorganisms. The students were also required to write reports discussing the findings of laboratory exercises. The course was mandatory for all students wishing to take advanced courses in the Department of Microbiology and Cell Science.

The faculty member of Class E was a 54 year-old female. She had 23 years of teaching experience at the college level; however she had no prior teaching experience at any other level. The faculty member insisted that instruments were to be administered during class, but completed outside of class time. Students were asked to bring completed instruments to the next normally scheduled class meeting time. The faculty member did not provide extra-credit for students participating in the study.

There were three sections of Class E, each taught by the faculty member with one syllabus. Each section consisted of 35 students of which 16 responded in each section. The three sections were combined to form Class E with a total of 48 student respondents. Among respondents, 97.9% (n=47) were full-time students with one student reporting as part-time. Female students held the majority (77.1%, n=37) with males making up 22.9% (n=11) of the class.

There were 18 academic majors reported in Class E, of which only four constituted more than 10% of the group. Those academic majors were nutritional science (18.8%, n=9), microbiology (14.6%, n=7), animal biology (12.5%, n=6) and biology (12.5%, n=6).

Student age in Class E was bimodal with 14 students (29.2%) being 21 years of age and 22 years of age. Three students (6.3%) were 19 years old and two students

(4.2%) were over 30 years old. Class E was made up of mostly seniors (64.6%, n=31) and juniors (33.3%, n=16). There was one sophomore enrolled in Class E.

Students were asked how many courses were taken in the subject area similar to Class E. Of the respondents, 8.3% (n=4) had taken no courses, 54.2% (n=26) had taken one to two courses, 14.6% (n=7) had taken three to four courses and 22.9% (n=11) had taken more than four courses in the subject area.

In this class, students were asked how many problem sets assigned during a typical week that require more than an hour to complete. In Class E, 91.7% (n=44) stated no problem sets were completed that met this criteria while 6.3% (n=3) declared one or two problem sets and 2.1% (n=1) claimed three to four problem sets assigned had taken longer than an hour to complete.

Class F

Two credit hours were assigned to Class F in the subject area of human nutrition. Concepts learned included nutritional requirements during different stages of the human life cycle as well as socioeconomic, cultural and psychological aspects of behaviors toward food. Critical thinking teaching methods were utilized throughout assignments, exams, and class discussions. Assignments resembled real-life situations in which students were asked to solve problems. Furthermore, students enrolled in the class were made aware of the research process to better understand the literature pertaining to nutrition. The course was required for nutritional science academic majors and dietetics majors.

The faculty member who taught Class F was a 46 year-old female who had taught 11 years at the University of Florida. Previous to that, she had worked as a dietician for 7 years in which she occasionally educated patients in group settings. The faculty member allowed administration of instruments during class time, but students were not allowed class time to complete the instruments and were asked to return the completed instruments at the next normally scheduled class meeting time. Students were given extra-credit for their participation.

There were 150 students enrolled in Class F of which 115 participated. All respondents of this course were full-time students. The majority of the course was female (69.6%, n=80) with 30.4% of the class being male (n=35).

Class F was composed of 12 academic majors of which 81.8% were held by two majors, nutritional science (55.7%, n=64) and food science and human nutrition (26.1%, n=30). Eight students (7%) were working towards majors in dietetics.

Class F students had a mode age of 21 years (43.5%, n=50). There were 30.4% (n=35) students reporting as 20 years old and 8.7% (n=10) students reporting as 22 years old. Of the respondents, juniors made up the majority (58.3%, n=67) of Class F with seniors constituting 33.0% (n=38). Also enrolled in Class F were six (5.2%) sophomores and four (3.5%) freshmen.

Students were asked how many courses were taken in the subject area similar to Class F. Of the respondents, 1.7% (n=2) had taken no courses, 29.6% (n=34) had taken one to two courses, 44.3% (n=51) had taken three to four courses and 24.3% (n=28) had taken more than four courses in the subject area.

Student participants were asked how many problem sets had taken more than an hour to complete during a typical week. In Class F, 81.7% (n=94) asserted no problem sets, 16.5% (n=19) claimed one to two problem sets and 1.7% (n=2) claimed three to four problem sets given during a typical week had taken longer than an hour to complete.

Class G

A three credit hour course, Class G content revolved around principles of youth development. Priority was given to physical, cognitive, social and emotional changes between childhood and adulthood. Students were required to work in teams for the purpose of participating in a service learning project. This project allowed students to pick a childhood or teen group, identify curriculum needs and teach the curriculum to the group. The course was required for majors and minors in family youth and community science.

The faculty member who taught Class G was a 35 year-old female. She had taught five years in her current position at the University of Florida. This faculty member also reported tutoring student athletes for eight years and two years of educational experience as a cooperative extension agent. Instruments were administered and completed by students during class time. Students were given extra-credit for participating in this study.

Class G enrollment consisted of 110 students of which 85 agreed to participate. Respondents in this course were 98.8% (n=84) full-time students. One (1.2%) student was identified as being part-time. However, 11 respondents did not answer the question specific to full-time status. Most of the respondents were female (81.2%, n=69) with males making up 18.8% (n=16) of the class. Still, 11 respondents did not answer the question regarding gender.

There were 13 reported academic majors in Class G. Of these majors, 75.3% (n=64) were family youth and consumer science and 10.6% (n=9) were psychology. None of the other academic majors totaled more than 3% (n=2) respondents. Again, 11 students did not answer the question regarding academic major.

Class G students reported a mode age of 21 years (34.1%, n=29) with 31.8% (n=27) reporting as 20 years old. Also, 11.8% (n=10) of respondents were 22 years of age. Class G respondents were 57.6% (n=49) juniors, 30.6% (n=26) seniors and 11.8% (n=10) sophomores. Still, 11 participating students did not answer the question regarding college classification.

Students were asked how many courses were taken in the subject area similar to Class G. Respondents declared that 2.4% (n=2) had taken no courses, 23.8% (n=20) had taken one to two courses, 41.7% (n=35) had taken three to four courses and 32.1% (n=27) had taken more than four courses in the subject area. There were 12 students that did not answer this specific question.

For the number of problem sets assigned during a typical week that had taken longer than an hour to complete, 50.0% (n=42) claimed none, 45.2% (n=38) said one to two problem sets and 4.8% (n=4) said three to four problem sets. There were 12 participating students who did not respond to the questions distinguishing number of problem sets completed during a typical week.

Class H

As a three credit hour course, the instructor of Class H taught topics relevant to agricultural and food marketing systems. Specifically, the topics included identification of food marketing participants, functions, interdependencies and trends, as well as evaluating components of the system. Student final grades were based on four exams and two projects. Furthermore, effort was made by the faculty member to apply learned content to actual settings requiring a solution to a problem. Written and oral presentations were used to showcase student learning and give opportunity to apply concepts to real-life situation. The course was required for students majoring in food and resource economics.

The faculty member who taught Class H was a 42 year-old male. He had five years of collegiate teaching experience at the University of Florida. This faculty member also reported teaching experiences during his two years of serving in the Peace Corps and two years at an agricultural technical college. Instruments were administered and completed by students during class time. Students were given extra-credit for participating in this study.

Class H consisted of 122 students of which 70 responded. Of the participating students 98.5% (n=67) were enrolled as full-time students. One (1.5%) student was determined as a part-time student while two (2.9%) students did not answer the question specifying enrollment status. Males held a slim majority of the respondents at 55.1% (n=38) with female respondents of Class H accounting for 44.9% (n=31). One student did not respond to the question regarding gender.

Nine academic majors were reported in Class H. The majority of the respondents (81.2%, n=56) majored in food and resource economics. Four (5.8%) students declared a major in animal science. The academic majors of agricultural communication and mechanical engineering each had two respondents (2.9%). The remaining five academic majors consisted of only one student each. There was one student who did not answer the question on the subject of academic major.

For ages of respondents in Class H the mode age was 21 years old (31.9%, n=22). There was an equal number of participants reporting 20 and 22 years of age (18.8%, n=13). Ten students (14.5%) reported the age of 23 years. One student did not answer the question specifying age. Class H respondents were primarily juniors (53.6%, n=37) and seniors (36.2%, n=25). Sophomores made up 7.2% (n=5) of the class and freshman accounted for 2.9% (n=2). One student did not respond to the question identifying college classification.

Students were asked how many courses were taken in the subject area similar to Class H. Respondents claimed that 15.9% (n=11) had taken no courses, 34.8% (n=24) had taken one to two courses, 27.5% (n=19) had taken three to four courses, and 21.7% (n=15) had taken more than four courses in the subject area. There was one student that did not answer this specific question.

Student participants were asked how many problem sets were completed during a typical week that had taken more than an hour to complete. In Class H, 55.7% (n=39) claimed none, 40% (n=28) declared one to two problem sets, 2.9% (n=2) stated three to four problem sets, and 1.4% (n=1), asserted more than five problem sets had taken more than an hour to complete during a typical week.

Class I

This course was identical to Class A in content, assignments and exams. However, the syllabus, content and classroom policies were determined by the instructor. There was no team teaching between Class A and Class I; rather these were two completely separate sections of the same course with standardized assignments and exams. Class I was a three credit hour course focused on developing students' writing skills. Students were led through the process of applying for a job which included creating a resume, completing job applications and mock interviews. Students were led through the process of conducting research and worked with the instructor to complete a research report. The course was not required for undergraduate students, but was suggested to undergraduate students in the College of Agriculture and Life Sciences.

The instructor who taught Class I was 26 year-old female and a graduate assistant with one year of collegiate teaching experience. She also had less than 6 months of leading non-formal educational programs at a community level. The instructor permitted administration of instruments in class, but students completed instruments outside of class time. Students were given extra-credit from the faculty member for returning completed instruments.

There were 100 students enrolled in Class I with 77 participating in this study. All students who responded (n=76) claimed to be full-time, however, one student did not answer the question concerning full-time status. Females constituted 62.3% (n=48) of the student respondents with males comprising 37.7% (n=29).

Thirty different academic majors were represented among the respondents. The most predominate academic majors were nutritional science (14.3%, n=11) and food and resource economics (14.3%, n=11). The academic major of family youth and consumer sciences constituted 11.7% (n=9) of the responding students. None of the other 27 academic majors accounted for more than 10% of the respondents.

Concerning the ages of Class I, respondents were bimodal with 34.2% (n=26) each at 20 and 21 years of age. Eleven (14.5%) students reported 22 years of age. One student did not report age. Class I respondents determined their college classification as 48.1% (n=37) juniors, 26.0% (n=20) seniors, 20.8% (n=16) sophomores and 5.2% (n=4) freshman.

Students were asked how many courses were taken in the subject area similar to Class I. In response, it was found that 34.2% (n=26) had taken no courses, 46.1% (n=35) had taken one to two courses, 13.2% (n=10) had taken three to four courses and 6.6% (n=5) had taken more than four courses in the subject area.

Student participants were asked how many problem sets were assigned during a typical week that had taken more than an hour to complete. In Class I, 47.4% (n=36) stated none, 43.4% (n=33) claimed one to two problem sets, 6.6% (n=5) declared three to four problem sets and 2.6% (n=2) stated more than five problem sets were completed during a typical week which required more than one hour.

All Students

The nine classes examined in this study were combined to present demographic information of all students participating in this study. There were 993 undergraduate students enrolled in the nine courses examined in this study, of which 716 (72.1%) participated. Of the respondents, 98.6% (n=698) were classified as full-time students. Ten students (1.4%) considered themselves as part-time students. There were eight students who did not respond to the item regarding full-time status. Of the student respondents, 65.7% (n=467) were female while 34.3% (n=244) were male. Five students did not answer the question regarding gender.

A total of 63 different academic majors were identified among the student participants. The five academic majors with the largest number of participating students were: food and resource economics (19.1%, n=136), animal science (17.5%, n=125), nutritional science (13.0%, n=93), family youth and consumer sciences (11.6%, n=83) and animal biology (8.8%, n=63). Together, these five academic majors comprised 70.1%

of the student respondents in this study. There were three students who did not answer the question specifying the student's academic major.

The mode age of student participants was 21 years (33.6%, n=239). There were 173 respondents (24.3%) with a reported age of 20 years and 115 respondents (16.2%) reporting an age of 22 years. There were four students who did not answer the item regarding student age. The majority of the students were juniors (48.6%, n=345) and seniors (41.4%, n=294). However sophomores accounted for 8.2% (n=58) of the class and freshman accounted for 1.8% (n=13). There were six students who did not report their college classification.

Considering the number of courses students had taken in the same subject area to the course of which instruments were administered, 11.5% (n=81) had taken no courses, 37.2% (n=263) had taken one to two courses, 26.7% (n=189) had taken three to four classes and 24.6% (n=174) had taken more than four courses. There were nine students who did not answer the item regarding number of similar courses taken.

The number of problem sets assigned during a typical week for the entire group of student respondents that had taken more than one hour to complete was a question asked to help validate that problem solving based assignments were being used in the classroom. It was found that 60.7% (n=432) of students had no assignments as such, but 33.8% (n=241) stated one to two problem sets during a typical week had taken more than an hour to complete. There were 4.5% (n=32) claiming three to four problem sets assigned during a typical week had taken more than an hour to complete and 1.0% (n=7) stated more than five such assignments existed. There were four students who did not answer the question regarding number of problem sets completed during a typical week.

Summary of Findings for Objective One

Faculty members were coded by their cognitive style score with the letter "A" designating the most adaptive faculty member and the letter "I" designating the most innovative faculty member. This group of faculty members ranged from a graduate student employed as a lecturer to tenured faculty members with ages ranging from 25 to 62. Six of the nine faculty members were female. The group's range of teaching experience was 1 to 38 years with few faculty members having teaching experience outside of the classroom. Faculty members represented six academic departments in the College of Agriculture and Life Sciences at the University of Florida. Faculty demographic information was not used in any further data analysis, but presented here simply to describe the faculty member group. See Table 4-2 for a summary of demographic information regarding participating faculty members.

Table 4-2. Summary of Classes Regarding Reported Demographic Information of Participating Faculty Members

Course Instructor	Age	Gender	Experience Teaching (years)	Academic Department
Faculty member A	25	Female	3	Agricultural Education & Communication
Faculty member B	54	Male	29	Animal Science
Faculty member C	36	Female	12	Food & Resource Economics
Faculty member D	62	Male	38	Animal Science
Faculty member E	54	Female	23	Microbiology & Cell Science
Faculty member F	46	Female	11	Food Science & Human Nutrition
Faculty member G	35	Female	7	Family Youth & Consumer Science
Faculty member H	42	Male	7	Food & Resource Economics
Faculty member I	26	Female	1	Agricultural Education & Communication

Students were asked demographic found on the NSSE (Kuh, 2001) which included: age, gender, major, college classification, full-time status and number of classes taken similar to the subject area of the course. Students were also asked how many problems sets that had taken more than an hour to complete during a typical week. This question provided some evidence that problem based assignments were used in the class, albeit less than anticipated by the researcher. This will be further discussed in chapter 5.

As most student participants were full-time students (taking more than 12 credit-hours) and were between the ages of 20 and 23, there is evidence that these students were mostly traditional undergraduate students. Seven of the nine classes were predominately female. The data suggests that the majority of students in the classes of study were either juniors or seniors in college classification indicating that courses were of higher level. Regarding the number of courses the student had taken with similar content varied across classes, however from participants' responses, 50.7% (n=363) of the students had taken at least three classes that were similar to the course used in the study. See Table 4-3 for a summary of student demographic information.

Table 4-3. Summary of Classes Regarding Reported Demographic Information of Participating Students

	Mode Age	Gender (No. of students)		College Classification (No. of students)				No. Similar Courses (No. of students)			
Course	(years)	F	M	Fr.	So.	Jr.	Sr.	0	1-2	3-4	4+
Class A	20	39	31	2	13	34	21	12	47	9	1
Class B	21	56	13	0	0	35	34	16	26	9	18
Class C	22	20	51	0	0	6	65	2	17	19	33
Class D	21	87	20	1	7	64	34	6	34	30	36
Class E	22	37	11	0	1	16	31	4	26	7	11
Class F	21	80	35	4	6	67	38	2	34	51	28
Class G	21	69	16	0	10	49	26	2	20	35	27
Class H	21	31	38	2	5	37	25	11	24	19	15
Class I	21	48	29	4	16	37	20	26	35	10	5
All students	21	467	244	13	58	345	294	81	263	189	174

Objective Two

Determine the cognitive style, student stress, student motivation and student engagement of undergraduate students.

Student participants in each class were asked to respond to four questionnaires. They included the following: Kirton Adaption-Innovation Inventory (KAI) to measure cognitive style with constructs of sufficiency of originality, efficiency, and rule/group conformity; the Student-life Stress Inventory (SSI) to measure classroom specific stress characterized by frustrations, conflicts, pressures, changes and self-imposed stress; the Motivated Strategies for Learning Questionnaire (MSLQ) to measure classroom specific motivation with components of intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy for learning and test anxiety; and the National Survey of Student Engagement (NSSE) to measure classroom specific engagement with scales of academic challenge, active and collaborative learning, and student faculty interaction. Chapter 3 discussed how these instruments were modified to meet the needs of this study. The data are presented here with results of all four questionnaires grouped by the classes described above. Also, cognitive style, stress, motivation and engagement were determined through examining all participating students as a group.

Class A

There were 58 usable responses in Class A (N=100, n=70) pertaining to the KAI. Cognitive style was coded with lower numbers signifying more adaptive and higher numbers signifying more innovative. The KAI has a range of 32 to 160 with a mean of 95. The total cognitive style mean for Class A student respondents was slightly more adaptive (M=90.60, SD=18.01, n=58) than the normalized mean reported by Kirton

(1999). Constructs of cognitive style were likewise slightly more adaptive than the general population (Kirton): sufficiency of originality was 1.38 points more adaptive, efficiency was 2.10 points more adaptive and rule/group conformity was 0.91 points more adaptive. However, constructs scores were consistent with the total mean of 90.60 (Kirton). The most adaptive student in Class A scored a 51 on the KAI and the most innovative student scored a 125. See Table 4-4 for findings specific to student cognitive style.

Table 4-4. Class A Student Mean Scores of Cognitive Style Constructs (n=58)

Construct	Mean	SD	Min	Max
Total cognitive style	90.60	18.01	51	125
Sufficiency of originality	39.62	8.40	22	58
Efficiency	16.90	4.72	8	28
Rule/Group conformity	34.09	8.45	17	51

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

There were 68 usable scores for determining Class A respondents' perceived classroom total stress. The SSI measured perceived stress with 22 items which were coded one for low level of perceived stress and five indicating a high perceived stress level. The total stress mean of student respondents for Class A was approximately 18 points lower (M=52.44, SD=10.57, n=68) than the norm provided by Gadzella and Baloglu (2001), indicating a lower level of stress. The student with the lowest level of stress scored 29 on the SSI and the highest level of perceived stress was 76. The construct mean for student frustrations stress was 5.62 points lower than the norm provided by Gadzella and Baloglu, however the researcher notes that one item was removed from this construct prior to data collection. The remaining stress constructs also indicated lower student stress levels than the instrument norm: conflicts was 2.46 points lower, pressures was 2.50 points lower, changes was 3.16 points lower, and self-imposed was 3.65 points lower in measuring student perceived level of stress in Class A. See Table 4-5 for findings regarding classroom specific stress.

Table 4-5. Class A Student Mean Scores of Stress Constructs

Construct	N	Mean	SD	Min	Max
Total stress	68	52.44	10.57	29	76
Frustrations	70	12.03	3.73	6	21
Conflicts	69	5.97	2.54	3	12
Pressures	69	11.58	3.42	5	19
Changes	70	4.87	2.04	3	10
Self-imposed	70	18.17	3.86	9	25

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

For total motivation of Class A there were 69 usable scores. The MSLQ was utilized to measure motivation and comprised 31 items. Construct scores were standardized and ranged from 1 to 7 providing for a total score range of 6 to 42. Items were coded with low scores signifying low motivation and high scores signifying high motivation. The least motivated student of Class A scored 21.03 for total motivation while the most motivated student scored 36.73. Class A respondents' total motivation (M=29.31, SD=3.59, n=69) was 1.15 points lower than the norm reported by Pintrich, Smith, Garcia and McKeachie (1991). Three motivation constructs between Class A and the instrument norm (Pintrich, et al.) indicated lower levels of motivation: intrinsic motivation was 1.02 points lower, task value was 1.01 points lower and control for learning was 0.05 points lower. However three motivation constructs indicated Class A had higher levels of motivation than the instrument norm (Pintrich, et al.): extrinsic motivation was 0.28 points higher, self-efficacy was 0.56 points higher and test anxiety was 0.05 points higher. All scale means of motivation were within one standard deviation identified by Pintrich et al. See Table 4-6 for findings regarding classroom specific motivation for Class A.

Table 4-6. Class A Student Mean Scores of Motivation Constructs

Construct	N	Mean	SD	Min	Max
Total motivation	69	29.31	3.59	21.03	36.73
Intrinsic motivation	70	4.03	1.07	1.75	6.50
Extrinsic motivation	69	5.31	1.06	3.00	7.00
Task value	70	4.53	1.14	1.50	6.83
Control of learning	70	5.79	0.92	3.25	7.00
Self-efficacy	69	6.03	0.86	3.75	7.00
Test anxiety	69	3.68	1.30	1.00	6.60

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

The NSSE was used to determine student engagement utilizing three constructs: academic challenge, active and collaborative learning and student-faculty interaction. The sum of these three constructs provided 24 items with a range of 24 to 96. A higher engagement scores signifies a more engaged student. Regarding student engagement related to Class A, the summed mean of the three construct scores was 48.43 (SD=7.70, n=70), 15.31 points lower than the reported national mean for college seniors (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001). Construct scores of student engagement in Class A were also lower than the national mean for college seniors: academic challenge was 8.39 points lower, active learning was 6.02 points lower and student-faculty interaction was 0.90 points lower. Examining the differences between mean scores in Class H and the average college senior mean scores (Kuh et al.) with respect to the standard deviation, there is evidence that these students had lower levels of academic challenge and active learning, but comparatively had an average level of student-faculty interaction. See Table 4-7 for findings regarding Class A student engagement.

Table 4-7. Class A Student Mean Scores of Engagement Constructs (n=70)

Construct	Mean	SD	Min	Max
Total student engagement	48.43	7.70	32	69
Academic challenge	24.79	3.76	14	33
Active learning	11.90	3.09	7	20
Student-faculty interaction	11.74	2.82	6	21

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class B

From Class B (N=100, n=72), there were 46 KAI responses considered usable by the researcher. The KAI determines cognitive style with lower scores signifying more adaptive and higher scores signifying more innovative. The KAI has 32 items with a range of 32 to 160 and a reported mean of 95 (Kirton, 1999). Class B students' total cognitive style mean score (M=92.43, SD=15.05, n=46) was 2.57 points more adaptive than the general population norm (Kirton). Construct scores of cognitive style were less than one point more adaptive than construct norms reported by Kirton, except the construct efficiency which was 1.59 points more adaptive than the general population norm. However, all construct mean scores in Class B were consistent with a total cognitive score of 92.43 (Kirton). In Class B, the most adaptive student had a total cognitive style score of 46, while the most innovative student in Class B scored 116. See Table 4-8 for results concerning student cognitive style for Class B.

Table 4-8. Class B Student Mean Scores of Cognitive Style Constructs (n=46)

Construct	Mean	SD	Min	Max
Total cognitive style	92.43	15.05	46	116
Sufficiency of originality	40.39	8.45	22	59
Efficiency	17.41	4.65	7	28
Rule/Group conformity	34.63	6.68	17	47

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

For classroom stress, 68 responses were deemed usable from Class B participants. The SSI was used to determine students total stress level with 22 Likert scale items. The range for the SSI was 22 to 110 with higher scores signifying more stress. The total stress mean of Class B (M=55.85, SD=12.95) was approximately 14 points lower than the total mean reported by Gadzella and Baloglu (2001). Also, Class B construct mean stress scores were lower than the norm (Gadzella & Baloglu): frustrations was 3.96 points lower, conflicts was 2.40 points lower, pressures was 3.14 points lower, changes was 2.72 points lower and self-imposed was 1.94 points lower. Note that one item was removed from the frustrations construct prior to data collection which would provide a slightly lower mean score. The student with the lowest level of perceived stress scored 31 for total stress and the student with the highest amount of perceived stress had a total score of 87. See table 4-9 for results regarding Class B student stress.

Table 4-9. Class B Student Mean Scores of Stress Constructs (n=68)

Construct	Mean	SD	Min	Max
Total stress	55.85	12.95	31	87
Frustrations	13.69	4.98	6	27
Conflicts	6.03	2.84	3	12
Pressures	10.94	3.79	4	20
Changes	5.31	2.60	3	11
Self-imposed	19.88	4.23	8	29

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

There were 69 usable scores for calculating student motivation in Class B. The MSLQ was used to measure student motivation and consisted of 31 items. Students responded to items using a 7-point Likert scale with one coded to signify low motivation and seven coded to signify high motivation. Construct scores were standardized providing for a total range of 6 to 48 points. Of total student motivation, Class B was 0.19

points higher (M=30.65, SD=12.95, n=68) than the reported sample reported by Pintrich et al. (1991). Construct mean scores were likewise similar with less than one point above or below the sample norm (Pintrich et al.): Specifically, intrinsic motivation was 0.45 points lower, extrinsic motivation was 0.44 points higher, task value was 0.49 points lower, control of learning was 0.01 points higher, self-efficacy was 0.08 points lower and test anxiety was 0.78 points higher. The least motivated student of Class B scored 17.43 for total motivation and the most motivated student scored 38.58. See Table 4-10 for findings regarding classroom specific motivation of Class B.

Table 4-10. Class B Student Mean Scores of Motivation Constructs

Construct	N	Mean	SD	Min	Max
Total motivation	69	30.65	4.37	17.43	38.58
Intrinsic motivation	70	4.60	1.19	1.50	7.00
Extrinsic motivation	70	5.47	1.09	2.25	7.00
Task value	69	5.05	1.27	1.00	7.00
Control of learning	70	5.75	1.17	2.50	7.00
Self-efficacy	69	5.39	1.27	2.25	7.00
Test anxiety	70	4.41	1.68	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

Class B had 70 usable scores for student engagement. The total student engagement score was calculated by adding the constructs of academic challenge, active learning and student-faculty interaction. Twenty four items each with a 4-point scale were coded one for low engagement and four for high engagement. The range of the three summed constructs was 24 to 96 with a mean of 63.74 for college seniors. Class B total student engagement mean (M=46.01, SD=7.47, n=70) was 17.73 points lower than the national mean of college seniors considering the three constructs of study (Kuh et al., 2001). Construct mean scores were also lower than the reported national mean of college seniors (Kuh, et al.): active learning was 6.11 points lower and student-faculty interaction was 0.68 points lower. Of particular note, the construct academic challenge was 10.94 points lower, indicating lower levels of student preparation and use of higher order thinking skills in Class B. The student with the lowest level of engagement in Class B had a total engagement score of 33 points while the most engaged student in the class scored 63 for total engagement. See Table 4-11 for findings specific to Class B student engagement.

Table 4-11. Class B Student Mean Scores of Engagement Constructs (n=70)

Construct	Mean	SD	Min	Max
Total student engagement	46.01	7.47	33	63
Academic challenge	22.24	3.63	16	31
Active learning	11.81	2.73	7	19
Student-faculty interaction	11.96	3.21	7	20

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class C

For Class C (N=90, n=71), there were 56 usable KAI responses considered acceptable by the researcher to determine cognitive style. Lower scores signify a more adaptive cognitive style and higher scores signify a more innovative cognitive style with a range of 32 to 160 and mean of 95. The total cognitive style mean for Class C was 5.86 points higher (M=100.86, SD=14.34) than the general population mean determined by Kirton (1999) which indicated a slightly innovative group. Cognitive style construct mean scores were likewise higher: sufficiency of originality was 3.59 points higher, efficiency was 0.61 points higher and rule/group conformity was 1.66 points higher indicating slightly more innovative students. However, all cognitive style construct mean scores in Class C was consistent with the total mean score (Kirton). The most adaptive student in Class C scored 65 on the KAI, while the most innovative student scored 142. See Table 4-12 for findings concerning student cognitive style of Class C.

Table 4-12. Class C Student Mean Scores of Cognitive Style Constructs (n=56)

Construct	Mean	SD	Min	Max
Total cognitive style	100.86	14.34	65	142
Sufficiency of originality	44.59	6.59	32	62
Efficiency	19.61	4.28	9	29
Rule/Group conformity	36.66	7.50	22	58

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

There were 70 usable responses to calculate total perceived stress in Class C. The SSI was utilized to measure stress with 22 items providing a range of 22 to 110. Low perceived stress scores signify low stress and high perceived stress scores signify high levels of perceived stress. The total stress mean for Class C participants was 15.18 points lower (M=54.91, SD=12.59, n=70) than reported means by Gadzella and Baloglu (2001). Construct mean scores for student stress also indicated lower levels of stress with respect to the norm (Gadzella and Baloglu): frustrations was 4.81 points lower, conflicts was 2.36 points lower, pressures was 3.63 points lower, changes was 3.40 points lower and self-imposed was 0.92 points lower. Note that one item was removed from the frustrations construct prior to data collection. Also note that total stress and constructs of stress were approximately one standard deviation lower than the sample reported by Gadzella and Baloglu, but self-imposed stress of Class C was less than one point from the sample norm. The student with the lowest level of total stress scored 29 on the SSI and the student with the highest level of total stress scored 83. See Table 4-13 for findings regarding classroom stress of Class C.

Table 4-13. Class C Student Mean Scores of Stress Constructs

Construct	N	Mean	SD	Min	Max
Total stress	70	54.91	12.59	29	83
Frustrations	70	12.84	4.68	6	29
Conflicts	71	6.07	2.53	3	12
Pressures	71	10.45	3.34	4	20
Changes	71	4.63	2.42	3	12
Self-imposed	71	20.90	4.78	9	30

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

There were 71 usable responses to determine student motivation of Class C. To measure total motivation, 31 items were used from the MSLQ. Respondents answered items on a 7-point Likert scale with one signifying low motivation and seven signifying high motivation. Construct scores were standardized and added to form a total motivation range of 6 to 48. Total motivation in Class C was 0.40 points higher (M=30.86, SD=3.80) than that reported by Pintrich et al. (1991), indicating higher levels of motivation. However, construct mean scores of motivation in Class C were both higher and lower than the test sample norm (Pintrich et al.). Intrinsic motivation was 0.26 points lower than the reported norm (Pintrich et al.) and the motivation construct task value was 0.45 points lower. However, extrinsic motivation was 0.37 points higher, control of learning was 0.01 points higher, self-efficacy was 0.45 points higher, and test anxiety was 0.27 points higher than the reported norm (Pintrich et al.), indicating higher levels of student motivation in Class C. The least motivated student of Class C respondents had a total score of 18.73 and the most motivated student scored 39.59. See Table 4-14 for findings regarding motivation in Class C.

Total student engagement of Class C was determined with the NSSE which in this study comprised three constructs. The possible range for total engagement was 24 to 96.

Table 4-14. Class C Student Mean Scores of Motivation Constructs (n=71)

Construct	Mean	SD	Min	Max
Total motivation	30.86	3.80	18.73	39.59
Intrinsic motivation	4.79	0.91	2.75	6.50
Extrinsic motivation	5.40	1.15	1.50	7.00
Task value	5.09	1.35	1.00	7.00
Control of learning	5.75	0.90	2.75	7.00
Self-efficacy	5.92	0.70	3.75	7.00
Test anxiety	3.90	1.52	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

The 4-point scale items were coded as one signifying low engagement and four signifying high engagement. The total student engagement mean score for Class C (M=54.73, SD=9.15, n=71) was 9.01 points lower than the national mean for college seniors (Kuh et al., 2001). Construct mean scores for student engagement in Class C were also lower than the national mean for college seniors (Kuh, et al.): academic challenge was 5.19 points lower and active learning was 3.93 points lower. The exception to this was the construct student-faculty interaction which was 0.12 points higher than the norm (Kuh, et al.). This indicated that students in Class C had an average level of student-faculty interaction despite low levels of academic challenge and active learning. In Class C, the least engaged student had a total engagement score of 37 and the most engaged student scored 80. See Table 4-15 for findings specific to Class C student engagement.

Table 4-15. Class C Student Mean Scores of Engagement Constructs (n=71)

Construct	Mean	SD	Min	Max
Total student engagement	54.73	9.15	37	80
Academic challenge	27.99	4.46	16	37
Active learning	13.99	3.53	8	23
Student-faculty interaction	12.76	3.54	7	21

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class D

For Class D (N=116, n=108), there were 73 usable KAI scores accepted by the researcher. The KAI uses 32 items to determine cognitive style and has a theoretical range of 32 to 160 and a mean of 95. Lower cognitive style scores signify adaptiveness while higher cognitive style scores signify innovativeness. The total cognitive style mean for Class D student respondents was 93.63 (SD=17.40). This was 1.37 points more adaptive than the standard mean of typical populations defined by Kirton (1999). The efficiency construct mean scores of cognitive style was also slightly more adaptive (1.93 points lower) than the general population mean (Kirton) in Class D. However, cognitive style constructs of sufficiency of originality and rule/group conformity were 0.49 points higher and 0.07 points higher respectively. Regardless, all construct mean scores were consistent with a cognitive style total mean score of 93.63 (Kirton). The most adaptive student in Class D had a total cognitive style score of 55 and the most innovative student had a cognitive style score of 135. See Table 4-16 for results regarding student cognitive style in Class D.

Table 4-16. Class D Student Mean Scores of Cognitive Style Constructs (n=73)

Construct	Mean	SD	Min	Max
Total cognitive style	93.63	17.40	55	135
Sufficiency of originality	41.49	8.37	23	55
Efficiency	17.07	5.37	7	32
Rule/Group conformity	35.07	7.98	20	55

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

For total perceived stress in Class D there were 101 usable scores recorded by the researcher. The SSI was used to measure total perceived stress which included 22 items and a range of 24 to 96. Using a 5-point Likert scale students responded by marking one to signify low perceived stress and five to signify high perceived stress. In Class D, the total stress mean of the class (M=52.80, SD=13.71, n=101) was 17.29 points lower than that reported by Gadzella and Baloglu (2001), indicating lower levels of perceived stress. Constructs mean scores of student stress in Class D were also lower than that reported by Gadzella and Baloglu: frustrations was 5.87 points lower, conflicts was 3.13 points lower, pressures was 3.32 points lower, changes was 3.40 points lower and self-imposed was 1.40 points lower. Note that one item was removed from the frustrations construct prior to data collection as it was not applicable to the study. See chapter 3 for an explanation for removing this item. Interestingly, all scales of stress were one standard deviation lower than the normalized means (Gadzella and Baloglu) except for self-imposed stress. This provided evidence that students in Class D had higher levels of self-imposed stress compared to the other stress constructs. The student in Class D with the lowest level of total perceived stress scored 26 points on the SSI while the student with the highest level of perceived stress scored 94 points. See Table 4-17 for findings specific to stress of Class D.

Table 4-17. Class D Student Mean Scores of Stress Constructs

Construct	N	Mean	SD	Min	Max
Total stress	101	52.80	13.71	26	94
Frustrations	103	11.78	4.25	6	26
Conflicts	102	5.30	2.48	3	12
Pressures	103	10.76	3.71	4	20
Changes	102	4.63	2.46	3	13
Self-imposed	103	20.42	4.34	9	30

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

For total student motivation in Class D, there were 102 usable responses. The MSLQ determines level of motivation with six standardized construct scores providing a total motivation range of 6 to 48. Students respond to 7-point Likert scale items with one signifying low motivation and seven signifying high motivation. In Class D, total motivation (M=32.42, SD=3.77, n=102) for the class was 1.96 points higher than the reported total motivation mean from the instrument's authors (Pintrich et al. 1991), indicating a higher level of motivation in this group. Motivation construct mean scores were also higher than the normalized construct mean scores (Pintrich et al.): extrinsic motivation was 0.68 points higher, task value was 0.27 points higher, control of learning was 0.30 points higher, self-efficacy was 0.38 points higher and test anxiety was 0.49 points higher. The exception to this was intrinsic motivation, which was 0.16 points lower than the norm reported by Pintrich et al. However, all constructs mean scores were within one standard deviation as presented in the study conducted by Pintich et al. The student with the lowest level of motivation in Class D scored 21.26 and the student with the highest level of motivation scored 38.85. See Table 4-18 for reported motivation scales of Class D.

Table 4-18. Class D Student Mean Scores of Motivation Constructs

Construct	N	Mean	SD	Min	Max
Total motivation	102	32.42	3.77	21.26	38.85
Intrinsic motivation	103	4.89	1.00	1.75	6.75
Extrinsic motivation	103	5.71	1.07	2.00	7.00
Task value	102	5.81	1.05	2.00	7.00
Control of learning	103	6.04	0.83	3.50	7.00
Self-efficacy	103	5.85	1.08	2.75	7.00
Test anxiety	103	4.12	1.43	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

Concerning student engagement of Class D, 108 participants provided usable responses for this study. In this study, three constructs with 24 items were used from the NSSE to provide a total student engagement score. Items used 4-point scales with one coded as low engagement and four coded as high engagement. The engagement score range was 24 to 96. In Class D, the total calculated student engagement mean was 48.33 (SD=7.89) which was 15.41 points lower than the national reported mean for college seniors (Kuh et al., 2001). Likewise, construct mean scores of student engagement in Class D were also lower than the norm (Kuh et al., 2001): academic challenge was 8.63 points lower, active learning was 6.25 points lower, and student faculty interaction was 0.53 points lower. Examining the standard deviation of student engagement constructs, there was evidence that students in Class D had an average level of student-faculty interaction, but had low levels of academic challenge and active learning. The least engaged student had a total score of 32 and the most engaged student scored 69. See Table 4-19 for student engagement construct scores for Class D.

Table 4-19. Class D Student Mean Scores of Engagement Constructs (n=108)

Construct	Mean	SD	Min	Max
Total student engagement	48.33	7.89	32	69
Academic challenge	24.55	4.22	16	33
Active learning	11.67	3.30	7	24
Student-faculty interaction	12.11	3.03	6	22

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class E

There were only 32 usable KAI responses from Class E (N=105, n=48). The high number of non-responders may be attributed to the faculty member not allocating extra-credit to encourage student participation. The KAI uses 32 items to determine a total cognitive style score with a range of 32 to 160 and mean of 95. Lower scores indicated a more adaptive cognitive style and higher scores indicated a more innovative cognitive style. The most adaptive student in Class E had a total cognitive style score of 66 while the most innovative student scored 116. In Class E, the total cognitive style score mean was more adaptive (M=89.41, SD=14.95) than the general population mean reported by Kirton (1999). Likewise, construct mean scores indicated slight adaptiveness with respect to the general population mean (Kirton): sufficiency of originality was 2.00 points lower, efficiency was 1.94 points lower and rule/group conformity was 1.66 points lower. All construct scores of cognitive style were considered consistent with the total cognitive style score (Kirton). See Table 4-20 for findings concerning student cognitive style in Class E.

Table 4-20. Class E Student Mean Scores of Cognitive Style Constructs (n=32)

Construct	Mean	SD	Min	Max
Total cognitive style	89.41	14.95	66	116
Sufficiency of originality	39.00	7.87	25	56
Efficiency	17.06	3.65	10	26
Rule/Group conformity	33.34	7.30	20	46

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, high score equals more innovative.

There were 47 usable responses in determining total perceived stress for students of Class E. Level of stress was determined with the SSI using 22 items and a total range of 22 to 110. Students responded to a 5-point Likert scale with one indicating a low level of perceived stress and five indicating a high level of perceived stress. The student with the lowest level of perceived stress in Class E scored a 27 for total stress while the student with the highest level of stress scored a 66. In Class E, the total stress score mean was more than two standard deviations lower (M=42.89, SD=11.28, n=47) than the test sample used by Gadzella and Baloglu (2001). Constructs of student stress were also had lower mean scores than the test sample constructs (Gadzella and Baloglu) indicating lower levels of stress in Class E: frustrations was 8.21 points lower, conflicts was 3.75 points lower, pressures was 5.43 points lower, changes was 3.58 points lower and self-imposed was 5.19 points lower. It is important to remember that one item was removed from the frustrations construct prior to data collection; however it was still two standard deviations below the test sample (Gadzella and Baloglu). The other four construct mean scores of stress were more than one standard deviation less than the mean reported by Gadzella and Baloglu. See Table 4-21 for findings specific to stress scores of Class E.

Table 4-21. Class E Student Mean Scores of Stress Constructs

Construct	N	Mean	SD	Min	Max
Total stress	47	42.89	11.28	27	66
Frustrations	48	9.44	3.73	6	21
Conflicts	47	4.68	2.15	3	11
Pressures	48	8.65	3.25	4	17
Changes	48	3.58	1.23	3	7
Self-imposed	48	16.63	4.70	7	29

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

Class E had 48 usable MSLQ responses for determining student motivation. The MSLQ included six standardized constructs to provide a total motivation score range of 6 to 48 using 31 items. Students responded to 7-point Likert scale items with a value of one indicating low motivation and a value of seven indicating high motivation. In Class E, the student with the lowest level of motivation scored 19.90 while the student with the highest level of motivation scored 37.57. The Class E total motivation score (M=31.20, SD=3.79) was 0.74 points higher than the total mean score reported by Pintrich et al. (1991). Four motivation scale mean scores measured by the MSLQ were also higher than the test sample (Pintrich et al.) included extrinsic motivation (0.19 points higher), task value (0.04 points higher), control of learning (0.28 points higher) and self-efficacy (0.77 points higher). Motivation scales means in Class E that were lower than the test sample included intrinsic motivation (0.47 points lower) and test anxiety (0.06 points lower). All motivation scale mean scores measured in Class E were within one standard deviation of the test sample (Pintrich et al.). See Table 4-22 for reported motivation mean scores of Class E.

Table 4-22. Class E Student Mean Scores of Motivation Constructs (n=48)

Construct	Mean	SD	Min	Max
Total motivation	31.20	3.79	19.90	37.57
Intrinsic motivation	4.58	1.15	2.00	6.50
Extrinsic motivation	5.22	1.05	2.75	7.00
Task value	5.58	1.19	2.00	7.00
Control of learning	6.02	0.93	2.50	7.00
Self-efficacy	6.24	0.77	3.50	7.00
Test anxiety	3.57	1.30	1.00	6.60

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

There were 48 usable NSSE responses in Class E to determine level of student engagement. In this study, constructs of academic challenge, active and collaborative learning and student-faculty interaction formed a total student engagement score with a range of 24 to 96 using 24 items. Items were coded in order that lower scores signify less student engagement while higher scores signify more student engagement. The least engaged student in Class E had a total engagement score of 32 and the most engaged student scored 59 for total engagement. The Class E total student engagement mean score was 47.88 (SD=5.50), which was 15.86 points lower than the national reported college senior total engagement mean (Kuh et al., 2001) indicating a lower level of student engagement in Class E. Constructs of student engagement as measured with the NSSE were also lower than national average for seniors (Kuh, et al.): academic challenge was 9.14 points lower, active learning was 5.32 points lower and student-faculty interaction was 1.41 points lower. Examining the standard deviation of the construct scores measured in Class E, there was evidence that students in Class E were less academically challenged. See Table 4-23 for findings determining Class E student engagement.

Table 4-23. Class E Student Mean Scores of Engagement Constructs (n=48)

Construct	Mean	SD	Min	Max
Total student engagement	47.88	5.50	32	59
Academic challenge	24.04	3.60	15	32
Active learning	12.60	2.16	8	17
Student-faculty interaction	11.23	2.34	6	17

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class F

For Class F (N=150, n=115), there were 71 KAI responses that were usable for this study. The KAI determined students' cognitive style level with 32 items. The theoretical range of the KAI was 32 to 160 with a mean of 95 (Kirton, 1999). Items were coded in order that lower scores indicated a more adaptive cognitive style and higher scores indicated a more innovative cognitive style. For Class F, the total cognitive style mean (M=90.17, SD=16.28) was approximately 4.83 points lower than the general population reported by Kirton (1999). That is, responding students of Class F were slightly more adaptive. Cognitive style construct mean scores also indicated students were slightly more adaptive as those mean scores were lower than Kirton specifies. In Class F these constructs include: sufficiency of originality which was 1.80 points lower, efficiency which was 0.85 points lower and rule/group conformity which was 2.18 points lower than the general population (Kirton). All constructs of cognitive style were consistent with a total cognitive style score of 90.17 (Kirton). The most adaptive student in Course F had a total cognitive style score of 55 while the most innovative student scored 132 on the KAI. See Table 4-24 for findings specific to Class F student respondent cognitive style.

Table 4-24. Class F Student Mean Scores of Cognitive Style Constructs (n=71)

Construct	Mean	SD	Min	Max
Total cognitive style	90.17	16.28	55	132
Sufficiency of originality	39.20	8.89	21	60
Efficiency	18.15	4.01	10	26
Rule/Group conformity	32.82	6.81	17	51

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

Class F had 112 usable responses for determining classroom stress. Level of perceived stress was determined with the SSI. The SSI used 22 items incorporated into five constructs. Students completing the SSI responded to 5-point Likert scale items providing a range of 22 to 110 for a total perceived stress score. The Class F total mean stress score was 49.29 (SD=13.20) which was 20.80 points lower than results provided by Gadzella and Baloglu (2001). All constructs of perceived stress likewise indicated lower levels of student stress in Class F. Compared to the test sample mean (Gadzella and Baloglu), Class F mean scores of stress constructs frustrations was 6.63 points lower, conflicts was 3.26 points lower, pressures was 4.43 points lower, changes was 3.48 points lower and self-imposed was 2.92 points lower. Note that the stress construct frustrations had one item removed by the researcher prior to data collection. All the aforementioned stress constructs in Class F were more than one standard deviation lower than the test sample except the construct self-imposed stress. The student with the lowest level of perceived stress had a total SSI score of 25 while the student with the highest level of perceived stress scored 89. See Table 4-25 for specific findings regarding Class F stress.

Table 4-25. Class F Student Mean Scores of Stress Constructs (n=112)

Construct	Mean	SD	Min	Max
Total stress	49.29	13.20	25	89
Frustrations	11.02	4.02	6	27
Conflicts	5.17	2.64	3	12
Pressures	9.65	3.69	4	20
Changes	4.55	2.53	3	13
Self-imposed	18.90	4.60	8	28

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

Class F had 115 usable responses in determining student motivation. Motivation was determined with the MSLQ which consisted of 31 items forming six standardized motivation construct scores. Thus, the total motivation score range was 6 to 48 with higher scores signifying more motivation. The student in Class F with the lowest level of motivation had a total score of 20.40 points on the MSLQ, while the student with the highest level of motivation scored a total 37.35 points. In Class F, the total motivation mean (31.25, SD=3.71) was 0.79 points higher to that reported by Pintrich et al. (1991). Four of the motivation constructs had higher mean scores than reported by Pintrich et al. including extrinsic motivation (0.48 points higher), task value (0.26 points higher), control of learning (0.08 points higher) and self-efficacy (0.47 points higher). The other two constructs had lower mean scores than reported by Pintrech et al.: intrinsic motivation was 0.37 points lower and test anxiety was 0.14 points lower. All motivation construct means for Class F were within one standard deviation of the instrument norm (Pintrich et al.). See Table 4-26 for results of Class F student motivation.

Table 4-26. Class F Student Mean Scores of Motivation Constructs (n=115)

Construct	Mean	SD	Min	Max
Total motivation	31.25	3.71	20.40	37.35
Intrinsic motivation	4.68	1.10	1.25	6.75
Extrinsic motivation	5.51	0.96	2.25	7.00
Task value	5.80	1.13	1.33	7.00
Control of learning	5.82	0.88	3.75	7.00
Self-efficacy	5.94	0.80	3.75	7.00
Test anxiety	3.49	1.39	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

Class F had 115 usable responses to the NSSE for the purpose of determining level of student engagement. The NSSE comprised of 24, 4-point scale items providing for a possible total engagement score range of 24 to 96. Items were coded so as higher scores indicated higher levels of student engagement. The student with the lowest level of engagement had a total engagement score of 33 while the most engaged student had a score of 74. In Class F, respondents' total student engagement mean was 47.87 (SD=7.81), a total score that was 15.87 points lower than the national mean for college seniors (Kuh et al., 2001). Construct mean scores of student engagement in Class F were also lower than the average college senior (Kuh et al.): academic challenge was 7.32 points lower, active learning was 6.69 points lower and student-faculty interaction was 1.87 points lower. This provides evidence that students in Class F had lower levels of total student engagement with emphasis placed on the construct of academic challenge. See Table 4-27 for reported means of student engagement in Class F.

Table 4-27. Class F Student Mean Scores of Engagement Constructs (n=115)

Construct	Mean	SD	Min	Max
Total student engagement	47.87	7.81	33	74
Academic challenge	25.86	4.28	14	38
Active learning	11.23	2.98	7	22
Student-faculty interaction	10.77	3.09	6	20

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class G

In Class G (N=110, n=85), the researcher found 65 of the KAI scores acceptable for the purpose of determining students cognitive style. The KAI consists of 32 items and three constructs. It has a theoretical range of 32 to 160 and a mean of 95. Lower scores indicated that an individual was more adaptive while higher scores indicated that an individual was more innovative. The most adaptive student in Class G had a total KAI score of 52, while the most innovative student scored 125. Class G had a total cognitive style mean score of 93.42 (SD=15.04) which was 1.58 points lower than the general population according to Kirton (1999). All construct mean scores of student cognitive style in Class G were less than one point lower than the general population construct means (Kirton). See Table 4-28 for findings of student cognitive style in Class G.

Table 4-28. Class G Student Mean Scores of Cognitive Style Constructs (n=65)

Construct	Mean	SD	Min	Max
Total cognitive style	93.42	15.04	52	125
Sufficiency of originality	40.18	7.67	21	56
Efficiency	18.31	4.76	9	29
Rule/Group conformity	34.92	7.85	16	54

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

Considering student stress for Class G, there were 84 usable responses. Total perceived level of stress was determined with the SSI which used 22 items to form a total level of perceived stress range of 22 to 110 points. Students completed the SSI by responding to 5-point Likert scale items with one signifying low stress and five signifying high stress. The student with the lowest level of perceived stress in Class G had a total stress score of 27 points while the student with the highest level of perceived stress scored a total of 92 points on the SSI. The Class G total mean stress score was 18.55 points lower (M=51.54, SD=13.72) than the results published by Gadzella and Baloglu (2001). Construct mean scores of student stress also indicated lower student stress levels as mean scores were lower than that reported by Gadzella and Baloglu: frustrations was 6.14 points lower, conflicts was 2.51 points lower, pressures was 3.31 points lower, changes was 2.86 points lower and self-imposed was 3.65 points lower. Note that one item was removed from the frustrations stress construct prior to data collection. See Table 4-29 for reported mean scores of student stress of Class G.

Table 4-29. Class G Student Mean Scores of Stress Constructs (n=84)

Construct	Mean	SD	Min	Max
Total stress	51.54	13.72	27	92
Frustrations	11.51	3.93	6	23
Conflicts	5.92	2.61	3	13
Pressures	10.77	3.95	4	20
Changes	5.17	2.94	3	15
Self-imposed	18.17	4.70	6	30

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

Considering student motivation in Class G, 85 student responses were considered usable. The MSLQ was used to determine level of students' motivation and totaled 31 Likert scale items with a value range of 1 to 7. Constructs were standardized providing a total MSLQ range of 6 to 48. A response of one indicated low motivation and a response of seven indicated high motivation. The student in Class G with the least amount of motivation had a total score of 12.60 while the student with the most amount of motivation scored 39.15 for total motivation. For Class G, the total motivation score mean was 30.01 (SD 4.27), which was 0.45 points lower than the total motivation norm provided by Pintrich et al. (1991). In this class, three construct mean scores were lower than the norm construct mean scores (Pintrich et al.): intrinsic motivation was 0.45 points lower, task value was 0.43 points lower and control for learning was 0.28 points lower. The remaining three constructs were higher than the norm construct mean scores (Pintrich et al.) indicating slightly higher levels of motivation: extrinsic motivation was 0.07 points higher, self-efficacy was 0.51 points higher and test anxiety was 0.13 points higher. All motivation construct score means were within one standard deviation from the normalized values. See Table 4-30 for scale mean scores of Class G participants.

Table 4-30. Class G Student Mean Scores of Motivation Constructs (n=85)

Construct	Mean	SD	Min	Max
Total motivation	30.01	4.27	12.60	39.15
Intrinsic motivation	4.60	1.15	1.75	6.75
Extrinsic motivation	5.10	1.24	1.00	7.00
Task value	5.11	1.28	1.00	7.00
Control of learning	5.46	1.14	1.00	7.00
Self-efficacy	5.98	0.92	3.25	7.00
Test anxiety	3.76	1.39	1.00	6.80

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

There were 24 items used from the NSSE to determine level of student engagement in Class G. Students responded to items using a 4-point scale with one signifying low engagement and four signifying high engagement. The range for total student engagement was 24 to 96. The least engaged student in Class G had a total score of 34 points while the student with the highest level of engagement scored 79 on the NSSE. For Class G, there were 85 usable response providing a total engagement mean score of 50.05 (SD=7.80) which was 13.69 points lower than the national average for college seniors (Kuh et al., 2001). Note that the total scores for student engagement consisted of the three constructs measured in this study. Construct mean scores of student engagement were also lower than the national college senior average (Kuh et al.) as academic challenge was 8.66 points lower, active learning was 3.64 points lower and student-faculty interaction was 1.39 points lower. This provides evidence that students in Class G had low levels of academic challenge. See Table 4-31 for findings specific to Class G student engagement.

Table 4-31. Class G Student Mean Scores of Engagement Constructs (n=85)

Construct	Mean	SD	Min	Max
Total student engagement	50.05	7.80	34	79
Academic challenge	24.52	4.22	16	37
Active learning	14.28	2.99	9	25
Student-faculty interaction	11.25	2.87	6	18

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class H

For Class H (N=122, n=70), 50 KAI scores were found acceptable to determine students' cognitive style. The KAI has 32 items with a theoretical range of 32 to 160 and mean of 95. A lower score signifies a more adaptive cognitive style and a higher score signifies a more innovative cognitive style. The most adaptive student in Class H had a total cognitive style score of 67, while the most innovative student had a total cognitive style score of 135. The total cognitive style mean of Class H was 95.30 (SD=15.01) which was 0.30 points higher than the general population mean determined by Kirton (1999). Cognitive style construct score means were not more than one point lower or higher than norms reported by Kirton. See Table 4-32 for results specific to student cognitive style in Class H.

Table 4-32. Class H Student Mean Scores of Cognitive Style Constructs (n=50)

Construct	Mean	SD	Min	Max
Total cognitive style	95.30	15.01	67	135
Sufficiency of originality	41.24	8.65	22	60
Efficiency	18.64	3.75	10	27
Rule/Group conformity	35.42	7.04	19	51

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

There were 70 students providing usable scores to determine stress in Class H. Level of perceived stress was determined using the SSI, an instrument consisting of 22 items. Students responded to items with a 5-point Likert scale with one signifying low stress and five signifying high stress. In Class H, the student with the lowest level of perceived stress had a total score of 30 while the student with the highest level of perceived stress scored 78. Class H had a total student perceived stress mean of M=50.73 (SD=11.54) which was 19.36 points lower than the total stress mean reported by Gadzella and Baloglu (2001). Likewise, constructs of student stress had mean scores lower than normalized values (Gadzella and Baloglu): frustrations was 5.85 points lower, conflicts was 2.99 points lower, pressures was 4.29 points lower, changes was 3.61 points lower and self-imposed was 2.55 points lower. Note that the frustrations stress construct had one item removed prior to data collection which lowers the measured construct in the study in comparison to the work conducted by Gadzella and Baloglu. Interestingly in Class H, all stress construct mean scores were more than one standard deviation lower than test norms (Gadzella and Baloglu) except for the construct self-imposed stress. See Table 4-33 for Class H responses concerning student stress.

Table 4-33. Class H Student Mean Scores of Stress Constructs (n=70)

Construct	Mean	SD	Min	Max
Total stress	50.73	11.54	30	78
Frustrations	11.80	3.33	6	22
Conflicts	5.44	2.53	3	15
Pressures	9.79	3.08	4	17
Changes	4.42	2.24	3	12
Self-imposed	19.27	5.10	8	30

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

Considering student motivation in Class H, 70 responders returned usable MSLQ instruments. The MSLQ consists of 31 items which form six standardized constructs. Constructs were then summed to provide a total motivation score. Students respond to 7-point Likert scale items with one signifying low motivation and seven signifying high motivation. The least motivated student in Class H had a total motivation score of 17.25 while the most motivated student scored 39.80 for total motivation. In Class H, the total motivation mean was 31.05 (SD=4.60), which was 0.59 points higher than the normalized mean reported by Pintrich et al. (1991). None of the motivation construct mean scores were more than 0.50 points higher or lower than the normalized mean scores (Pintrich et al.). See Table 4-34 for reported mean scores of motivation of Class H.

Table 4-34. Class H Student Mean Scores of Motivation Constructs (n=70)

Construct	Mean	SD	Min	Max
Total motivation	31.05	4.60	17.25	39.80
Intrinsic motivation	4.85	1.16	2.00	7.00
Extrinsic motivation	5.50	1.10	2.50	7.00
Task value	5.56	1.18	1.50	7.00
Control of learning	5.69	1.02	1.75	7.00
Self-efficacy	5.48	1.08	2.25	7.00
Test anxiety	3.96	1.49	1.00	6.60

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

There were between 69 and 70 usable NSSE responses for determining student engagement in Class H. Twenty-four items were used from the NSSE to form three constructs and a total student engagement score. Items were coded with one indicating low engagement and four indicating high engagement using a 4-point scale. The total possible range for student engagement was 24 to 96. The student least engaged in Class H had a total engagement score of 34 while the student most engaged in the class scored 72 for total student engagement. For Class H, the total student engagement mean (M=52.28, SD=8.59, n=69) was 11.46 points lower than the national reported mean for college seniors (Kuh et al., 2001). Considering the constructs of student engagement measured in this study mean scores were also lower than the national mean for college seniors (Kuh et al.): academic challenge was 6.29 points lower, active learning was 4.38 points lower and student faculty interaction was 0.70 points lower. Examining the standard deviation of student engagement constructs measured in Class H, there is evidence that in Class H there was higher levels of student-faculty interaction and lower levels of academic challenge and academic learning. See Table 4-35 for reported student engagement mean scores of Class H.

Table 4-35. Class H Student Mean Scores of Engagement Constructs

Construct	N	Mean	SD	Min	Max
Total student engagement	69	52.28	8.59	34	72
Academic challenge	70	26.89	3.61	18	34
Active learning	70	13.54	3.28	9	23
Student-faculty interaction	69	11.94	3.60	6	21

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Class I

For Class I (N=100, n=77), there were 60 usable KAI responses to determine students' cognitive style. The KAI has 32 items providing for a theoretical range of 32 to 160 and a mean of 95. Lower scores indicated that a person was more adaptive while higher scores indicated that a person was more innovative. The most adaptive student in Class I had a total cognitive style score of 50 while the most innovative student had a total score of 124 on the KAI. For Class I, the total cognitive style mean was 92.90 (SD=14.25), which was 2.10 points lower than the general population reported by Kirton (1999). Comparing Class I cognitive style construct mean scores to the general population construct mean scores found sufficiency of originality 0.13 points higher, efficiency 1.37 points lower and rule/group conformity 0.87 points lower. However all cognitive style construct scores were consistent with a total score of 92.90 (Kirton). See Table 4-36 for reported cognitive style scale means determined for Class I.

Table 4-36. Class I Student Mean Scores of Cognitive Style Constructs (n=60)

Construct	Mean	SD	Min	Max
Total cognitive style	92.90	14.25	50	124
Sufficiency of originality	41.13	7.61	25	58
Efficiency	17.63	4.77	7	29
Rule/Group conformity	34.13	7.42	18	53

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

Class I had 77 acceptable responses to the SSI in determining student perceived stress. The SSI used 22, 5-point Likert scale items to which students responded with a one to signify low stress and five to signify high stress. The possible range for total student stress was 22 to 110. In Class I, the student with the least amount of perceived stress had a score of 29 while the student with the highest level of perceived stress had a total score of 80. For Class I, the total mean stress score was 49.82 (SD=11.96) which was 20.27 points lower than the sample findings of Gadzella and Baloglu (2001). Construct scores of student stress were also lower than the test sample (Gadzella and Baloglu): frustrations was 6.77 points lower, conflicts was 2.49 points lower, pressures was 4.26 points lower, changes was 3.39 points lower and self-imposed was 3.27 points lower. The frustrations construct was more than one standard deviation lower than the norm, however one item was removed from this summative scale prior to data collection. The student stress constructs conflicts, pressures and changes were also one standard deviation lower than the norm, however self-imposed stress was within the instrument reported standard deviation. See Table 4-37 for findings specific to Class I respondents' stress.

Table 4-37. Class I Student Mean Scores of Stress Constructs (n=77)

Construct	Mean	SD	Min	Max
Total stress	49.82	11.96	29	80
Frustrations	10.88	4.15	6	22
Conflicts	5.94	2.58	3	14
Pressures	9.82	2.87	4	16
Changes	4.64	2.35	3	14
Self-imposed	18.55	4.87	7	27

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

For motivation, 77 responses were considered usable. The MSLQ was used to determine motivation and consisted of six standardized constructs and totaled 31 items. The possible range for total motivation was 6 to 48. The least motivated student of Class I had a total score of 19.76 while the most motivated student scored 37.75 points for total motivation. In Class I, the total motivation mean was 29.86 (SD=3.74) which was 0.60 points lower than the total motivation mean reported by Pintrich et al. (1991). Construct scores of student motivation in Class I varied positively and negatively but differed less than one point from the norm (Pintrich et al.). Specifically compared to the norm, intrinsic motivation was 0.74 points lower, extrinsic motivation was 0.35 points higher, task value was 0.69 points lower, control of learning was 0.21 points lower, self-efficacy was 0.66 points higher and test anxiety was 0.03 points higher. See Table 4-38 for reported findings of motivation in Class I.

Table 4-38. Class I Student Mean Scores of Motivation Constructs (n=77)

Construct	Mean	SD	Min	Max
Total motivation	29.86	3.74	19.76	37.75
Intrinsic motivation	4.31	1.00	1.50	6.25
Extrinsic motivation	5.38	1.15	2.50	7.00
Task value	4.85	1.22	1.00	7.00
Control of learning	5.53	0.99	2.50	7.00
Self-efficacy	6.13	0.87	3.75	7.00
Test anxiety	3.66	1.66	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

Student engagement was determined using 24 items from the NSSE which formed three constructs. The possible range for total engagement was 24 to 96. Items were coded with one signifying low engagement and four signifying high engagement. The least engaged student of Class I had a total engagement score of 36 points while the most engaged student of the class scored 71 points for total engagement. Class I had 76 responses in determining student total engagement. The total engagement mean was 51.58 (SD=7.72) which was 12.16 points lower than the national mean for college seniors (Kuh et al, 2001). Construct scores of student engagement were also lower than the national average for college seniors (Kuh et al.): academic challenge was 7.69 points lower, active learning was 4.06 points lower and student-faculty interaction was 0.43 points lower. This provides evidence that Class I students had lower levels of academic challenge and active learning, but had an average level of student-faculty interaction. See Table 4-39 for reported construct scores of Class I student engagement.

Table 4-39. Class I Student Mean Scores of Engagement Constructs

Construct	N	Mean	SD	Min	Max
Total student engagement	76	51.58	7.72	36	71
Academic challenge	76	25.49	4.47	17	36
Active learning	77	13.86	2.65	9	22
Student-faculty interaction	77	12.21	2.53	7	19

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

All Students

Students were grouped together (N=993, n=716) to determine values of student cognitive style, stress, motivation and engagement for all students participating in the study. There were 511 acceptable KAI responses to be used in determining student cognitive style. There are 32 items in the KAI providing a theoretical range of 32 to 160 with a mean of 95. Lower scores indicated an individual was more adaptive while higher scores indicated an individual was more innovative. The most adaptive student in this study had a total KAI score of 46 while the most innovative student had a cognitive style score of 142. The mean of the total group was 93.28 (SD=15.95) which was 1.72 points lower than the general population defined by Kirton (1999). Likewise, construct mean scores for cognitive style also indicated slight adaptiveness as scores were lower than the general population mean (Kirton): sufficiency of originality was 0.19 points lower, efficiency was 1.11 points lower and rule/group conformity was 0.42 points lower. All construct scores of cognitive style were consistent with a total cognitive style score of 93.28 (Kirton). See Table 4-40 for the total student cognitive style for all participants of this study.

Table 4-40. All Student Mean Scores of Cognitive Style Constructs (n=511)

Construct	Mean	SD	Min	Max
Total cognitive style	93.28	15.95	46	142
Sufficiency of originality	40.81	8.19	21	62
Efficiency	17.89	4.58	7	32
Rule/Group conformity	34.58	7.52	16	58

Note. Cognitive style measured by the KAI with 32 items. Theoretical range: Total (32-160), Sufficiency of Originality (13-65), Efficiency (7-35) and Rule/Group Conformity (12-60). Coded: lower score equals more adaptive, higher score equals more innovative.

There were 697 usable SSI scores in determining total perceived stress for all participants. The SSI consisted of 22 summated 5-point Likert scale items coded as one signifying low stress and five signifying high stress. The student with the lowest level of perceived stress in this study scored 25 while the student with the highest level of perceived stress scored 94 for total perceived stress. The total stress mean was 51.35 (SD=12.91), which was 18.74 points lower than the reported norm (Gadzella & Baloglu, 2001). Construct mean scores of student stress were also lower than the norm (Gadzella & Baloglu): frustrations was 5.96 points lower, conflicts was 2.82 points lower, pressures was 3.77 points lower, changes was 3.35 points lower and self-imposed was 2.72 points lower. Note that one item was removed from the frustrations construct prior to data collection, which was discussed in chapter 3. This modification affects the comparison between norm values and the assessment of student stress in this study by lowering the summated scale for the frustrations stress construct as well as the total stress score. Of the constructs assessing student stress, all were more than one standard deviation lower than norm values except for self-imposed stress. See Table 4-41 for findings of stress of all participants of this study.

There were 706 usable MSLQ scores for determining student motivation of all participants. The MSLQ consists of six standardized constructs summed to provide a total

Table 4-41. All Student Mean Scores of Stress Constructs

Construct	N	Mean	SD	Min	Max
Total stress	697	51.35	12.91	25	94
Frustrations	702	11.69	4.23	6	29
Conflicts	700	5.61	2.59	3	15
Pressures	702	10.31	3.57	4	20
Changes	702	4.68	2.43	3	15
Self-imposed	703	19.10	4.69	6	30

Note. Perceived stress was measured with the SSI using 22 summated items. Possible range: Total (22 to 110), Frustrations (6-30), Conflicts (3-15), Pressures (4-20), Changes (3-15), Self-imposed (6-30). Coded: higher score equals higher level of perceived stress.

motivation score and possible range of 6 to 48. The instrument uses 31, 7-point Likert scale items. The least motivated student participating in the study had a total score of 12.60 while the most motivated student in the study scored 39.80 in determining total motivation. Considering all participating students, the total mean motivation score was 30.81 (SD=4.04, n=706), which was 0.35 points higher than the norm reported by Pintrich et al. (1991). Comparing constructs of the mean scores with norm values (Pintrich et al.), motivation constructs of participating students varied positively and negatively within one standard deviation of the norm construct value. Specifically participating students reported the following construct mean scores with respect to values reported by Pintrich et al.: intrinsic motivation was 0.44 points lower, extrinsic motivation was 0.39 points higher, task value was 0.23 points lower, control of learning was .02 points higher, self-efficacy was 0.41 points higher and test anxiety was 0.20 points higher. See Table 4-42 for findings specific to student stress of all participants.

For total student engagement there were 712 responses to the NSSE considered usable for this study. Twenty-four items were used from the NSSE to measure total student engagement. To complete the NSSE, students completed items using a 4-point scale with one signifying low engagement and four signifying high engagement. The

Table 4-42. All Student Mean Scores of Motivation Constructs

Construct	N	Mean	SD	Min	Max
Total motivation	706	30.81	4.04	12.60	39.80
Intrinsic motivation	709	4.61	1.10	1.25	7.00
Extrinsic motivation	708	5.42	1.10	1.00	7.00
Task value	707	5.31	1.26	1.00	7.00
Control of learning	709	5.76	0.99	1.00	7.00
Self-efficacy	707	5.88	0.97	2.25	7.00
Test anxiety	708	3.83	1.48	1.00	7.00

Note. Motivation was measured with the MSLQ using 31 items with standardized constructs. Possible range: Total motivation (6-48), all constructs (1-7). Coded: higher score equals higher level of motivation.

least engaged student in this study had a total score of 32 while the most engaged student had a total engagement score of 80. The total mean for student engagement of all students was 49.58 (SD=8.20, n=712) which was 14.16 points lower than the national mean for college seniors (Kuh et al., 2001). Constructs of student engagement were also lower than the national mean for college seniors (Kuh et al.): academic challenge was 7.99 points lower, active learning was 5.26 points lower and student-faculty interaction was 0.90 points lower. These construct mean score differences provide evidence that student respondents had low levels of academic challenge and active learning, but an average level of student-faculty interaction. See Table 4-43 for specific findings regarding student engagement of all participants of this study.

Table 4-43. All Student Mean Scores of Engagement Constructs

Construct	N	Mean	SD	Min	Max	Range
Total student engagement	712	49.58	8.20	32	80	48
Academic challenge	713	25.19	4.33	14	38	24
Active learning	714	12.66	3.22	7	25	18
Student-faculty interaction	713	11.74	3.08	6	22	16

Note. Engagement was measured by the NSSE with 24 summated items. Possible range: Total Engagement (24-96), Academic Challenge (11-44), Active Learning (7-28), Student-Faculty Interaction (6-24). Coded: higher score equals higher level of engagement.

Comparisons Between Classes

The literature provided evidence that students had more stress in courses requiring characteristics of adaptiveness (Puccio, Talbot, & Joniak, 1993). To test this, a one-way ANOVA was conducted to examine significant differences of student stress levels between students taught by adaptive faculty members (Classes A, B, & C), middle score faculty members (Classes D, E & F) and innovative faculty members (Classes G, H & I). With total stress designated as the dependent variable, a significant difference was found between the three groups (F=8.92, p=.00). A Bonferroni post-hoc test was conducted to further examine between group differences. The adaptive teacher group had student stress scores (M=54.51) that were significantly higher than the student stress scores of the middle score teacher group (M=49.49, p=.00) and significantly higher than student stress scores of the innovative teacher group (M=50.72, p=.01). However, there was no significant difference between stress scores for students in the middle score teacher group and the innovative teacher group (p=.87). This finding confirms the results found by previous research (Puccio et al., 1993)

A one-way ANOVA was conducted to examine significant differences of student motivation scores between courses taught by adaptive teacher group (Classes A, B & C), courses taught by the middle score teacher group (Classes D, E & F) and courses taught by the innovative teacher group (Classes G, H & I). With total motivation as the dependent variable, a significant difference was found between the three groups (F=10.41, p=.00). A Bonferroni post-hoc test was conducted to further examine the significant differences between each of the three groups. Students in the innovative teacher group had total motivation scores (M=30.27) that were significantly lower than student motivation scores in the middle score teacher group (M=31.69, p=.00), a difference of 1.42 points on a 36 point scale. Student respondents in the adaptive teacher group had motivation scores (M=30.28) that were also significantly lower than motivation scores in the middle score teacher group (p=.00). There was no significant difference for student motivation scores between the adaptive teacher group and the innovative teacher group (p=.99). This indicated that in these classes, students were less motivated in classes taught by more adaptive faculty members and more innovative faculty members.

To determine if student engagement varied among adaptive faculty members and innovative faculty members, a one-way ANOVA was conducted to examine significant differences between an adaptive teacher group (Classes A, B & C), a middle score teacher group (Classes D, E & F) and an innovative teacher group (Classes G, H & I). Using total student engagement as the dependent variable, a significant difference was found between groups (F=9.61, p=.00). A Bonferroni post-hoc test was conducted to further examine group differences. Students in the innovative teacher group had total engagement scores (M=51.22) significantly higher than engagement scores of students enrolled in the middle score teacher group (M=48.05, p=.00). However, students in the innovative teacher group did not have significantly higher engagement scores than students in the adaptive teacher group (M=49.75, p=.17). There was no significant difference for student engagement scores between the middle score teacher group and the adaptive teacher group (p=.07). This finding indicated that students in these classes taught by innovative faculty members tended to have higher engagement scores.

In the nine classes utilized in this study, total student engagement mean scores were lower than the national average for college seniors (Kuh et al., 2001). However, only 41.06% of the total respondents were seniors. It may be that freshman, sophomore and junior students lowered student engagement mean scores in each of the classes since college freshman tend to have lower levels of engagement than college seniors (Kuh et al.). A one-way ANOVA was conducted to examine if significant differences of student engagement scores existed between college freshman, sophomores, juniors and seniors. Significant differences were found among the four groups of students ($F=2.75$, $p=.04$). However the assumption of homogeneity of variance was not met as Levene's Test of Equality of Error Variances indicated to reject the null hypothesis, ($F=3.00$, $p=.03$) and conclude that the four groups of students were not equal regarding variance. Because variances among the four groups of students were not homogenous and sample sizes differed among the four groups, a Games-Howell post-hoc test was conducted to account for these differences. In this analysis, college senior student engagement scores were not significantly different from junior student engagement scores ($p=.07$), sophomore student engagement scores ($p=.99$) or freshman student engagement scores ($p=.87$). The researcher concluded that low scores of student engagement found in this study were not attributed to college classification.

Summary of Findings for Objective Two

In determining students' cognitive style seven classes had total score means that were slightly adaptive (below the mean of 95), one class had total cognitive style score means that were slightly innovative (above the mean of 95), and one class had a cognitive style score approximating 95. Although self-selected courses may have a tendency to be more adaptive or more innovative, the total mean cognitive style scores of these classes were indicative of the percentage of females in the course. Kirton (1999) states that the total cognitive style mean score for females is 90, which is five points lower than the general population mean. In this study, the overall cognitive style mean score for females was 91.49 (n=339), while the cognitive style mean score for males was 96.81 (n=170). Therefore, classes with a larger percentage of females tend to have more adaptive mean scores. Note that Class C was 72% male and had the most innovative total cognitive style mean score (M=100.86) of the nine classes examined.

In all classes, cognitive style construct mean scores were consistent for the respective total score (Kirton, 1999). However, it is interesting to note that the efficiency cognitive style construct was the most adaptive construct in Classes A, B, C, D, H and I. Among these six classes the difference between the efficiency cognitive style construct and the next most adaptive cognitive style construct ranged from .60 (Class H) to 2.00 (Class D).

Non-response error limited the findings of this study as not every student completed all four instruments. Particularly, non-response error may be higher in Class E given that less than 50% of the students responded. The low response rate may be attributed to the faculty member not providing extra-credit points to participating students. No assessment for non-response error was conducted as explained in chapter 3.

The KAI suffered a 29% mortality rate in this study. The KAI was scored by the researcher with the guidelines presented by Kirton (1999). Many of these scores were discarded as students tended to answer most of the items as easy or very easy indicating that all tasks were easy to perform over a long period of time. This left few or no marks to signify a specific task as hard or very hard to exhibit over a long period of time. Because everyone has difficulty with some aspect of solving a problem, students marking all items as easy or very easy were not providing a true measure of cognitive style, but were confounding the measure with cognitive level (Kirton).

For student stress, there was a tendency for perceived stress mean scores to be lower than the reported norm by Gadzella and Baloglu (2001). One small contributor to this was the removal of one frustrations stress construct item prior to data collection. Another contributor may be the time of year at which the instrument was administered. There was no indication of the semester that Gadzella and Baloglu conducted their study which provided instrument norms, but Shields (2001) found that student stress decreases during the second semester of the academic year. This may be why student stress mean scores in this study were low when compared to Gadzella and Baloglu as these data were collected during the spring semester.

A one-way ANOVA was conducted to examine significant differences of student stress levels between students taught by adaptive faculty members, middle score faculty members and innovative faculty members. With total stress designated as the dependent variable, a significant difference was found between the three groups ($F=8.92$, $p=.00$). A Bonferroni post-hoc test was conducted to further examine between group differences. The adaptive teacher group had student stress scores ($M=54.51$) that were on average significantly higher than the student stress scores of the middle score teacher group ($M=49.49$, $p=.00$) and on average significantly higher than student stress scores of the innovative teacher group ($M=50.72$, $p=.01$). This finding confirms the results found by previous research (Puccio, Talbot, & Joniak, 1993) and indicates a relationship between student stress and courses taught by adaptive faculty members.

The MSLQ was used to determine level of student motivation in each course. Throughout the nine courses total motivation means ranged from 29.31 (Class A) to 32.42 (Class D) with no construct mean score in any class exceeding one standard deviation from the norm (Pintrich et al., 1991).

A one-way ANOVA was conducted to examine significant differences of student motivation scores between courses taught by adaptive teacher group, middle score teacher group and innovative teacher group. With total motivation as the dependent variable, a significant difference was found between the three groups ($F=10.41$, $p=.00$). A Bonferroni post-hoc test was conducted to further examine the significant differences between each group. Students in the innovative teacher group had a mean score of 30.27 which was significantly lower than student motivation mean scores in the middle score teacher group ($M=31.69$, $p=.00$), but not significantly lower than the adaptive teacher group ($M=30.28$, $p=.99$). The evidence suggests that students were less motivated in classes taught by more adaptive faculty members and more innovative faculty members.

Mean scores of total student engagement were low compared to national score means of college seniors. Kuh (2001) states that engagement scores tend to increase with college classification. However, this was not found to be true in this study as no significant differences were found between student engagement scores of seniors and engagement scores of freshman, sophomores or juniors. That is, there was no evidence of this relationship among these data.

A one-way ANOVA was conducted to examine significant differences of student engagement between the adaptive teacher group, middle score teacher group and innovative teacher group. A significant difference was found between groups ($F=9.61$, p=.00). A Bonferroni post-hoc test was conducted to further examine group differences. Students in the innovative teacher group had total engagement scores (M=51.22) significantly higher than engagement scores of students enrolled in the middle score teacher group (M=48.05, p=.00). This finding indicated that students in these classes taught by innovative faculty members tended to have higher engagement scores.

See Table 4-44 for a summary of student total mean scores for cognitive style, stress, motivation and student engagement per class.

Table 4-44. Summary of Classes Regarding Student Cognitive Style, Stress, Motivation and Engagement Mean Scores

Course	Total Cognitive Style Mean	Total Stress Mean	Total Motivation Mean	Total Engagement Mean
Class A	90.60	52.44	29.31	48.43
Class B	92.43	55.85	30.65	46.01
Class C	100.86	54.91	30.86	54.73
Class D	93.63	52.80	32.42	48.33
Class E	89.41	42.89	31.20	47.88
Class F	90.17	49.29	31.25	47.87
Class G	93.42	51.54	30.01	50.05
Class H	95.30	50.73	31.05	52.28
Class I	92.90	49.82	29.86	51.58
All Classes	93.28	51.35	30.81	49.58

Objective Three

Determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students.

Student and faculty member participants in each class were asked to respond to the KAI to determine their cognitive style. The faculty member's total cognitive style score and construct scores were subtracted from students' total cognitive style and construct scores which provided cognitive style gap scores for each individual student. Once cognitive style gap scores were calculated between each student and their respective teacher, Pearson's correlation coefficient was used to determine relationships between cognitive style gap and student stress, motivation, engagement and selected demographic variables. Gender was the only categorical variable and was dummy coded one for males and two for females. Miller (1998) provided a classification for determining the magnitude of a correlation with r=0.01 to 0.09 described as negligible, r=0.10 to 0.29 described as low, r=0.30 to 0.49 described as moderate, r=0.50 to 0.69 described as substantial, r=0.70 to 0.99 described as very high, and r=1.0 described as perfect.

Class A

There were 58 usable KAI responses for determining cognitive style gap of students in Class A. The faculty member had a total cognitive style score of 64, indicating that she was more adaptive. The reported total cognitive style gap mean in Class A was 26.60 (SD=18.00), indicating that students on average were 26.60 points more innovative than the faculty member. In Class A, the most adaptive student had a 13 point lower cognitive style score than the faculty member's cognitive style score. The most innovative student in the class scored 61 points higher than the faculty member for the total KAI score. Note that stress becomes apparent to individuals with a cognitive style gap at 20 points or higher (Kirton, 2003). In Class A, 38 (65.5%) of the 58 student respondents had a cognitive style gap at or above 20 points. See Table 4-45 for findings specific to cognitive style gap of Class A.

Once cognitive style gaps were calculated, Pearson's correlation coefficient was used to find relationships with total scores and constructs scores of stress, motivation, engagement and demographics.

Table 4-45. Class A Student Mean Scores of Cognitive Style Construct Gaps (n=58)

Construct	Mean	SD	Min	Max
Total cognitive style gap	26.60	18.00	-13	61
Sufficiency of originality gap	10.62	8.40	-7	29
Efficiency gap	6.90	4.72	-2	18
Rule/Group conformity gap	9.09	8.45	-8	26

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Examining internal correlations for the KAI, very high correlations were found between the total cognitive style gap score and the sufficiency of originality cognitive style gap (r=.87, p<.05) as well as the rule/group conformity gap (r=.93, p<.05). Sufficiency of originality gap was very highly correlated with rule/group conformity gap (r=.70, p<.05). However, efficiency cognitive style gap had a substantial correlation with total cognitive style gap (r=.66, p<.05), but only a moderate correlation with sufficiency of originality (r=.36, p<.05). This data suggests that in Class A, sufficiency of originality gap and rule/group conformity gap are closely associated, while the efficiency cognitive style gap is less associated with total cognitive style gap. Note that direction and degree of construct gap correlations were dependent on cognitive style scores of faculty member in relation to students' cognitive style mean scores. Another explanation to the lower efficiency gap correlations may include the lower post-hoc reliability coefficient for the efficiency scale.

Total cognitive style gap had a significant moderate relationship with total stress (r=.34, p<.05), indicating an association with an innovative cognitive style gap and higher total stress scores. Also note that efficiency cognitive style gap had moderate correlations with stress constructs: frustrations (r=.37, p<.05), conflicts (r=.35, p<.05), and pressure (r=.38, p<.05). Furthermore, rules group/conformity cognitive style gap had moderate correlations with stress constructs: frustrations ($r=.34$, $p<.05$), and changes ($r=.33$, $p<.05$). These findings indicate a relationship between higher stress construct scores and both constructs, efficiency cognitive style gap and rule/group conformity cognitive style gap.

Total cognitive style gap had a significant low relationship with total motivation ($r=-.29$, $p<.05$). This indicated that in this course taught by an adaptive faculty member, students' innovative total cognitive style gap was associated with students' lower motivation scores. Also of interest, efficiency cognitive style gap scores had moderate correlations with total motivation ($r=-.33$, $p<.05$), extrinsic motivation ($r=-.36$, $p<.05$) and self-efficacy ($r=-.44$, $p<.05$) indicating that a higher innovative gap was associated with lower stress among these constructs. Considering the rule/group conformity cognitive style gap, moderate correlations were found with total motivation ($r=.31$, $p<.05$) and task motivation ($r=-.33$, $p<.05$) signifying that higher innovative rule/group conformity gaps were associated with lower motivation levels among these constructs in Class A.

Total cognitive style gap had a negligible correlation with total engagement ($r=.04$, $p>.05$) signifying little association between the two variables. No other significant correlations were found between constructs of cognitive style gap and constructs of student engagement.

For internal correlations of the SSI, student total stress significantly correlated with stress constructs: frustrations ($r=.83$, $p<.05$), conflicts ($r=.59$, $p<.05$), pressures ($r=.73$, $p<.05$), changes ($r=.48$, $p<.05$) and self-imposed ($r=.60$, $p<.05$). As expected, these correlations indicated that the scales used to measure stress in this study were moderately to highly related with the total stress measured by the SSI.

Total stress scores of students were negatively correlated with self-efficacy (r=-.37, p<.05) indicating lower self-efficacy was associated with higher stress in this class. Self-efficacy was also negatively correlated with stress constructs frustrations (r=-.40), pressures (r=-.41, p<.05) and changes (r=-.31, p<.05). These correlations also indicated that low self-efficacy was associated with higher stress in this class.

Examining student stress and student engagement, a moderate correlation was found between total stress and total student engagement (r=.37, p<.05). Total stress was also correlated with the engagement constructs: academic challenge (r=.30, p<.05) and student-faculty interaction (r=.35, p<.05). The stress construct frustrations moderately correlated with total student engagement (r=.38, p<.05), academic challenge (r=.36, p<.05) and active learning (r=.32, p<.05). All of these correlations provide evidence that associations exist between students' higher stress scores and students' higher engagement scores.

For Class A, the MSLQ was used to measure motivation of students. Moderate to very high correlations were found between the total motivation score and construct scores: intrinsic motivation (r=.73, p<.05), extrinsic motivation (r=.62, p<.05), task motivation (r=.77, p<.05), control of learning (r=.31, p<.05) and self-efficacy (r=.33, p<.05). However, the correlation between total motivation scores and test anxiety scores was not significant, but did have a low correlation (r=.24, p>.05). The data suggests that constructs used to measure motivation were related to the total motivation score, less test anxiety.

Examining correlations between motivation and engagement in Class A, no significant relationship was found with total motivation and total engagement (r=.24, p>.05). However extrinsic motivation was moderately correlated with total engagement (r=.32, p<.05) and student-faculty interaction (r=.43, p<.05). Also task motivation was moderately correlated with total engagement (r=.31, p<.05) and academic challenge (r=.33, p<.05). These correlations indicated that higher scores in student motivation were associated with higher scores in student engagement among the aforementioned constructs. However, a correlation was found in the opposite direction when considering motivation constructs control of learning and self-efficacy. Control of learning was negatively correlated with total student engagement (r=-.32, p<.05) and academic challenge (r=-.30, p<.05). These two correlations indicated that higher levels of student control of learning were associated with lower levels of student engagement and lower levels of academic challenge. Self-efficacy was also negatively correlated with active learning (r=-.32, p<.05) which indicated that lower levels of student self-efficacy were associated with higher levels of active learning.

Considering the internal correlations for the NSSE found in this class, very high correlations existed between total student engagement and the constructs: academic challenge (r=.79, p<.05), active learning (r=.85, p<.05) and student-faculty interaction (r=.76, p<.05). These correlations signify a close association between these constructs. See Table 4-46 for relationships between cognitive style gap, stress, motivation and engagement.

Table 4-46. Class A Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=56)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.87*	--											
3. Gap-efficiency	.66*	.32*	--										
4. Gap-rule	.93*	.70*	.54*	--									
5. Total stress	.34*	.24	.37*	.29*	--								
6. Frustrations	.34*	.20	.37*	.34*	.83*	--							
7. Conflicts	.21	.14	.35*	.13	.59*	.47*	--						
8. Pressures	.29*	.14	.38*	.28*	.73*	.57*	.19	--					
9. Changes	.35*	.28*	.28*	.33*	.48*	.30*	.20	.36*	--				
10. Self-imposed	.01	.10	-.09	-.03	.60*	.28*	.18	.24	.05	--			
11. Total motivation	-.29*	-.13	-.33*	-.31*	-.06	-.06	-.18	-.16	-.27*	.30*	--		
12. Intrinsic motivation	-.13	.01	-.12	-.22	-.07	-.12	-.08	-.23	-.01	.18	.73*	--	
13. Extrinsic motivation	-.31*	-.20	-.36*	-.26	.02	.02	-.04	.01	-.10	.10	.62*	.22	--
14. Task motivation	-.28*	-.19	-.15	-.33*	-.06	.06	-.08	-.12	-.21	.04	.77*	.69*	.37*
15. Control of learning	.01	.06	-.11	.02	-.17	-.19	-.03	-.24	-.39*	.15	.31*	.07	.12
16. Self-efficacy	-.13	.01	-.44*	-.05	-.37*	-.40*	-.29*	-.41*	-.31*	.11	.33*	.06	.26
17. Test anxiety	-.09	-.05	-.01	-.14	.27*	.22	-.11	.27*	.02	.34*	.45*	.24	.11
18. Total Engagement	.04	-.02	.12	.04	.37*	.38*	.19	.29*	.18	.16	.24	.27*	.32*
19. Academic Challenge	.16	.14	.17	.12	.30*	.36*	.16	.29*	.17	-.01	.20	.28*	.12
20. Active Learning	-.02	-.12	.07	.04	.25	.32*	.10	.17	.02	.13	.13	.17	.23
21. Faculty Interaction	-.06	-.09	.03	-.06	.35*	.21	.20	.23	.23	.28*	.25	.17	.43*
M	26.8	10.8	6.77	9.25	53.0	12.1	5.95	11.8	4.77	18.4	154	15.9	21.2
SD	18.0	8.32	4.70	8.32	10.4	3.82	2.64	3.34	1.92	3.80	17.4	4.26	4.10

Note. Cases excluded listwise. All constructs coded: high scores equals increased levels. * signifies p<.05

Table 4-46 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	-.05	--						
16. Self-efficacy	.11	.44*	--					
17. Test anxiety	.24	-.21	-.36*	--				
18. Total Engagement	.31*	-.32*	-.29*	.27*	--			
19. Academic Challenge	.33*	-.30*	-.24	.24	.79*	--		
20. Active Learning	.20	-.24	-.32*	.19	.85*	.51*	--	
21. Faculty Interaction	.20	-.22	-.13	.21	.76*	.32*	.54*	--
M	27.2	23.3	48.6	17.9	49.0	25.2	12.0	11.9
SD	7.01	3.57	6.23	6.81	7.37	3.40	2.92	2.93

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies $p<.05$

Demographic questions were asked of students regarding age, gender, college classification and number of classes taken similar to the content of Class A. The variable student age was found positively associated with total cognitive style gap ($r=.31$, $p<.05$) indicating that younger students were associated with smaller cognitive style gaps. Student gender was found moderately related with total cognitive style gap ($r=-.32$, $p<.05$), indicating that being female was related to lower total cognitive style gap with the faculty member. Considering the number of collegiate courses taken related to the subject area of Class A, a correlation was found with total engagement ($r=.39$, $p<.05$), indicating that more courses relevant to the subject matter of Class A was coupled with higher engagement. Also, college classification had a moderate association ($r=.30$, $p<.05$) with total student engagement, indicating that a higher class rank was associated with higher engagement.

Class B

For cognitive style gap of Class B, there were 46 usable responses. The instructing faculty member of Class B scored 68 on the KAI providing evidence that his cognitive style was more adaptive. Cognitive style gap was calculated by subtracting the faculty member cognitive style score from the student cognitive style score. The reported mean of total cognitive style gap between the faculty member and the students was 24.43 (SD=15.05) indicating that students on average were 24.43 points more innovative than the faculty member. A cognitive style gap of 20 points has been identified as the threshold at which stress becomes apparent to involved individuals (Kirton, 2003). There were 29 (63.0%) students with a cognitive style gap of 20 points or higher with the faculty member in Class B. The most adaptive student scored 22 points less than this adaptive faculty member in determining total cognitive style. The most innovative student in the class had a 48 point gap in the direction of innovation with the faculty member. See Table 4-47 for findings of calculated cognitive style gap scores.

Table 4-47. Class B Student Mean Scores of Cognitive Style Construct Gaps (n=46)

Construct	Mean	SD	Min	Max
Total cognitive style gap	24.43	15.05	-22	48
Sufficiency of originality gap	15.39	8.45	-3	34
Efficiency gap	-1.59	4.65	-12	9
Rule/Group conformity gap	10.63	6.68	-7	23

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

After calculating cognitive style gaps between the faculty member and individual students, Pearson's correlation coefficient was used to determine relationships among total and construct scores of stress, motivation and engagement.

Internal correlations of the KAI found that total cognitive style gap had very high correlations with sufficiency of originality gap ($r=.86$, $p<.05$), and rule/group conformity gap ($r=.86$, $p<.05$). A substantial correlation was found between sufficiency of originality gap and rule/group conformity gap ($r=.63$, $p<.05$) providing evidence that in Class B, a strong relationship existed between these two construct gaps. However, efficiency gap only had a moderate correlation with total cognitive style gap ($r=.43$, $p<.05$) a negligible correlation with sufficiency of originality ($r=.05$, $p>.05$) and rule/group conformity ($r=.20$, $p>.05$). This indicated that efficiency gap was not as closely associated with the two other cognitive style constructs which coincides with findings from cognitive style gap construct mean scores. For example, the mean score for efficiency gap was -1.59 whereas sufficiency of originality gap mean and the rule/group conformity gap mean was 15.39 and 10.63 respectively. Also note the lower post-hoc reliability of the efficiency construct.

For Class B, there was a negligible correlation between total cognitive style gap and total student stress ($r=-.01$, $p>.05$). Additionally, no significant correlations were found between cognitive style gap constructs and stress constructs.

Interestingly, the cognitive style gap construct efficiency had a moderate correlation with total motivation ($r=-.46$, $p<.05$), intrinsic motivation ($r=-.30$, $p<.05$), extrinsic motivation ($r=-.36$, $p<.05$), control of learning ($r=-.35$, $p<.05$) and self-efficacy

($r=-.44$, $p<.05$). These correlations indicated that among students in Class B, a larger efficiency gap was associated with lower levels of motivation in these constructs.

Total cognitive style gap was moderately correlated with total student engagement ($r=.31$, $p<.05$) and active learning ($r=.44$, $p<.05$), indicating that more innovativeness was related to higher levels of student engagement and active learning. Likewise sufficiency of originality gap was positively correlated with total engagement ($r=.33$, $p<.05$) and active learning ($r=.33$, $p<.05$). Also rule/group conformity gap was correlated with total engagement ($r=.36$, $p<.05$), active learning ($r=.48$, $p<.05$) and student-faculty interaction ($r=.32$, $p<.05$); all indicating higher levels of engagement with student innovativeness.

The SSI had internal correlations ranging from substantial to very high between total stress and stress constructs: frustrations ($r=.76$, $p<.05$), conflicts ($r=.50$, $p<.05$), pressures ($r=.78$, $p<.05$), changes ($r=.69$, $p<.05$) and self imposed ($r=.65$, $p<.05$). As expected, these correlations indicate that these scales of stress were closely associated.

Considering the relationship between stress and motivation in Class B, self-imposed stress was moderately correlated with total motivation ($r=.34$, $p<.05$) and extrinsic motivation ($r=.40$, $p<.05$), but substantially correlated with test anxiety ($r=.60$, $p<.05$). These correlations provide evidence that higher levels of self-imposed stress were coupled with higher levels of total motivation, extrinsic motivation and test anxiety. Furthermore, test anxiety had moderate to substantial correlations with total stress ($r=.56$, $p<.05$), frustrations ($r=.34$, $p<.05$), pressures ($r=.46$, $p<.05$) and changes ($r=.31$, $p<.05$). These correlations provide evidence of a relationship between high student stress scores and high test anxiety scores among students enrolled in Class B.

There were significant negative correlations found between self-efficacy and total stress ($r=-.30, p<.05$), frustrations ($r=-.31, p<.05$) and changes ($r=-.44, p<.05$). This indicated that lower levels of self-efficacy were related to higher levels of total stress, frustrations and changes.

Total motivation measured by the MSLQ had substantial and high correlations with internal constructs. Specifically, total motivation was correlated with intrinsic motivation ($r=.74, p<.05$), extrinsic motivation ($r=.56, p<.05$), task motivation ($r=.72, p<.05$), control of learning ($r=.71, p<.05$) and self-efficacy ($r=.62, p<.05$). These correlations indicated a close relationship between motivation constructs and total motivation. However, the motivation construct test anxiety did not have a significant correlation with total motivation ($r=.24, p>.05$) indicating less of an association with the other motivation constructs.

Total motivation was moderately correlated with total engagement ($r=.37, p<.05$) as well as academic challenge ($r=.43, p<.05$). Likewise, intrinsic motivation was moderately correlated with total student engagement ($r=.40, p<.05$) and academic challenge ($r=.35, p<.05$) as well as student-faculty interaction ($r=.32, p<.05$). Additionally, task motivation was moderately correlated with total student engagement ($r=.46, p<.05$), academic challenge ($r=.41, p<.05$) and student-faculty interaction ($r=.32, p<.05$). All of these correlations provide evidence that in Class B, higher levels of student motivation were associated with higher levels of student engagement.

Examining the internal correlations of constructs measuring student engagement, very high correlations were found between total student engagement and constructs: academic challenge ($r=.76, p<.05$), active learning ($r=.74, p<.05$) and student faculty interaction ($r=.77$, $p<.05$). These correlations indicated a close relationship between scales of student engagement and total student engagement. See Table 4-48 for findings specific to relationships between cognitive style gap, stress, motivation and engagement.

Demographic questions were asked of students regarding age, gender, number of subject area courses and college classification. For Class B, students' age had a positive association with efficiency style gap ($r=.30$, $p<.05$) indicating that older students were associated with larger efficiency style gap. No other significant correlations were found among these demographic variables and cognitive style gap. Age was also correlated with intrinsic motivation ($r=-.32$, $p<.05$) indicating that older students were associated with lower intrinsic motivation scores. However, neither gender or college classification was associated with study variables at a moderate level or higher. Considering the number of collegiate courses related to the subject area of Class B, no significant correlations were found.

Table 4-48. Class B Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=44)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.86*	--											
3. Gap-efficiency	.43*	.05	--										
4. Gap-rule	.86*	.63*	.20	--									
5. Total stress	-.01	.02	.08	-.10	--								
6. Frustrations	.11	.14	.15	-.05	.76*	--							
7. Conflicts	.20	.17	.16	.12	.50*	.11	--						
8. Pressures	-.18	-.12	-.09	-.19	.78*	.38*	.36*	--					
9. Changes	-.05	-.11	.19	-.09	.69*	.41*	.43*	.56*	--				
10. Self-imposed	-.11	-.05	-.10	-.11	.65*	.41*	.12	.41*	.18	--			
11. Total motivation	-.15	.03	-.46*	-.05	.06	-.04	-.01	.09	-.24	.34*	--		
12. Intrinsic motivation	.03	.13	-.30*	.11	-.04	-.04	-.03	.05	-.18	.01	.74*	--	
13. Extrinsic motivation	-.19	-.02	-.36*	-.16	.17	.13	.03	.03	-.06	.40*	.56*	.06	--
14. Task motivation	.10	.11	-.13	.18	-.05	.01	-.10	.01	-.23	.04	.72*	.80*	.11
15. Control of learning	.03	.13	-.35*	.15	-.24	-.35*	.01	-.13	-.36*	.04	.71*	.43*	.28
16. Self-efficacy	-.13	.03	-.44*	-.03	-.30*	-.31*	-.10	-.22	-.44*	.04	.62*	.42*	.17
17. Test anxiety	-.31*	-.22	-.10	-.35*	.56*	.34*	.18	.46*	.31*	.60*	.24	-.04	.40*
18. Total Engagement	.31*	.33*	-.10	.36*	.02	.02	.03	.11	-.17	.03	.37*	.40*	.07
19. Academic Challenge	.11	.22	-.16	.08	.14	.27	-.15	.09	-.12	.19	.43*	.35*	.33*
20. Active Learning	.44*	.33*	.13	.48*	.06	-.05	.19	.18	-.09	-.01	.03	.20	-.26
21. Faculty Interaction	.21	.20	-.14	.32*	-.16	-.24	.10	-.01	-.17	-.14	.29*	.32*	-.03
M	23.8	15.2	-1.64	10.3	58.1	14.0	6.50	11.4	5.82	20.4	156	17.7	21.8
SD	15.1	8.56	4.74	6.61	13.0	5.30	2.86	4.04	2.73	3.79	25.8	5.37	4.79

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-48 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.47*	--						
16. Self-efficacy	.34*	.76*	--					
17. Test anxiety	-.10	-.27	-.35*	--				
18. Total Engagement	.46*	.23	.06	.07	--			
19. Academic Challenge	.41*	.12	-.06	.32*	.74*	--		
20. Active Learning	.26	.02	-.11	-.04	.74*	.27	--	
21. Faculty Interaction	.32*	.36*	.29	-.18	.77*	.25	.51*	--
M	29.3	22.7	43.0	21.6	47.1	22.4	12.3	12.5
SD	8.69	5.44	10.9	8.71	7.01	3.70	2.56	3.14

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies $p<.05$

Class C

For determining cognitive style gap, 56 responses were deemed acceptable by the researcher. The total cognitive style score was 83 for the faculty member instructing Class C indicating that she was more adaptive. The reported total cognitive style gap mean of this class was M=17.86 (SD=14.34). To interpret, the average student in Class C was 17.86 points more innovative than the faculty member. It is also noted that the mean is just less than 20 points (Kirton, 2003) at which "clearly noticeable differences" (p. 67) may cause psychological stress. There were 26 (46.4%) students with a cognitive style gap of 20 points or higher in Class C. The most adaptive student in the class had an 18 point gap with the faculty member while the most innovative student had a 59 point gap with the faculty member. See Table 4-49 for reported results of cognitive style gap of Class C.

Table 4-49. Class C Student Mean Scores of Cognitive Style Construct Gaps (n=56)

Construct	Mean	SD	Min	Max
Total cognitive style gap	17.86	14.34	-18	59
Sufficiency of originality gap	4.59	6.59	-8	22
Efficiency gap	7.61	4.28	-3	17
Rule/Group conformity gap	5.66	7.50	-9	27

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Cognitive style gap calculations allowed the researcher to look for relationships with student stress, motivation and student engagement, using Pearson's correlation coefficient. Examining total cognitive style gap correlations with cognitive style gap constructs found very high and moderate relationships. Specifically, total cognitive style gap was correlated with sufficiency of originality gap ($r=.86$, $p<.05$), efficiency gap ($r=.40$, $p<.05$) and rule/group conformity gap ($r=.93$, $p<.05$). Furthermore sufficiency of originality gap was highly correlated with rule/group conformity gap ($r=.76$, $p<.05$), but was negligibly correlated with efficiency gap ($r=-.01$, $p>.05$). These findings indicated that although constructs of cognitive style were associated with total cognitive style, the construct gap efficiency had low or negligible association with the other two constructs. The may partially be explained by the lower post-hoc reliability of the efficiency construct.

Considering correlations between cognitive style gap and student stress, significant correlations were found only with the self-imposed stress construct. That is, self-imposed stress had negative moderate correlations with total cognitive style gap (r=-

.31, $p<.05$) and rule/group conformity gap ($r=-.31$, $p<.05$). This indicated that lower levels of self-imposed stress were associated with more innovative total cognitive gap and innovative rule/group conformity gap. This finding does not coincide with Kirton's (2003) adaption-innovation theory as applied in this context.

Moderate correlations were found between total motivation and total cognitive style gap ($r=-.34$, $p<.05$) and efficiency gap ($r=-.30$, $p<.05$) indicating that among students in Class C, larger cognitive style gaps and efficiency gaps were related to lower total motivation. The same was found with extrinsic motivation when comparing this construct to total cognitive style gap ($r=-.34$, $p<.05$) and rule/group conformity gap ($r=-.31$, $p<.05$). Test anxiety was moderately correlated with total cognitive style gap ($r=-.49$, $p<.05$), sufficiency of originality gap ($r=-.47$, $p<.05$) and rule/group conformity gap ($r=-.41$, $p<.05$) signifying an association between low test anxiety and high innovative gap within these cognitive style constructs.

Only one moderate correlation was found between cognitive style gap scores and student engagement scores. Sufficiency of originality was correlated with active learning ($r=.31$, $p<.05$) which provided evidence that having a more innovative sufficiency of originality gap with the faculty member was associated with having a higher level of active learning in Class C.

For scales of student stress, correlations were moderate and very high between total stress and constructs of total stress. Specifically in Class C, total stress was correlated with frustrations ($r=.81$, $p<.05$), conflicts ($r=.70$, $p<.05$), pressures ($r=.81$, $p<.05$), changes ($r=.54$, $p<.05$) and self-imposed ($r=.71$, $p<.05$). These findings indicated that scales of stress were closely associated with total stress.

Total stress was correlated with extrinsic motivation ($r=.39$, $p<.05$) and test anxiety ($r=.52$, $p<.05$) indicating higher levels of student stress was coupled with higher levels of extrinsic motivation and higher levels of test anxiety. Furthermore, test anxiety was moderately or substantially correlated with frustrations ($r=.41$, $p<.05$), pressures ($r=.40$, $p<.05$) and self-imposed stress ($r=.54$, $p<.05$). Correlation coefficients in these relationships indicated that higher levels of test anxiety were associated with higher levels of these stress constructs.

Examining relationships between student stress and student engagement in Class C, a moderate correlation was found between conflicts and student faculty interaction ($r=.35$, $p<.05$). This finding indicated that higher levels of conflict stress were related to higher levels of student-faculty interaction. Furthermore, self-imposed stress was correlated with total student engagement ($r=.31$, $p<.05$) indicating higher levels of self-imposed stress were associated with higher levels of student engagement. This is interesting in the light of the negative relationship found between lower self-imposed stress and higher cognitive style gap.

Total motivation was substantially to very highly correlated with motivation constructs: intrinsic motivation ($r=.62$, $p<.05$), extrinsic motivation ($r=.66$, $p<.05$), task motivation ($r=.79$, $p<.05$), control of learning ($r=.47$, $p<.05$) and test anxiety ($r=.57$, $p<.05$). However self-efficacy was not significantly correlated with total motivation. Findings indicated that motivation constructs were related to total motivation, except for self-efficacy.

Examining the relationships between motivation and engagement among students in Class C, total motivation was moderately correlated with academic challenge ($r=.43$,

$p<.05$) and substantially correlated with academic challenge ($r=.50$, $p<.05$). Likewise, task motivation was moderately correlated with total engagement ($r=.41$, $p<.05$) and substantially correlated with academic challenge ($r=.56$, $p<.05$). Extrinsic motivation was moderately correlated with total engagement ($r=.34$, $p<.05$), active learning ($r=.30$, $p<.05$) and student faculty interaction ($r=.30$, $p<.05$). All of these correlations indicated a higher level of motivation associated with a higher level of student engagement.

For correlations regarded as internal to the NSSE, total student engagement was very highly correlated with constructs: academic challenge ($r=.77$, $p<.05$), active learning ($r=.80$, $p<.05$) and student-faculty interaction ($r=.76$, $p<.05$). These correlations indicated that constructs of engagement were closely related to total engagement. See Table 4-50 for relationships among cognitive style gap, stress, motivation and engagement of respondents in Class C.

Demographic questions were asked of students regarding age, gender, number of related courses taken and college classification. For gender, a moderate negative correlation was found with total cognitive style gap ($r=-.38$, $p<.05$). That is, being male was associated with a larger innovative cognitive style gap in Class C. Student college classification of the student had significantly correlated with total cognitive style gap ($r=.42$, $p<.05$). This indicated that higher college rank was associated with higher cognitive style gap. No other demographic variables had statistically significant relationships with cognitive style gap in this course.

Table 4-50. Class C Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=56)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.86*	--											
3. Gap-efficiency	.40*	-.01	--										
4. Gap-rule	.93*	.76*	.20	--									
5. Total stress	-.22	-.25	-.07	-.16	--								
6. Frustrations	-.14	-.22	.01	-.08	.81*	--							
7. Conflicts	-.08	-.14	-.03	-.02	.70*	.55*	--						
8. Pressures	-.13	-.19	-.01	-.07	.81*	.58*	.54*	--					
9. Changes	-.03	-.04	-.07	.01	.54*	.24	.42*	.41*	--				
10. Self-imposed	-.31*	-.22	-.14	-.31*	.71*	.41*	.23	.43*	.21	--			
11. Total motivation	-.34*	-.24	-.30*	-.28*	.26*	.14	-.03	.09	.06	.50*	--		
12. Intrinsic motivation	.02	.06	-.12	.06	-.06	-.15	-.14	-.16	.06	.14	.62*	--	
13. Extrinsic motivation	-.34*	-.29*	-.17	-.31*	.39*	.24	.14	.21	.17	.51*	.66*	.28*	--
14. Task motivation	-.22	-.11	-.22	-.20	-.04	-.10	-.25	-.10	.03	.19	.79*	.68*	.34*
15. Control of learning	.10	.18	-.17	.13	.04	.07	-.02	.02	-.17	.12	.47*	.09	.16
16. Self-efficacy	.08	.18	-.07	.04	-.27*	-.22	-.27*	-.36*	-.20	-.01	.15	.27*	.01
17. Test anxiety	-.49*	-.47*	-.21	-.41*	.52*	.41*	.24	.40*	.15	.54*	.57*	-.05	.33*
18. Total Engagement	-.05	.09	-.17	-.08	.22	.01	.16	.23	.14	.31*	.43*	.30*	.34*
19. Academic Challenge	-.14	-.01	-.23	-.13	.18	-.02	.04	.29*	.11	.24	.50*	.23	.21
20. Active Learning	.11	.31*	-.15	.02	.08	-.06	.01	.03	.01	.27*	.25	.25	.30*
21. Faculty Interaction	-.06	-.06	-.01	-.06	.27*	.09	.35*	.12	.20	.21	.21	.22	.30*
M	17.9	4.59	7.61	5.66	55.4	13.1	6.00	10.7	4.82	20.8	162	19.3	21.8
SD	14.3	6.59	4.28	7.50	13.5	4.98	2.60	3.43	2.60	4.84	18.8	3.56	4.51

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-50 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.19	--						
16. Self-efficacy	-.02	.29*	--					
17. Test anxiety	.29*	.13	-.37*	--				
18. Total Engagement	.41*	-.01	.03	.26*	--			
19. Academic Challenge	.56*	.16	-.17	.41*	.77*	--		
20. Active Learning	.22	-.07	.21	.01	.80*	.38*	--	
21. Faculty Interaction	.11	-.16	.09	.12	.76*	.30*	.56*	--
M	30.8	23.2	47.4	20.0	53.4	27.6	13.5	12.3
SD	8.35	3.55	5.32	7.88	8.63	4.35	3.42	3.35

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Class D

Cognitive style gap was measured by subtracting faculty member's total cognitive style score and construct scores from students' total cognitive style and construct scores in each class. Calculating cognitive style gap for Class D, the researcher found 73 usable KAI responses. Reported total cognitive style gap mean was approximately zero (M=-0.37, SD=17.40) indicating that the average student in Class D had little cognitive style gap with the faculty member. This was expected as the total cognitive style score of the faculty member was 94, one point less than the general population mean (Kirton, 1999).

All the same, this course was still worthy of examination as the cognitive style score range included one student who was 39 points more adaptive and one student 41 points more innovative. Kirton (2003) claims individuals become aware of cognitive style differences given a 20-point cognitive style gap which results in stress. In Class D, 24 (32.9%) student responses from the 73 usable responses had a cognitive style gap of 20 points or higher with the faculty member. See Table 4-51 for findings concerning Class D cognitive style gap.

Table 4-51. Class D Student Mean Scores of Cognitive Style Construct Gaps (n=73)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-0.37	17.40	-39	41
Sufficiency of originality gap	-6.51	8.37	-25	7
Efficiency gap	2.06	5.37	-8	17
Rule/Group conformity gap	4.07	7.98	-11	24

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Cognitive style gap scores were used to find associations with student stress, motivation and engagement using Pearson's correlation coefficient. Examining correlations between constructs of cognitive style, total cognitive style correlated with sufficiency of originality gap ($r=.81$, $p<.05$), efficiency gap ($r=.61$, $p<.05$), and rule/group conformity gap ($r=.89$, $p<.05$). These correlations indicated that construct measures of cognitive gap were closely associated with total cognitive style gap measured by the KAI. However, efficiency gap was not significantly correlated with sufficiency of originality ($r=.16$, $p>.05$) indicating little association. This finding may be explained by the degree and direction of cognitive style gaps of constructs; the sufficiency of originality cognitive style gap mean was -6.51 whereas the efficiency gap mean was 2.06 in Class D. Furthermore, the reliability coefficient for the efficiency construct was below par.

Only one moderate correlation was found among cognitive style gap scores and stress scores in Class D. A correlation was found between efficiency gap and self-imposed stress ($r=-.36$, $p<.05$) indicating an association between higher innovative efficiency gap and lower self-imposed stress. This correlation was not congruent with previous research conducted by Kirton (2003) as applied in the context of this study.

In Class D, only one moderate correlation was found among student scores of cognitive style and motivation. Specifically, efficiency cognitive style gap was correlated with extrinsic motivation ($r=-.38$, $p<.05$) which provided evidence that larger innovative efficiency gap was related to lower levels of extrinsic motivation. There were no significant correlations among cognitive style gap and student engagement in Class D.

Considering the internal correlations of the SSI, total student stress had very high correlations with frustrations ($r=.84$, $p<.05$), conflicts ($r=.74$, $p<.05$), pressures ($r=.84$, $p<.05$), changes ($r=.74$, $p<.05$) and self-imposed ($r=.76$, $p<.05$). These correlations indicate that stress constructs were closely associated with the total stress measure.

In Class D, correlations were found among the stress construct self-imposed and the motivation constructs self-efficacy and test anxiety. That is self efficacy was correlated with total stress ($r=-.40$, $p<.05$), frustrations ($r=-.50$, $p<.05$), conflicts ($r=-.33$, $p<.05$), pressures ($r=-.34$, $p<.05$) and changes ($r=-.30$, $p<.05$); all indicating that increase in self-efficacy scores was associated with a decrease of stress scores in these students. Test anxiety was moderately to substantially related to stress as this construct correlated with total stress ($r=.64$, $p<.05$), frustrations ($r=.52$, $p<.05$), conflicts ($r=.46$, $p<.05$), pressures ($r=.59$, $p<.05$), changes ($r=.50$, $p<.05$) and self-imposed stress ($r=.44$, $p<.05$). All of the correlations between the test anxiety construct and stress scores suggest an increase in stress was associated with an increase in test anxiety. Furthermore, self-imposed stress was moderately correlated with extrinsic motivation ($r=.34$, $p<.05$) indicating that higher levels of extrinsic motivation was coupled with high levels of self-imposed stress. No significant correlations were found among motivation scores and engagement scores for students in Class D.

Moderate and very high correlations were found between total motivation and motivation constructs: intrinsic motivation ($r=.78$, $p<.05$), extrinsic motivation ($r=.66$, $p<.05$), task motivation ($r=.72$, $p<.05$), control of learning ($r=.77$, $p<.05$) and self-efficacy ($r=.70$, $p<.05$). However, test anxiety did not have a significant correlation with total motivation. Considering these correlations, the data suggests a close relationship exists between motivation constructs and the measure of total motivation, except for test anxiety.

Examining relationships between motivation and engagement, moderate correlations were found between total motivation and total engagement ($r=.38$, $p<.05$) as well as the engagement construct academic challenge ($r=.36$, $p<.05$). These correlations describe an association of higher levels of motivation and higher levels of student engagement and higher levels of academic challenge. In Class D, moderate correlations with task motivation also existed with total student engagement ($r=.42$, $p<.05$) as well as engagement constructs academic challenge ($r=.33$, $p<.05$) and active learning ($r=.38$, $p<.05$). That is, high levels of task motivation in Class D were related to high levels of total engagement including the constructs academic challenge and active learning.

This study used three constructs to determine a total student engagement score. In Class D, total student engagement was correlated with these constructs: academic challenge ($r=.74$, $p<.05$), active learning ($r=.74$, $p<.05$) and student-faculty interaction ($r=.67$, $p<.05$). This data suggests that construct scores of student engagement were closely related to the total measure of student engagement used in this study. See Table 4-52 for reported associations between Class D cognitive style gap, stress, motivation and engagement.

For demographic information concerning Class D, participating students were asked their age, gender, number of courses taken related to Class D and college classification. The number of collegiate courses similar to the subject area of Class D was significantly correlated to total cognitive style gap ($r=-.24$, $p<.05$). Said differently, there was an association between more innovative cognitive style and fewer courses taken similar to the content taught in Class D. No other student demographic variable was statistically significant with cognitive style gap.

For age, there were no significant correlations found with other variables used in this study in Class D. Concerning gender, there was a significant low correlation ($r=-.24$, $p<.05$) with test anxiety. That is in Class D, being male was associated with higher levels of test anxiety. College level of classification had a moderately negative association ($r=-.32$, $p<.05$) with total stress. This finding indicated an association between higher college classification and lower levels of stress.

Table 4-52. Class D Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=67)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.81*	--											
3. Gap-efficiency	.61*	.16	--										
4. Gap-rule	.89*	.56*	.49*	--									
5. Total stress	-.09	-.03	-.21	-.02	--								
6. Frustrations	.03	-.01	-.05	.10	.84*	--							
7. Conflicts	.15	.12	-.03	.22	.74*	.69*	--						
8. Pressures	-.18	-.15	-.14	-.14	.84*	.57*	.44*	--					
9. Changes	-.08	-.07	-.21	.04	.74*	.57*	.42*	.65*	--				
10. Self-imposed	-.21	-.01	-.36*	-.19	.76*	.42*	.42*	.61*	.40*	--			
11. Total motivation	-.05	.11	-.22	-.09	.10	.03	.03	.10	-.03	.24*	--		
12. Intrinsic motivation	.07	.19	-.10	-.01	-.06	-.10	-.07	-.02	-.09	.01	.78*	--	
13. Extrinsic motivation	-.25*	-.09	-.38*	-.20	.19	.05	.04	.14	.14	.34*	.66*	.27*	--
14. Task motivation	-.09	.04	-.13	-.15	-.12	-.12	-.15	-.11	-.19	.02	.72*	.72*	.24*
15. Control of learning	.12	.20	.04	.01	-.12	-.18	-.04	-.11	-.17	.02	.77*	.68*	.34*
16. Self-efficacy	.01	.20	-.18	-.10	-.40*	-.50*	-.33*	-.34*	-.30*	-.10	.70*	.61*	.37*
17. Test anxiety	.01	-.06	-.03	.09	.64*	.52*	.46*	.59*	.50*	.44*	.17	-.20	.18
18. Total Engagement	.09	.20	-.10	.05	.09	-.03	.03	.13	.05	.17	.38*	.30*	.12
19. Academic Challenge	.01	.09	-.12	-.01	.18	.14	.09	.19	.12	.14	.36*	.27*	.15
20. Active Learning	.19	.20	.09	.13	-.08	-.20	-.15	.01	-.06	.06	.28*	.29*	-.01
21. Faculty Interaction	.02	.15	-.18	-.01	.07	-.05	.12	.04	.01	.15	.15	.06	.08
M	-0.57	-6.57	1.97	4.03	54.2	12.2	5.40	11.1	4.61	20.9	166	19.1	22.5
SD	16.8	8.56	5.13	7.61	13.8	4.50	2.60	3.71	2.51	4.24	22.0	4.43	4.70

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-52 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.55*	--						
16. Self-efficacy	.56*	.69*	--					
17. Test anxiety	-.23	-.16	-.38*	--				
18. Total Engagement	.42*	.26*	.28*	.05	--			
19. Academic Challenge	.33*	.19	.07	.26*	.74*	--		
20. Active Learning	.38*	.26*	.40*	-.18	.74*	.26*	--	
21. Faculty Interaction	.17	.10	.17	-.05	.67*	.17	.40*	--
M	33.7	24.2	46.6	20.3	48.3	24.1	12.0	12.2
SD	6.90	3.61	9.04	7.60	7.78	4.35	3.38	3.11

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Class E

There were 32 usable responses in determining cognitive style gap of Class E. The faculty member instructing Class E had a cognitive style score of 95 which was equivalent to the general population mean defined by Kirton (1999). The total cognitive style gap mean (M=-5.59, SD=14.95) was more than 14 points lower than the threshold of 20 points at which stress between dissimilar cognitive styles becomes apparent (Kirton, 2003). Only nine (28.1%) of the 32 student respondents had a cognitive style gap of 20 points or higher with the faculty member. This course was still worthy of examination as the lowest total cognitive style gap score was 29 points more adaptive than the faculty member and the highest total cognitive gap score was 21 points more innovative than the faculty member. See Table 4-53 for cognitive style gap findings for Class E.

Table 4-53. Class E Student Mean Scores of Cognitive Style Construct Gaps (n=32)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-5.59	14.95	-29	21
Sufficiency of originality gap	-2.00	7.87	-16	15
Efficiency gap	-0.94	3.65	-8	8
Rule/Group conformity gap	-2.66	7.30	-16	10

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Once calculating the cognitive style gap of Class E, the researcher explored associations with stress, motivation and engagement using the Pearson correlation coefficient. First, cognitive style constructs were examined for relationships with total cognitive style gap. Very high correlations were found between total cognitive style gap and cognitive style constructs sufficiency of originality gap ($r=.91$, $p<.05$) and rule/group conformity gap ($r=.94$, $p<.05$). However, the correlation between efficiency gap and total cognitive style gap was not significant ($r=.24$, $p<.05$). This finding may partially be explained by examining the differences of gap score means between students and the faculty member instructing Class E. It may also be partially explained by the low internal reliability of the efficiency construct.

There were no significant correlations found among scores of cognitive style gap and scores of student stress. However, considering motivation, moderate correlations were found between sufficiency of originality gap and motivation constructs intrinsic motivation ($r=.36$, $p<.05$) and self-efficacy ($r=.38$, $p<.05$). These correlations indicated that more innovative sufficiency of originality gap was associated with higher scores of motivation and higher scores of self-efficacy. There were no significant correlations found between scores of cognitive style and scores of student engagement in Class E.

Regarding the internal correlations of student stress, total stress was substantially to very highly correlated with stress constructs: frustrations ($r=.78$, $p<.05$), conflicts ($r=.58$, $p<.05$), pressures ($r=.85$, $p<.05$), changes ($r=.56$, $p<.05$) and self-imposed ($r=.83$, $p<.05$). These correlations indicate that scales used to measure stress in this study closely related to total stress scores.

Total stress was not significantly correlated with total motivation ($r=.26$, $p<.05$) but was moderately correlated with both extrinsic motivation ($r=.48$, $p<.05$) and test anxiety ($r=.44$, $p<.05$). This data suggests that higher levels of extrinsic motivation were coupled with high levels of extrinsic motivation and high levels of test anxiety in Class E. Likewise, the pressures construct was correlated with extrinsic motivation ($r=.43$, $p<.05$) and test anxiety ($r=.51$, $p<.05$). Considering self-imposed stress, moderate and substantial correlations were found between total motivation ($r=.44$, $p<.05$), extrinsic motivation ($r=.60$, $p<.05$) and task motivation ($r=.43$, $p<.05$). All of these correlations indicated that higher levels of stress were associated with higher levels of motivation.

Only one significant correlation was found considering stress and student engagement. The pressures stress construct was correlated with active learning ($r=.50$, $p<.05$) which indicated that higher levels of student pressures were associated with higher levels of student active learning.

For correlations among scales of student motivation, total student motivation was correlated with constructs: intrinsic motivation ($r=.70$, $p<.05$), extrinsic motivation ($r=.74$, $p<.05$), task motivation ($r=.86$, $p<.05$), control of learning ($r=.68$, $p<.05$) and test anxiety ($r=.32$, $p>.05$). The correlation between total motivation and test anxiety was smaller, but still moderate. These correlations provided evidence that motivation constructs were positively associated with total motivation.

Interestingly, only one correlation was found between scores of motivation and scores of student engagement. There was a moderate correlation between extrinsic motivation and active learning ($r=.40$, $p<.05$). The finding indicated an association between higher levels of extrinsic motivation and higher levels of active learning in this class.

Examining internal correlations for student engagement, total student engagement was correlated with constructs: academic challenge ($r=.83$, $p<.05$), active learning ($r=.59$, $p<.05$) and student-faculty interaction ($r=.58$, $p<.05$). These correlations suggest that student engagement construct scores were closely related to the measure of total student engagement. See Table 4-54 for findings specific to correlates of cognitive style gap, stress, motivation and engagement for Class E.

The researcher examined correlations among demographic information as students answered questions regarding age, gender, number of courses taken similar to the course and college classification. None of the demographic variables were found to correlate with cognitive style gap in Class E. However, number of college courses related to the subject area of Class E was significantly correlated with student-faculty interaction ($r=.48$, $p<.05$). This finding indicated that taking more classes in the subject area of Class E was moderately associated with higher levels of student-faculty interaction.

Table 4-54. Class E Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=31)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.91*	--											
3. Gap-efficiency	.24	-.08	--										
4. Gap-rule	.94*	.82*	.07	--									
5. Total stress	-.02	-.03	.13	-.08	--								
6. Frustrations	.08	.02	.16	.05	.78*	--							
7. Conflicts	.03	-.01	.10	.03	.58*	.40*	--						
8. Pressures	-.24	-.20	-.01	-.28	.85*	.52*	.44*	--					
9. Changes	-.09	-.10	-.01	-.07	.56*	.39*	.69*	.38*	--				
10. Self-imposed	.05	.06	.15	-.04	.83*	.47*	.21	.68*	.25	--			
11. Total motivation	.19	.35	-.15	.08	.26	.14	-.22	.21	.06	.44*	--		
12. Intrinsic motivation	.27	.36*	-.11	.22	-.08	-.15	-.28	-.15	.01	.13	.70*	--	
13. Extrinsic motivation	.20	.30	.01	.06	.48*	.29	.03	.43*	.08	.60*	.74*	.29	--
14. Task motivation	.15	.26	.01	.02	.22	.15	-.29	.10	.10	.43*	.86*	.68*	.56*
15. Control of learning	-.07	.09	-.15	-.18	-.01	-.01	-.18	-.08	-.14	.16	.62*	.44*	.27
16. Self-efficacy	.18	.38*	-.33	.11	-.19	-.19	-.44*	-.13	-.22	.01	.68*	.58*	.44*
17. Test anxiety	.02	.02	-.09	.07	.44*	.33	.20	.51*	.30	.30	.32	-.16	.32
18. Total Engagement	.14	.15	-.13	.19	.23	.28	.16	.18	.01	.13	.10	.05	.27
19. Academic Challenge	.16	.12	-.07	.23	.18	.27	.22	.13	.03	.04	.10	.09	.19
20. Active Learning	-.14	-.11	-.05	-.15	.30	.24	-.11	.50*	-.10	.26	.20	-.11	.40*
21. Faculty Interaction	.19	.24	-.14	.21	.01	.06	.14	-.17	.06	.01	-.08	.08	.02
M	-4.94	-1.87	-0.84	-2.23	43.3	9.39	4.52	9.16	3.48	16.8	164	18.3	21.1
SD	14.7	7.97	3.67	6.99	12.2	3.95	2.22	3.30	1.12	5.30	21.9	4.59	4.37

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-54 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.49*	--						
16. Self-efficacy	.43*	.54*	--					
17. Test anxiety	.15	-.20	-.12	--				
18. Total Engagement	.20	-.04	-.10	-.02	--			
19. Academic Challenge	.17	.12	-.13	-.07	.83*	--		
20. Active Learning	.19	-.14	.08	.32	.59*	.33	--	
21. Faculty Interaction	.05	-.14	-.11	-.21	.58*	.16	.04	--
M	33.5	23.4	49.5	17.8	48.3	24.5	13.0	10.9
SD	7.15	4.16	6.83	6.56	5.75	3.66	2.04	2.66

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies $p<.05$

Class F

For cognitive style gap of Class F, 71 responses were considered usable. The faculty member instructing Class F had a total cognitive style score of 103, indicating she was slightly innovative. The total cognitive style gap mean was calculated by subtracting the faculty member's cognitive style score from each student's cognitive style score. The mean difference was -12.83 (SD=16.28) indicating that the average student was 12.83 points more adaptive than the faculty member. The most adaptive student had a cognitive style gap of 48 points lower than the instructor while the most innovative student had a cognitive style gap of 29 points higher than the faculty member. Note that Kirton (2003) identifies a cognitive style gap of 20 points as the threshold for awareness of cognitive style differences, which may result in stress. In Class F, 30 (42.3%) student respondents had a cognitive style gap of 20 points or higher with the instructing faculty member. See Table 4-55 for findings specific to cognitive style gap scores of Class F.

Table 4-55. Class F Student Mean Scores of Cognitive Style Construct Gaps (n=71)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-12.83	16.28	-48	29
Sufficiency of originality gap	-11.80	8.89	-30	9
Efficiency gap	9.15	4.01	1	17
Rule/Group conformity gap	-10.18	6.81	-26	8

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Calculated cognitive style gaps were used to find relationships with student stress, motivation and engagement. Pearson's correlation coefficient was used for this task. Considering internal correlations for cognitive style gap, total cognitive style gap was correlated with sufficiency of originality gap ($r=.89$, $p<.05$), efficiency gap ($r=.52$, $p<.05$) and rule/group conformity gap ($r=.89$, $p<.05$). Furthermore, sufficiency of originality gap was substantially correlated with rules/group conformity gap ($r=.67$, $p<.05$). These correlations indicated that sufficiency of originality gap and rule/group conformity gap were closely related to total cognitive gap. Conversely, efficiency gap did not have a significant correlation with sufficiency of originality gap. This data suggests that in Class F, cognitive style construct gaps were related to total cognitive style gap, but there was little association between efficiency gap and sufficiency of originality gap. This may partially be explained by examining the degree and direction of cognitive style gap mean scores for this class. For example in Class F, the mean score for sufficiency of originality gap was -11.80 whereas the mean score for efficiency gap was 9.15. Also note that the post-hoc reliability coefficient for the efficiency construct was lower than the acceptable level of .70 (Schmitt, 1996).

No moderate correlations were found among scores of cognitive style gap and scores of stress, or scores of engagement. However, one moderate correlation was found between sufficiency of originality gap and extrinsic motivation ($r=-.33$, $p<.05$). This indicated that a more innovative gap was related to less extrinsic motivation among students in Class F.

For correlations within total stress and stress constructs substantial to very high correlations were found. Specifically, total stress was correlated with frustrations ($r=.86$, $p<.05$), conflicts ($r=.68$, $p<.05$), pressures ($r=.81$, $p<.05$), changes ($r=.59$, $p<.05$) and self-imposed ($r=.65$, $p<.05$). The correlations imply that these stress constructs were closely related to the measure of total stress.

Examining relationships between stress scores and motivation scores, significant correlations were found between self-efficacy and total stress ($r=-.44$, $p<.05$), frustrations ($r=-.50$, $p<.05$), pressures ($r=-.46$, $p<.05$) and changes ($r=-.38$). This provided evidence that lower scores of self-efficacy were associated with higher scores of these stress constructs. Positive relationships were found between test anxiety and total stress ($r=.42$, $p<.05$), frustrations ($r=.33$, $p<.05$), pressures ($r=.44$, $p<.05$) and self-imposed ($r=.42$, $p<.05$). These correlations indicated that higher scores of test anxiety were related to these higher stress constructs.

No significant correlations were found with regard to stress scores and engagement scores.

Concerning relationships among motivation scores, moderate to very high correlations existed within the data. Specifically, total motivation correlated with intrinsic motivation ($r=.64$, $p<.05$), extrinsic motivation ($r=.52$, $p<.05$), task motivation ($r=.82$, $p<.05$), control of learning ($r=.56$, $p<.05$), self-efficacy ($r=.30$, $p<.05$) and test anxiety ($r=.53$, $p<.05$). These correlations indicated that all of the motivation constructs were related to the total measure of motivation.

There were three moderate correlations between scales of motivation and scales of engagement. Academic challenge was correlated with both total motivation ($r=.31$, $p<.05$) and intrinsic motivation ($r=.33$, $p<.05$). This finding indicates that higher levels of academic challenge were associated with higher levels of total motivation with emphases on intrinsic motivation. Active learning was negatively correlated with control of learning ($r=-.33$, $p<.05$). Interestingly, this indicated lower levels of control of learning associated with higher levels of active learning.

For correlations among constructs of student engagement, total engagement was very highly correlated with academic challenge ($r=.72$, $p<.05$), active learning ($r=.73$, $p<.05$) and student-faculty interaction ($r=.70$, $p<.05$). This provided evidence that constructs of student engagement were closely related to total student engagement. See Table 4-56 for findings concerning relationships among cognitive style gap, stress, motivation and engagement.

Table 4-56. Class F Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=69)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.89*	--											
3. Gap-efficiency	.52*	.18	--										
4. Gap-rule	.89*	.67*	.39*	--									
5. Total stress	.06	.11	.05	-.03	--								
6. Frustrations	.01	.01	.06	-.01	.86*	--							
7. Conflicts	.18	.25*	.01	.10	.68*	.54*	--						
8. Pressures	-.09	-.04	.02	-.17	.81*	.64*	.40*	--					
9. Changes	.16	.17	.06	.13	.59*	.51*	.41*	.46*	--				
10. Self-imposed	.03	.09	.04	-.08	.65*	.40*	.27*	.41*	.01	--			
11. Total motivation	-.12	-.12	-.04	-.10	-.04	.04	-.20	.13	-.25*	.24*	--		
12. Intrinsic motivation	-.01	.10	-.21	-.03	-.01	-.07	.02	.05	-.12	.05	.64*	--	
13. Extrinsic motivation	-.29*	-.33*	-.03	-.23*	.14	.29*	-.23	.20	-.07	.15	.52*	-.15	--
14. Task motivation	-.15	-.20	-.01	-.08	-.08	.01	-.26*	.05	-.30*	.05	.82*	.55*	.39*
15. Control of learning	-.01	-.01	-.17	.10	-.17	-.22	-.08	-.15	-.36*	.11	.56*	.38*	.06
16. Self-efficacy	.17	.23	-.11	.17	-.44*	-.50*	-.22	-.46*	-.38*	-.09	.30*	.30*	-.12
17. Test anxiety	-.06	-.10	.25*	-.15	.42*	.33*	.01	.44*	.17	.42*	.53*	.12	.44*
18. Total Engagement	-.01	.03	-.06	-.01	.12	.16	.02	.07	-.01	.13	.09	.07	.10
19. Academic Challenge	-.16	-.08	-.16	-.17	.18	.18	.02	.15	-.05	.23	.31*	.33*	.05
20. Active Learning	.16	.12	.04	.19	.09	.20	-.03	.04	.17	-.04	-.15	-.19	.15
21. Faculty Interaction	.04	.05	.03	.02	-.04	-.06	.04	-.07	-.13	.04	-.05	-.10	.03
M	-13.2	-12.0	9.07	-10.3	49.1	10.9	5.32	9.32	4.54	19.0	163	17.9	21.6
SD	15.6	8.75	3.95	6.55	12.6	4.01	2.70	3.60	2.53	4.40	18.5	4.63	4.27

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-56 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.39*	--						
16. Self-efficacy	.19	.45*	--					
17. Test anxiety	.25*	-.08	-.33*	--				
18. Total Engagement	.10	-.14	-.03	.13	--			
19. Academic Challenge	.28*	.10	.04	.19	.72*	--		
20. Active Learning	-.12	-.32*	-.12	.02	.73*	.23	--	
21. Faculty Interaction	-.03	-.14	-.01	.05	.70*	.16	.46*	--
M	34.6	23.2	47.8	17.6	47.8	25.6	11.5	10.8
SD	6.98	3.55	5.93	6.99	7.49	4.18	3.05	3.18

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

The researcher examined correlations among demographic information as students answered questions regarding age, gender, number of classes taken similar to the class and college classification. No significant correlations were found in Class F regarding these demographic variables and total cognitive style gap.

However, age was associated with extrinsic motivation, ($r=-.30$, $p<.05$). This finding indicated that older students were associated with less extrinsic motivation in Class F. Gender was moderately correlated to total student motivation ($r=.42$, $p<.05$). That is, females in this class were associated with higher levels of total motivation.

Considering students' college classification, a moderate correlations was found with test anxiety (r=-.35, p<.05). The finding indicated that higher levels of test anxiety were associated with lower college classification. Considering the number of collegiate courses related to the subject area of Class F, no significant correlations were found.

Class G

There were 65 responses considered usable by the researcher for determining cognitive style gap. The faculty member instructing Class G had a total KAI score of 116, indicating her cognitive style was more innovative. The mean cognitive style gap of Class G was -22.58 (SD=15.04). Said differently, the average student in Class G was 22.58 points more adaptive than the faculty member. The lowest total score cognitive style gap was 67 points more adaptive than the faculty member while the highest total score cognitive style gap was 9 points more innovative than the faculty member. Note that Kirton (2003) has determined that a 20 point gap between two individuals is the point at which cognitive style differences become apparent. In this class, 39 (60.0%) student respondents had a cognitive style gap of 20 points or more with the faculty member. See Table 4-57 for results regarding Class G cognitive style gap.

Table 4-57. Class G Student Mean Scores of Cognitive Style Construct Gaps (n=65)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-22.58	15.04	-64	9
Sufficiency of originality gap	-8.82	7.67	-28	7
Efficiency gap	-2.69	4.76	-12	8
Rule/Group conformity gap	-11.08	7.85	-30	8

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Calculated cognitive gap scores were utilized in finding relationships with student stress, student motivation and student engagement. Pearson's correlation coefficient was used to find correlations among total scores and construct scores of cognitive style gap, stress, motivation and engagement.

In Class G, total cognitive style gap was internally correlated with sufficiency of originality gap ($r=.83, p<.05$), efficiency gap ($r=.44, p<.05$) and rule/group conformity gap ($r=.84, p<.05$) indicating a close relationship among construct gap scores and the total measure of cognitive style gap. However, efficiency gap was not significantly correlated with either sufficiency of originality gap ($r=.12, p>.05$) or rule/group conformity gap ($r=.13, p>.05$). This finding can partially be explained by differences among construct gap mean scores found in Class G. Another explanation may be the lower post-hoc reliability coefficient for the cognitive style efficiency construct.

Only one moderate correlation existed among constructs of cognitive style gap and constructs of student stress. Sufficiency of originality gap was correlated with self-imposed stress ($r=.33, p<.05$) indicating a more innovative sufficiency of originality gap was associated with higher scores of self-imposed stress.

No significant correlations were found between scores of cognitive style gap and scores of total motivation. However total cognitive style gap was correlated with active learning ($r=.30, p<.05$) indicating a more innovative gap in this class taught by an innovative faculty member was associated with higher levels of active learning.

Considering correlations internal to the measurement of stress, substantial and very high correlations were found between total stress and frustrations ($r=.85, p<.05$), conflicts ($r=.68, p<.05$), pressures ($r=.85, p<.05$), changes ($r=.76, p<.05$) and self-imposed ($r=.71, p<.05$). These correlations indicated that constructs of student stress were closely related to the measure of total stress.

Examining correlations between stress and motivation in Class G, self-efficacy was negatively correlated with total stress ($r=-.59$, $p<.05$), frustrations ($r=-.63$, $p<.05$), conflicts ($r=-.37$, $p<.05$), pressures ($r=-.41$, $p<.05$), changes ($r=-.61$, $p<.05$) and test anxiety ($r=-.30$, $p<.05$). These correlations indicated that lower self-efficacy scores were associated with high stress scores among all constructs. On the other hand, test anxiety was moderately to substantially correlated with total stress ($r=.55$, $p<.05$), frustrations ($r=.48$, $p<.05$), pressures ($r=.44$, $p<.05$), changes ($r=.47$, $p<.05$) and self-imposed stress ($r=.47$, $p<.05$). The data suggests an association between high levels of test anxiety and high levels of stress among the aforementioned constructs. Further explaining self-imposed stress, moderate correlations were found with total motivation ($r=.38$, $p<.05$) and extrinsic motivation ($r=.36$, $p<.05$). These correlations indicated an association between higher scores of self-imposed stress and higher score of total motivation and extrinsic motivation.

Total student stress in Class G was correlated with total student engagement ($r=.32$, $p<.05$). Furthermore, total engagement was correlated with frustrations ($r=.34$, $p<.05$). Additionally, total stress was correlated with academic challenge ($r=.30$, $p<.05$). These correlations indicated that higher levels of stress were associated with higher levels of engagement in the aforementioned constructs.

For correlations internal to the measure of motivation, total motivation was correlated with intrinsic motivation ($r=.58$, $p<.05$), extrinsic motivation ($r=.69$, $p<.05$), task motivation ($r=.67$, $p<.05$), control of learning ($r=.51$, $p<.05$), self-efficacy ($r=.29$, $p<.05$), and test anxiety ($r=.43$, $p<.05$). These correlations provided evidence that constructs of motivation were related to the measure of total motivation. However, the measure of self-efficacy was less related with total motivation then expected.

Considering the relationships among student motivation and student engagement in Class G, total engagement was correlated with total motivation ($r=.42$, $p<.05$), intrinsic motivation ($r=.42$, $p<.05$), extrinsic motivation ($r=.43$, $p<.05$) and task motivation ($r=.36$, $p<.05$). Likewise, the engagement construct academic challenge was correlated with total motivation ($r=.43$, $p<.05$), intrinsic motivation ($r=.35$, $p<.05$), extrinsic motivation ($r=.45$, $p<.05$) and task motivation ($r=.32$, $p<.05$). Similarly, active learning was significantly correlated with total motivation ($r=.30$, $p<.05$), intrinsic motivation ($r=.37$, $p<.05$), extrinsic motivation ($r=.31$, $p<.05$) and task motivation ($r=.26$, $p<.05$). These correlations indicated that higher levels of intrinsic motivation, extrinsic motivation and task motivation were associated with higher levels of academic challenge and active learning. Examining relationships among constructs of student engagement found that total student engagement was correlated with academic challenge ($r=.85$, $p<.05$), active learning ($r=.71$, $p<.05$) and student faculty interaction ($r=.73$, $p<.05$). These very high correlations suggest a close relationship between constructs of student engagement and the measure of student engagement. See Table 4-58 for correlations among total cognitive style gap, stress, motivation and engagement.

Student respondents were asked demographic questions including age, gender, number of classes taken similar to Class G and college classification. None of these demographic variables were significantly associated with total cognitive style gap. Furthermore, no moderate correlations were found among demographic variables.

Table 4-58. Class G Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=64)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.83*	--											
3. Gap-efficiency	.44*	.12	--										
4. Gap-rule	.84*	.54*	.13	--									
5. Total stress	.17	.18	.12	.08	--								
6. Frustrations	.08	.04	.17	-.01	.85*	--							
7. Conflicts	.10	.03	.07	.11	.68*	.64*	--						
8. Pressures	.08	.07	.07	.05	.85*	.63*	.49*	--					
9. Changes	.15	.13	.01	.16	.76*	.67*	.46*	.66*	--				
10. Self-imposed	.22	.33*	.12	.04	.71*	.40*	.23	.52*	.31*	--			
11. Total motivation	.10	.22	-.15	.07	.17	.02	-.10	.22	-.04	.38*	--		
12. Intrinsic motivation	.11	.18	-.12	.11	.10	.01	.01	.11	.03	.18	.58*	--	
13. Extrinsic motivation	.04	.13	-.16	.05	.34*	.22	.07	.39*	.15	.36*	.69*	.23	--
14. Task motivation	.13	.11	.06	.12	.09	.01	-.11	.14	-.19	.29*	.67*	.45*	.40*
15. Control of learning	.06	.22	-.20	.02	-.25*	-.34*	-.29*	-.21	-.23	.02	.51*	.17	.15
16. Self-efficacy	-.01	.01	-.11	.03	-.59*	-.63*	-.37*	-.41*	-.61*	-.30*	.29*	.02	.02
17. Test anxiety	.01	.08	-.01	-.06	.55*	.48*	.23	.44*	.47*	.47*	.43*	.04	.27*
18. Total Engagement	.19	.14	.11	.16	.32*	.34*	.18	.27*	.16	.23	.42*	.42*	.43*
19. Academic Challenge	.05	.09	.04	-.02	.30*	.36*	.13	.24	.14	.22	.43*	.35*	.45*
20. Active Learning	.30*	.18	.20	.28*	.25*	.23	.20	.21	.18	.15	.30*	.37*	.31*
21. Faculty Interaction	.11	.04	.03	.15	.18	.17	.11	.16	.03	.16	.20	.22	.20
M	-22.6	-8.78	-2.73	-11.1	51.3	11.8	5.97	10.7	4.95	17.8	160	19.0	20.5
SD	15.2	7.73	4.79	7.91	14.1	4.16	2.70	3.93	2.57	4.82	17.2	3.81	4.63

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-58 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.02	--						
16. Self-efficacy	.11	.52*	--					
17. Test anxiety	.10	.01	-.40*	--				
18. Total Engagement	.36*	.01	-.08	.14	--			
19. Academic Challenge	.32*	.07	-.14	.22	.85*	--		
20. Active Learning	.26*	-.01	.01	.02	.71*	.39*	--	
21. Faculty Interaction	.24	-.06	-.03	.03	.73*	.46*	.27*	--
M	31.5	22.4	48.4	18.3	49.1	24.1	14.0	10.9
SD	7.07	3.71	7.07	6.81	7.42	3.87	2.99	2.78

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies $p<.05$

Class H

For cognitive style gap of Class H, there were 50 usable responses. The course was instructed by a faculty member with a total KAI score of 132, indicating a preference to solve problems innovatively. Cognitive style gap score was calculated by subtracting the faculty member's cognitive style from each student's cognitive style. The total cognitive style mean for Class H was -36.70 (SD=15.01). That is, the average student in Class H was 36.70 points more adaptive than the faculty member instructing the course. Note that stress is noticeable between dissimilar cognitive styles with at least a 20-point gap (Kirton, 2003). In this class, 45 (90.0%) of the 50 students with usable KAI responses had a cognitive style gap of 20 points or more with the faculty member. The most adaptive cognitive style gap score was 65 points lower than the faculty member. The most innovative student's cognitive style was identified as 3 points more innovative than the faculty member. See Table 4-59 for findings of calculated cognitive style gap for Class H.

Table 4-59. Class H Student Mean Scores of Cognitive Style Construct Gaps (n=50)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-36.70	15.01	-65	3
Sufficiency of originality gap	-11.76	8.65	-31	7
Efficiency gap	-10.36	3.75	-19	-2
Rule/Group conformity gap	-14.58	7.04	-31	1

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Once cognitive style gaps were calculated, Pearson's correlation coefficient was used to find relationships among total and construct scores of stress, motivation and engagement.

For correlations examining relationships between cognitive style gaps, total cognitive style gap was correlated with sufficiency of originality gap ($r=.84$, $p<.05$), efficiency gap ($r=.47$, $p<.05$) and rule/group conformity gap ($r=.85$, $p<.05$). These correlations indicated that sufficiency of originality gap and rule/group conformity gap were closely related to the total measure of cognitive style gap. However, efficiency gap was less associated with total cognitive style gap. The correlation between sufficiency of originality gap and efficiency gap was not statistically significant. The lower correlations associated with the efficiency gap may be attributed to differences of size among gap constructs. The efficiency cognitive style construct also suffered in reliability as the post-hoc alpha coefficient was lower than an acceptable level of .70 (Schmitt, 1996).

In Class H, moderate correlations were found between rule/group conformity gap and total stress ($r=-.36$, $p<.05$), frustrations ($r=-.30$, $p<.05$) and pressures ($r=-.49$, $p<.05$). These negative correlations indicated that a more innovative gap was associated with lower levels of stress in this class taught by an innovative faculty member. This finding was congruent with previous research conducted by Kirton (2003).

Examining relationships between cognitive style gap and motivation, moderate correlations were found between intrinsic motivation and total cognitive style gap ($r=.32$, $p<.05$), sufficiency of originality gap ($r=.35$, $p<.05$), and rule/group conformity gap ($r=.30$, $p<.05$). The data suggests that a more innovative gap in these two constructs was associated with higher levels of intrinsic motivation in Class H.

Total cognitive style gap was correlated with total student engagement ($r=.40$, $p<.05$), active learning ($r=.46$, $p<.05$) and student-faculty interaction ($r=.41$, $p<.05$). Likewise, sufficiency of originality gap was correlated with total engagement ($r=.33$, $p<.05$), active learning ($r=.41$, $p<.05$) and student-faculty interaction ($r=.31$, $p<.05$). Also rule/group conformity gap was moderately correlated with total engagement ($r=.32$, $p<.05$), active learning ($r=.40$, $p<.05$) and student-faculty interaction ($r=.37$, $p<.05$). This evidence suggests that more innovative sufficiency of originality gap and rule/group conformity gap was associated with higher levels of active learning and student-faculty interaction in Class H.

For internal correlations of stress scales, total stress was correlated with frustrations ($r=.64$, $p<.05$), conflicts ($r=.71$, $p<.05$), pressures ($r=.73$, $p<.05$), changes ($r=.67$, $p<.05$) and self-imposed ($r=.71$, $p<.05$). These correlations signify a close relationship between stress constructs and the total measure of stress.

In Class H, correlations were found between test anxiety and total stress ($r=.52$, $p<.05$), frustrations ($r=.31$, $p<.05$), conflicts ($r=.30$, $p<.05$), pressures ($r=.36$, $p<.05$) and self-imposed ($r=.49$, $p<.05$). The data suggests that higher levels of these stress constructs were related to test anxiety. Negative correlations were found between self-efficacy and total stress ($r=-.33$, $p<.05$), frustrations ($r=-.46$, $p<.05$) and conflicts ($r=-.31$, $p<.05$). This provided evidence that higher levels of self-efficacy were associated with lower levels of stress constructs frustrations and conflicts. No significant correlations were found between constructs of stress and constructs of engagement.

Total motivation in Class H was correlated with intrinsic motivation ($r=.72$, $p<.05$), extrinsic motivation ($r=.65$, $p<.05$), task motivation ($r=.81$, $p<.05$), control of learning ($r=.63$, $p<.05$) and self-efficacy ($r=.62$, $p<.05$). These correlations indicated that constructs of motivation were related to the measure of total motivation. However, note that the correlation between total motivation and test anxiety was not significant ($r=.22$, $p>.05$) indicating a low association.

Considering the relationship between total motivation and total student engagement, a moderate correlation ($r=.44$, $p<.05$) indicated higher levels of motivation associated with higher levels of student engagement. This finding was supported by correlations found between constructs of motivation and engagement. Specifically, moderate and substantial correlations existed between intrinsic motivation and total engagement ($r=.50$, $p<.05$), active learning ($r=.49$, $p<.05$) and student-faculty interaction ($r=.41$, $p<.05$). Likewise, task motivation was moderately correlated with total student engagement ($r=.41$, $p<.05$), academic challenge ($r=.31$, $p<.05$) and student-faculty interaction ($r=.32$, $p<.05$). Again, these correlations provided evidence that higher levels of motivation were associated with higher levels of engagement in this class.

Considering the internal correlations to scales of student engagement, total engagement was very highly correlated with academic challenge ($r=.75$, $p<.05$), active learning ($r=.86$, $p<.05$) and student-faculty interaction ($r=.79$, $p<.05$). These correlations provided evidence that these constructs are closely related to the total measure of student engagement. See Table 4-60 for associations of cognitive style gap, student stress, student motivation, and student engagement for Class H.

Student respondents were asked demographic questions specific to age, gender, number of courses taken similar to the content of Class H and college classification. Answers to these questions were used to find correlations with cognitive style gap. None of these demographic variables were found to significantly correlate with total cognitive style gap in Class H.

Table 4-60. Class H Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=50)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.84*	--											
3. Gap-efficiency	.47*	.11	--										
4. Gap-rule	.85*	.51*	.34*	--									
5. Total stress	-.23	-.14	.06	-.36*	--								
6. Frustrations	-.21	-.14	.05	-.30*	.64*	--							
7. Conflicts	-.08	-.08	.08	-.13	.71*	.44*	--						
8. Pressures	-.32*	-.15	-.01	-.49*	.73*	.49*	.43*	--					
9. Changes	-.03	-.03	.05	-.05	.67*	.33*	.61*	.41*	--				
10. Self-imposed	-.12	-.07	.04	-.20	.71*	.11	.29*	.28*	.33*	--			
11. Total motivation	.14	.22	-.04	.05	.01	-.16	-.05	-.03	-.21	.24	--		
12. Intrinsic motivation	.32*	.35*	-.09	.30*	-.17	-.21	.03	-.29*	-.18	-.01	.72*	--	
13. Extrinsic motivation	-.03	.02	.14	-.16	.15	.01	-.10	.18	-.07	.28*	.65*	.23	--
14. Task motivation	.20	.27	-.09	.15	-.24	-.19	-.14	-.29*	-.42*	-.01	.81*	.77*	.36*
15. Control of learning	.09	.12	.03	.03	-.04	-.20	-.09	-.01	-.05	.09	.63*	.28*	.26
16. Self-efficacy	.19	.28*	-.18	.16	-.33*	-.46*	-.31*	-.15	-.21	-.11	.62*	.36*	.31*
17. Test anxiety	-.20	-.18	.03	-.22	.52*	.31*	.30*	.36*	.13	.49*	.22	-.02	.22
18. Total Engagement	.40*	.33*	.23	.32*	.10	-.03	.14	-.02	.08	.16	.44*	.50*	.25
19. Academic Challenge	.08	.07	.19	-.01	.22	.05	.24	.10	.11	.22	.32*	.29*	.27
20. Active Learning	.46*	.41*	.15	.40*	.02	.08	.01	-.04	.05	-.01	.35*	.49*	.18
21. Faculty Interaction	.41*	.31*	.22	.37*	.02	-.19	.08	-.11	.04	.16	.37*	.41*	.16
M	-36.7	-11.8	-10.4	-14.6	49.3	11.4	5.34	9.56	4.10	19.0	158	19.0	21.6
SD	15.0	8.65	3.75	7.04	10.2	3.00	2.21	2.92	1.74	4.84	20.7	4.63	4.07

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-60 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.50*	--						
16. Self-efficacy	.56*	.68*	--					
17. Test anxiety	-.15	-.21	-.41*	--				
18. Total Engagement	.41*	.32*	.27	-.10	--			
19. Academic Challenge	.31*	.28*	.19	-.10	.75*	--		
20. Active Learning	.35*	.18	.20	-.08	.86*	.50*	--	
21. Faculty Interaction	.32*	.30*	.25	-.05	.79*	.32*	.57*	--
M	33.1	22.5	43.5	18.7	51.2	26.3	13.2	11.7
SD	6.81	3.92	8.11	7.34	7.75	3.15	3.22	3.30

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Class I

For Class I, there were 60 usable KAI responses for calculating cognitive gap. The faculty member instructing Class I had a total cognitive style score of 134 which was subtracted from each student's cognitive style score. In Class I, the total cognitive style gap mean was -41.10 (SD=14.25) which was obviously larger than the 20-point cognitive style gap Kirton (2003) claims as a threshold for noticeable differences. Furthermore, 55 (91.7%) of the 60 students with usable responses had a cognitive style gap of 20 points or higher with this innovative faculty member. The most adaptive student was 84 points lower than the faculty member's cognitive style while the most innovative student in

Class I was 10 points more innovative than the faculty member. See Table 4-61 for findings of calculated cognitive style gap reported in Class I.

Table 4-61. Class I Student Mean Scores of Cognitive Style Construct Gaps (n=60)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-41.10	14.25	-84	-10
Sufficiency of originality gap	-18.87	7.61	-35	-2
Efficiency gap	-2.37	4.77	-13	9
Rule/Group conformity gap	-19.87	7.42	-36	-1

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Calculated cognitive style gap scores were used to find relationships with student stress, student motivation and student engagement. Pearson's correlation coefficient was used to complete this task.

For correlations internal to the measurement of cognitive style gap, total cognitive style gap was correlated with sufficiency of originality gap ($r=.75$, $p<.05$), efficiency gap ($r=.46$, $p<.05$) and rule/group conformity gap ($r=.84$, $p<.05$). These correlations indicated a positive relationship between construct measures of cognitive style gap and total cognitive style gap. However, efficiency gap was negatively correlated with sufficiency of originality ($r=-.05$, $p<.05$). This correlation provides evidence of a negligible relationship between the two constructs; however this may be explained by examining differences between the sufficiency of originality gap mean and the efficiency gap mean. That is, correlations between gap score constructs were affected by degree and direction of the gap between the faculty member and the student. Another explanation for lower correlations may be attributed to the lower post-hoc reliability of the efficiency construct.

One moderate correlation was found between efficiency cognitive style gap and conflict stress ($r=.35$, $p<.05$) indicating that more innovative students had higher levels of conflict stress in this innovative class; a finding that conflicts with Kirton's (2003) theory as applied in this context. No other cognitive style gap constructs were correlated with stress constructs, motivation constructs or student engagement constructs in Class I.

Considering correlations internal to the measurement of student stress, total stress was correlated with the constructs: frustrations ($r=.74$, $p<.05$), conflicts ($r=.67$, $p<.05$), pressures ($r=.71$, $p<.05$), changes ($r=.63$, $p<.05$) and self-imposed ($r=.67$, $p<.05$). The data suggests that all of the constructs were at least substantially related to student stress.

The motivation construct self-efficacy was negatively correlated with the total student stress ($r=-.60$, $p<.050$), as well as stress constructs: frustrations ($r=-.55$, $p<.05$), conflicts ($r=-.35$, $p<.05$), pressures ($r=-.52$, $p<.05$) and changes ($r=-.43$, $p<.05$). These correlations indicated that lower levels of self-efficacy were associated with higher levels of stress among these stress constructs. On the other hand, test anxiety was positively correlated with total stress ($r=.63$, $p<.05$) and stress constructs: frustrations ($r=.58$, $p<.05$), conflicts ($r=.33$, $p<.05$), pressures ($r=.35$, $p<.05$) and self-imposed ($r=.52$, $p<.05$). This provided evidence that a relationship exists between higher levels of test anxiety and higher levels of the aforementioned stress constructs in Class I.

Self-imposed stress was moderately correlated with total motivation ($r=.33$, $p<.05$) and the construct extrinsic motivation ($r=.35$, $p<.05$). This finding indicated an association between higher levels of self-imposed stress and higher levels of total motivation with emphasis placed on extrinsic motivation. No moderate correlations were found between constructs of student stress and constructs of student motivation in Class I.

Moderate correlations internal to the measurement of total motivation were found to be moderate to substantial. Specifically, total motivation was correlated with intrinsic motivation (r=.58, p<.05), extrinsic motivation (r=.53, p<.05), task motivation (r=.68, p<.05), control of learning (r=.51, p<.05), self-efficacy (r=.36, p<.05) and test anxiety (r=.48, p<.05). This data provided evidence that constructs used to measure motivation were related to the total motivation scale used in Class I.

Examining relationships between total engagement and motivation, total student engagement was moderately correlated with total motivation (r=.38, p<.05), intrinsic motivation (r=.33, p<.05) and task motivation (r=.41, p<.05). Furthermore, academic challenge was correlated with total motivation (r=.40, p<.05), intrinsic motivation (r=.34, p<.05) and task motivation (r=.45, p<.05). The data indicated an association between higher levels of motivation with higher levels of engagement among these constructs.

Total student engagement had very high correlations with engagement constructs academic challenge (r=.82, p<.05), active learning (r=.77, p<.05) and student-faculty interaction (r=.74, p<.05). These correlations indicated that constructs of student engagement were closely related to the total measurement of student engagement in Class I. See Table 4-62 for findings regarding relationships among cognitive style gap, stress, motivation and engagement in Class I.

Student respondents were asked demographic questions specific to age, gender number of course relevant classes taken and college classification. Answers to these questions were used to find correlations with cognitive style gap. Gender had a moderate negative relationship with intrinsic motivation (r=-.36, p<.05) and control of learning (r=-.31, p<.05). That is, females in Class I were associated with lower levels of intrinsic motivation.

Table 4-62. Class I Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=59)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.75*	--											
3. Gap-efficiency	.46*	-.04	--										
4. Gap-rule	.84*	.42*	.27*	--									
5. Total stress	.06	-.01	.26*	-.06	--								
6. Frustrations	.06	.07	.22	-.11	.74*	--							
7. Conflicts	.18	.02	.35*	.11	.67*	.40*	--						
8. Pressures	.05	-.10	.13	.12	.71*	.42*	.31*	--					
9. Changes	.11	.15	-.01	.06	.63*	.42*	.53*	.41*	--				
10. Self-imposed	-.11	-.09	.16	-.21	.67*	.23	.25	.38*	.10	--			
11. Total motivation	-.10	.02	.06	-.26*	.21	.15	.09	.01	-.02	.33*	--		
12. Intrinsic motivation	.04	.09	.01	-.03	.29*	.26*	.18	.20	.21	.15	.58*	--	
13. Extrinsic motivation	-.07	.15	-.04	-.27*	.13	.02	-.09	-.01	-.01	.35*	.53*	.06	--
14. Task motivation	-.14	-.14	.12	-.21	.06	.05	.12	.01	-.09	.08	.68*	.47*	.21
15. Control of learning	-.10	-.09	.04	-.12	-.21	-.22	-.13	-.24	-.15	-.03	.51*	.11	-.02
16. Self-efficacy	-.05	.09	-.16	-.08	-.60*	-.55*	-.35*	-.52*	-.43*	-.24	.36*	.03	.17
17. Test anxiety	-.01	.01	.12	-.10	.63*	.58*	.33*	.35*	.23	.52*	.48*	.17	.22
18. Total Engagement	-.03	.16	-.09	-.16	.29*	.27*	.05	.27*	.26*	.15	.38*	.33*	.25
19. Academic Challenge	-.13	.04	-.16	-.19	.30*	.25	.11	.32*	.19	.17	.40*	.34*	.24
20. Active Learning	-.02	.10	.02	-.15	.08	.13	-.11	.01	.07	.10	.26*	.19	.20
21. Faculty Interaction	.16	.29*	-.03	.02	.26*	.24	.06	.24	.38	.05	.17	.21	.12
M	-40.7	-18.8	-2.25	-19.7	50.1	10.8	6.04	9.98	4.66	18.6	156	17.2	21.3
SD	14.1	7.65	4.73	7.33	11.6	4.15	2.69	2.83	2.42	4.78	18.4	4.27	4.47

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-62 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.27*	--						
16. Self-efficacy	.17	.50*	--					
17. Test anxiety	.05	-.02	-.34*	--				
18. Total Engagement	.41*	-.01	-.17	.25	--			
19. Academic Challenge	.45*	.01	-.13	.23	.82*	--		
20. Active Learning	.31*	-.01	-.09	.15	.77*	.39*	--	
21. Faculty Interaction	.12	-.01	-.19	.19	.74*	.34*	.55*	--
M	28.6	22.2	49.2	17.7	51.6	25.4	14.0	12.3
SD	7.41	4.06	7.12	7.82	7.61	4.32	2.73	2.64

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Considering the number of collegiate courses related to the subject area of Class I, a moderate correlation was found with academic challenge ($r=.44$, $p<.05$). This finding signifies that taking more courses related to the content of Class I was coupled with higher levels of academic challenge.

All Students

This study combined all participants into one group for broader data analysis. There were 511 participants with usable KAI scores to calculate cognitive style gap. For analysis, students retained their individual cognitive style gap with the faculty member from their respective classes. The mean cognitive style gap for all participants was -6.30

(SD=28.19) indicating that on average, students' cognitive style gap in this group of students was 6.30 points more adaptive then their respective faculty member. The most adaptive cognitive style gap was 84 points lower than the student's faculty member while the most innovative cognitive style gap was 61 points higher than the faculty member. Note that awareness of cognitive style differences between individuals occurs at a 20-point gap (Kirton, 2003). Of the 511 usable KAI responses from students, 295 (57.7%) students had at least a 20 point cognitive style gap with the faculty member. See Table 4-63 for findings relevant to cognitive style gap for all student respondents.

Table 4-63. All Student Class Mean Scores of Cognitive Style Construct Gaps (n=511)

Construct	Mean	SD	Min	Max
Total cognitive style gap	-6.30	28.19	-84	61
Sufficiency of originality gap	-4.09	13.24	-35	34
Efficiency gap	1.35	7.41	-19	18
Rule/Group conformity gap	-3.56	12.88	-36	27

Note. Cognitive style gap scores were calculated by subtracting faculty member's KAI score from individual student's KAI score. Coded: lower score equals more adaptive, higher score equals more innovative.

Using calculated student cognitive style gaps, the researcher was able to look for relationships among student stress, student motivation and student engagement. Pearson's correlation coefficient was used to find such relationships.

Among all the students, correlations internal to the measurement of cognitive style gap were examined for the purpose of determining degree and direction of relationships. Total cognitive style gap was very highly correlated with sufficiency of originality gap ($r=.90$, $p<.05$) and rule/group conformity gap ($r=.94$, $p<.05$). Furthermore, the correlation between sufficiency of originality gap and rule/group conformity gap was .80 ($p<.05$). This indicated a very close association between these two constructs and the total measure of cognitive style gap. Efficiency gap was substantially correlated with total cognitive style gap ($r=.56$, $p<.05$), but had a low correlation with sufficiency of originality gap ($r=.23$, $p<.05$) and a moderate correlation with rule group conformity gap ($r=.40$, $p<.05$). These correlations indicated that efficiency gap was associated with total cognitive style gap, but had less association with the other two gap constructs. Partial explanation to why efficiency gap was less related to other cognitive style gap constructs may exist in the differences found between cognitive style gap means for all students. That is, efficiency cognitive style gap was the only construct mean with a negative value. Another explanation may exist in the lower post-hoc reliability of the efficiency scale.

Examining correlations between cognitive style gap and student stress, no moderate correlations were found among total scores and construct scores for these students. There were no moderate correlations found between scales of cognitive style gap and scales of student motivation. Furthermore, no moderate correlations were found between scales of cognitive style gap and student engagement. Although there were relationships between the aforementioned scales among individual classes, the researcher concluded that measures of cognitive style gap had little association with stress, motivation and engagement in these students.

For correlations between the measurement of stress, total student stress was very highly correlated with frustrations ($r=.81$, $p<.05$), substantially correlated with conflicts ($r=.66$, $p<.05$), highly correlated with pressures ($r=.80$, $p<.05$), substantially correlated with changes ($r=.65$, $p<.05$) and very highly correlated with self-imposed stress ($r=.70$, $p<.05$). These correlations indicated a very close relationship between total stress and each of the constructs measuring stress.

Moderate correlations were found between total stress and the motivation construct self-efficacy ($r=-.40$, $p<.05$). Furthermore, self-efficacy was negatively correlated with stress constructs: frustrations ($r=-.43$, $p<.05$), pressures ($r=-.32$, $p<.05$) and changes ($r=-.36$, $p<.05$). These correlations indicated that lower levels of self-efficacy were associated with higher levels of these stress constructs. Test anxiety was substantially correlated with total student stress ($r=.53$, $p<.05$) indicating an association between higher levels of stress and higher levels of test anxiety among all student participants. Test anxiety was also moderately correlated with stress constructs: frustrations ($r=.42$, $p<.05$), pressures ($r=.43$, $p<.05$) and self imposed stress ($r=.48$, $p<.05$). Again, higher levels of test anxiety were associated with higher levels of stress among these constructs.

There were no moderate correlations found among measurements of stress and measurement of student engagement among students surveyed for this study. However, a low correlation was found between total stress and total engagement ($r=.18$, $p<.05$) indicating that higher levels of stress were associated with higher levels of student engagement.

Concerning the measurement of motivation, correlations were found between total student motivation and motivation constructs: intrinsic motivation ($r=.68$, $p<.05$), extrinsic motivation ($r=.61$, $p<.05$), task motivation ($r=.75$, $p<.05$), control of learning ($r=.58$, $p<.05$), self-efficacy ($r=.44$, $p<.05$) and test anxiety ($r=.37$, $p<.05$). As expected, these correlations suggest that constructs of motivation were related to the total measurement of motivation.

A moderate correlation existed between total motivation and total engagement (r=.30, p<.05) indicating that higher levels of student motivation were associated with higher levels of student engagement among these respondents. Additionally, total motivation was correlated with the engagement construct academic challenge (r=.33, p<.05) suggesting that higher levels of student motivation were coupled with higher levels of academic challenge. Moderate correlations were also found between task motivation and total engagement (r=.30, p<.05) as well as academic challenge (r=.34, p<.05). The data suggests that among these students, higher levels of total motivation were associated with total student engagement with emphasis placed on the constructs academic challenge and task motivation.

For the correlations specific to the measurement of student engagement, total student engagement was correlated with internal constructs: academic challenge (r=.77, p<.05), active learning (r=.76, p<.05), and student-faculty interaction (r=.71, p<.05). These correlations provided evidence that constructs measuring motivation were closely related to the total measure of student engagement. See Table 4-62 for findings regarding relationships among cognitive style gap, stress, motivation and engagement for all participating students.

For demographic questions, student respondents were asked to specify age, gender, number of similar courses taken and college classification. Responses were used to correlate with cognitive style gap. No moderate correlations existed among demographic variables and the measurement of cognitive style gap, stress, motivation and engagement.

Table 4-64. All Student Class Correlations, Means, and Standard Deviations among Constructs of Cognitive Style Gap, Stress, Motivation and Engagement (n=496)

Construct	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Total gap	--												
2. Gap-originality	.90*	--											
3. Gap-efficiency	.56*	.23*	--										
4. Gap-rule	.94*	.80*	.40*	--									
5. Total stress	.15*	.15*	.08	.13*	--								
6. Frustrations	.16*	.15*	.10*	.15*	.81*	--							
7. Conflicts	.10*	.10*	.07	.08	.66*	.49*	--						
8. Pressures	.11*	.09*	.05	.11*	.80*	.55*	.41*	--					
9. Changes	.11*	.11*	.03	.11*	.65*	.46*	.45*	.51*	--				
10. Self-imposed	.06	.07	.04	.04	.70*	.37*	.25*	.43*	.21*	--			
11. Total motivation	-.04	.01	-.08	-.03	.11*	.03	-.08	.07	-.11*	.33*	--		
12. Intrinsic motivation	-.01	.05	-.13*	.01	-.01	-.04	-.03	-.04	-.04	.10*	.68*	--	
13. Extrinsic motivation	-.06	-.02	-.08	-.06	.22*	.15*	-.02	.17*	.04	.35*	.61*	.15*	--
14. Task motivation	-.11*	-.12*	-.03	-.10*	-.06	-.05	-.17*	-.07	-.19*	.12*	.75*	.63*	.31*
15. Control of learning	.08	.09*	-.01	.09*	-.13*	-.18*	-.10*	-.12*	-.23*	.08	.58*	.30*	.19*
16. Self-efficacy	-.02	.02	-.03	-.04	-.40*	-.43*	-.27*	-.32*	-.36*	-.12*	.44*	.27*	.15*
17. Test anxiety	.01	.01	-.01	.01	.53*	.42*	.21*	.43*	.28*	.48*	.37*	.03	.28*
18. Total Engagement	.01	.05	-.04	-.01	.18*	.13*	.10*	.15*	.07	.17*	.30*	.29*	.23*
19. Academic Challenge	-.04	-.02	.03	-.08	.18*	.17*	.07	.16*	.05	.16*	.33*	.28*	.21*
20. Active Learning	-.03	.03	-.10*	-.04	.08	.06	.02	.08	.04	.07	.15*	.20*	.13*
21. Faculty Interaction	.11	.13*	-.03	.12*	.14*	.05	.15*	.09*	.08	.15*	.16*	.16*	.16*
M	-6.53	-4.14	1.29	-3.68	51.8	11.8	5.71	10.5	4.68	19.2	160	18.1	21.5
SD	28.1	13.3	7.39	12.8	12.9	4.36	2.63	3.57	2.38	4.66	20.2	4.47	4.44

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies p<.05

Table 4-64 (continued).

Construct	14	15	16	17	18	19	20	21
1. Total gap								
2. Gap-originality								
3. Gap-efficiency								
4. Gap-rule								
5. Total stress								
6. Frustrations								
7. Conflicts								
8. Pressures								
9. Changes								
10. Self-imposed								
11. Total motivation								
12. Intrinsic motivation								
13. Extrinsic motivation								
14. Task motivation	--							
15. Control of learning	.31*	--						
16. Self-efficacy	.24*	.54*	--					
17. Test anxiety	.06	-.10*	-.36*	--				
18. Total Engagement	.30*	.03	.03	.12*	--			
19. Academic Challenge	.34*	.08	-.02	.18*	.77*	--		
20. Active Learning	.17*	-.06	.07	.01	.76*	.34*	--	
21. Faculty Interaction	.12*	.02	.04	.05	.71*	.25*	.44*	--
M	31.4	23.0	47.2	18.8	49.6	25.1	12.8	11.7
SD	7.70	3.94	7.71	7.47	7.74	4.14	3.13	3.07

Note. Cases excluded listwise. All constructs coded: higher scores equals increased levels. * signifies $p<.05$

Group Comparisons

Kirton (2003) theorized and provided evidence that individuals with more than a 20-point cognitive style gap differ in the manner in which they solve problems. As the two individuals perceive the problem differently, they also differ in how they generate solutions, create change and utilize rules in their problem solving efforts. Stress is a result of the two individuals working together in solving a problem (Kirton). To test if this data supports Kirton’s theory, a two-tailed independent sample t-test was conducted to examine stress score differences between students with less than a 20-point gap and students with more than a 20-point gap with their respective instructor. Groups were coded one for students with a 20-point gap or higher and zero for students with less than a 20-point gap. No significant difference was found (t=-.05, p=.96) in total stress scores between students with more than a 20-point gap (M=51.76, n=284) and students with less than a 20-point gap (M=51.82, n=212). The data suggests that there was no significant difference of stress scores between students with more than a 20-point cognitive style gap and students with less than a 20-point cognitive style gap.

The same data analysis was conducted to examine differences among students' level of motivation. A two-tailed independent sample t-test was conducted to examine motivation score differences between students with more than a 20-point gap and students with less than a 20-point gap. A significant difference was found (t=-3.13, p=.00) between motivation scores of students with more than a 20-point gap (M=30.09) and students with less than a 20-point gap (M=31.20). This indicated that students with less than a 20-point gap with their respective instructor had on average scored 1.11 points higher than students with more than a 20-point gap on the MSLQ.

Note that in objective 2, courses taught by innovative instructors (Classes A, B & C) and adaptive instructors (Classes G, H & I) were found to have students with significantly lower levels of motivation than students in courses taught by instructors with a cognitive style score similar to the general population mean (Classes D, E & F). Were motivation scores lower when students had more than a 20-point gap and taught by an adaptive instructor or innovative instructor? A two-way ANOVA was conducted to examine the interaction effect of these two variables. With motivation as the dependent variables, a significant difference was found (F=3.94, p=.03) for the interaction of students with a 20-point cognitive style gap and the group effect of faculty members' cognitive style. A closer examination of group means finds that the lowest motivation scores were found in students with a 20-point gap taught by adaptive faculty members (M=29.24). This motivation mean score was 2.07 points lower than students enrolled in the same courses with a cognitive style gap less than 20 points (M=31.32). The MSLQ scale has a range of 36 points. Considering students enrolled in courses taught by innovative faculty members, students with more than a 20-point gap scored less (M=30.08) than students with less than a 20-point gap (M=30.52), a difference of 0.44 points. In the middle score teaching group, the difference between those with more than a 20-point gap and those with less than a 20-point gap was 0.24. The evidence suggests that in these classes, students with more than a 20-point gap enrolled in an adaptive course on average have lower levels of motivation.

Another t-test was conducted to examine differences of total student engagement between students with less than a 20-point gap with their instructor and students with more than a 20-point gap with their instructor. No significant difference was found (t=1.14, p=.25) between the group with less than a 20-point gap (M=49.11) and the group with more than a 20-point gap (M=49.91). This finding provided evidence that among these respondents, students having a 20-point gap with their respective faculty member did not differ in engagement scores measured by the NSSE.

Summary of Findings for Objective Three

This study calculated dissimilar cognitive style by subtracting the faculty member's cognitive style score from each individual student's cognitive style score which yielded a cognitive style gap. Kirton (2003) stated that individuals become aware of cognitive style gap above 20 points, at which stress becomes apparent.

As expected, faculty members who were either highly adaptive or highly innovative also had more cognitive style gap scores higher than twenty points with their students. For example, Class E had the least number of students having a cognitive style gap of more than 20 points (n=9, 28.1%), while Class I had the most students having a cognitive style gap of more than 20 points (n=55, 91.7%). Note that every class had students with more than a 20-point cognitive style gap.

For all students participating in this study, 295 (57.7%) students had at least a 20 point cognitive style gap score with the faculty member. Considering all participating students, the most adaptive cognitive style gap was 84 points lower than the student's faculty member while the most innovative cognitive style gap was 61 points higher than the faculty member. The total cognitive style gap score mean (M=-6.30) was slightly adaptive for all students combined. This was reflective of the faculty member cognitive style mean of 98.78 which was slightly innovative and the students' cognitive style mean of 93.28 which was slightly adaptive. Note that number of students in each class gives different amounts of weight to the mean cognitive style gap when accounting for all students.

A two-tailed independent sample t-test was conducted to examine if stress scores differed between students with less than a 20-point cognitive style gap and students with more than a 20-point cognitive style gap with their respective instructor. No significant difference was found (t=-.05, p=.96) in total stress scores between students with more than a 20-point cognitive style gap (M=51.76, n=284) and students with less than a 20-point cognitive style gap (M=51.82, n=212). The data suggests that students in these classes with a 20-point cognitive style gap with their faculty member do not have higher levels of stress, which does not support previous research conducted by Kirton (2003).

A two-tailed independent sample t-test was conducted to examine motivation score differences between students with more than a 20-point cognitive style gap and students with less than a 20-point cognitive style gap. A significant difference was found ($t=-3.13$, $p=.00$) between motivation scores of students having more than a 20-point cognitive style gap ($M=30.09$) and students having less than a 20-point cognitive style gap ($M=31.20$). That is, a 1.11 point difference between the two groups on a 36-point scale. This indicates that in these classes, students with more than a 20-point cognitive style gap with their instructor on average have lower levels of motivation. In further analysis, a two-way ANOVA was conducted to examine the interaction effect of students with a 20-point cognitive style gap and students enrolled in a course taught by an adaptive faculty member. With motivation as the dependent variables, a significant difference was found ($F=3.94$, $p=.03$). The lowest motivation scores were found in students with a 20-point cognitive style gap taught by adaptive faculty members ($M=29.24$). This motivation mean score was 2.07 points lower than students enrolled in the same courses with a cognitive style gap less than 20 points ($M=31.32$).

Another t-test was conducted to examine differences of total student engagement between students with less than a 20-point cognitive style gap with their instructor and students with more than a 20-point cognitive style gap with their instructor. No significant difference was found ($t=1.14$, $p=.25$) between the group with less than a 20-point cognitive style gap ($M=49.11$) and the group with more than a 20-point cognitive style gap ($M=49.91$). The data suggests that students in these classes with a 20-point cognitive style gap or more with the faculty member did not have lower engagement scores.

Among all classes, total cognitive style gap had very high correlations with sufficiency of originality gap and rule/group conformity gap indicating a very close relationship. However the efficiency gap was less correlated in these classes and sometimes negatively correlated with the other two cognitive style constructs. This may partially be explained by the degree and direction of students' mean cognitive style gap in relation to the faculty member cognitive style gap. The lower post-hoc reliability of the efficiency scale may also have contributed to the efficiency construct being less related.

For the SSI, total motivation consistently correlated with stress constructs at a substantial or very high level. This indicated a very close relationship between stress constructs and the total measure of stress. Although stress constructs did not always significantly correlate with other stress constructs, the correlations were always positive.

Correlations were examined between total motivation and motivation constructs to determine the degree of association the construct had with the total measure of motivation. The constructs intrinsic motivation, extrinsic motivation, and task motivation were always substantially or very highly correlated with the total measurement of motivation in these classes. Control of learning had correlations with total motivation that ranged from moderate to very high. In all classes except Class C and Class G, self-efficacy was moderately or substantially correlated with total motivation. In both these classes, this correlation was low. For test anxiety, correlations were generally moderate in these classes except for Classes B, D and H, in which correlations were low. Still, all correlations were positive and evidence was provided that motivation constructs were related to the total measurement of motivation.

In these classes, total student engagement was substantially or very highly correlated with the three constructs of student engagement used from the NSSE. However, the construct active learning had low correlations with academic challenge and student-faculty interaction in Classes B, D, E and F. This indicated that active learning was less associated with the other two engagement constructs in these four classes.

Except for Class A, total student stress had no significant relationship with total cognitive style gap. Class A was unique in that both the efficiency gap and the rule/group conformity gap significantly correlated with at least three stress constructs. Further examining other classes found that self-imposed stress had moderate correlations with a cognitive style gap construct in Classes C, D and G. However in these classes, the data suggests that the relationship between student stress and cognitive style gap are minimal.

Examining relationships between cognitive style gap and motivation Classes A and B had moderate correlations between efficiency gap and specific constructs of motivation. Also, extrinsic motivation was correlated with at least one cognitive style gap construct in every class except for Classes G, H and I, which were taught by innovative faculty members. Only Classes G and I had no moderate correlations. However, examining all students together as a group, no moderate correlations were found between any measures of motivation and measures of cognitive style gap. The data suggests that there are no consistent relationships between constructs of motivation and constructs of cognitive style gap, although relationships do exist.

For student engagement, cognitive style gaps sufficiency of originality and rule/group conformity had moderate and positive relationships with active learning in Classes B and H. However, Classes A, D, E, F and I had no moderate correlations between any student engagement construct and cognitive style gap construct. Likewise considering all students grouped, no moderate correlation was found between any construct of student engagement and any construct of cognitive style gap. The data suggests that relationships do exist between cognitive style gap and student engagement, but no relationships provided a consistent pattern.

In every class the motivation construct self-efficacy was negatively correlated with constructs of stress, often with moderate level correlations. This evidence supports the literature review written by Pfeiffer (2001). Also, test anxiety consistently had at least one moderate correlation with a stress construct in every class. This finding helps confirm the research conducted by Misra and McKean (2000).

Considering correlations between total student stress and total student engagement only Classes A and G had moderate correlations between the two measures; both of which were positive relationships. Also in these two classes, the frustrations stress construct was moderately correlated with total engagement and academic challenge. The data suggests that in these two classes moderate relationships exist between student stress and engagement with emphasis placed on frustrations and academic challenge.

Considering all students, total student engagement had positive and moderate correlations with total student motivation ($r=.30$, $p<.05$). However, a moderate correlation was not found in Classes A, E and F. Furthermore Classes A and F had moderate inverse relationships between constructs of student engagement and constructs of motivation. This finding contradicts the depicted relationship by Astin (1984). However, among classes B, D, G, H and I task motivation was moderately correlated with academic challenge and one other student engagement construct. Likewise, academic challenge was a prominent construct in finding correlations with motivation. Also, note that Classes B, G and H had many moderate correlations between constructs of motivation and constructs of engagement when compared to other classes. This provided evidence that the relationships between engagement and motivation in these classes did not offer consistent patterns of association.

Pintrich and Schunk (2002) claim that expectancy components of motivation are related to student engagement. The two expectancy motivational measures used in this study include control of learning and self-efficacy. Although Classes A, B, D, F and H had a moderate correlation between one expectancy motivation construct and one student engagement construct, the data did not provide evidence of any consistent pattern for this relationship. That is, these correlations were negative in Classes A and F. The data provided evidence that the expectancy components of motivation as measured in this study did not provide a consistent pattern to determine the relationship among these variables and student engagement.

Objective Four

Explain Undergraduate Student Motivation and Student Stress based on Cognitive Style Gap and Selected Demographic Variables.

The goal of objective four was to use backward stepwise multiple regression to explain student stress from the cognitive style gap between a student and his or her respective teacher. This data analysis procedure was utilized to determine if dissimilar cognitive style between a student and the faculty member instructing the course contributed to the explanation of student perceived stress. Finding a relationship in the appropriate direction would provide evidence to support Kirton's Adaption-Innovation theory. Demographic variables included as independent variables in data analysis were gender, age, number of similar courses the student had taken and college classification.

Additionally, backward stepwise multiple regression was used to explain student motivation from cognitive style gap between student and faculty member. This data analysis procedure was utilized to determine if dissimilar cognitive style between a student and the faculty member instructing the course contributed to the explanation of student motivation. Finding a relationship in the appropriate direction would provide evidence that students were using coping behavior (Kirton, 2003) to operate at a cognitive style closer to the faculty member instructing the course. Demographic variables included as independent variables in data analysis included gender, age, number of similar courses student had taken and college classification. Gender was the only categorical variable and was dummy coded one for males and two for females.

For data analysis cognitive style gap was calculated by subtracting the faculty member cognitive style score from the student cognitive style score. Before employing backward stepwise multiple regression to analyze data in each class, the researcher examined the possibility of cognitive style gap constructs having a curvilinear relationship with total stress and with total motivation. However, no curvilinear relationships contributed more explanation of the dependent variable stress or motivation. Furthermore, the researcher examined the possibility of interaction effects between variables. No interaction effects were found in the data analysis for determining student stress and student motivation in these classes.

Class A

In Class A, student stress was explained by efficiency cognitive style gap (β=.33) and students' age (β=.31) using a backward stepwise regression analysis. The model had an adjusted R^2 of .20 indicating that 20% of the variance of students' perceived stress in Class A was contributed by these two variables ($p<.05$). For Class A, both independent variables had a positive relationship with student stress, but efficiency cognitive style gap was more important than age in explaining the dependent variable. The data provided evidence that 21 year-old students in Class A with an innovative 5-point efficiency cognitive style gap with the faculty member have an average total stress score of 51.22. However, 21 year-old students with no efficiency cognitive style gap with this faculty member have an average total stress level score of 47.52. Note that total stress had a possible range of 88 points. The researcher concluded that in Class A, controlling for age, students with an innovative efficiency cognitive style gap with this adaptive faculty member have higher levels of total stress. This indicated that as student efficiency cognitive style gap moved from adaptiveness to innovativeness with respect to the faculty member, students have increased stress levels. See Table 4-65 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-65. Class A Backward Stepwise Multiple Regression Explaining Student Total Stress (n=57)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	17.07	11.77		1.45	.15	8.04	.01
Efficiency gap	0.74	0.27	.33	2.76	.01		
Age	1.45	0.55	.31	2.61	.01		

Note. Adjusted R^2=.20

In Class A, two independent variables were best found to explain student motivation. Efficiency cognitive style gap (β=-.37) and number of similar courses (β=.17) contributed to the explanation of variance in student motivation. However, efficiency cognitive style gap was more important in explaining student motivation in Class A. Students in this course having taken 1 to 2 similar courses and with a 5-point innovative efficiency cognitive style gap with the faculty member have an average total motivation score of 28.74. Students with 1 to 2 courses taken with similar content to Class A and no efficiency cognitive style gap with the faculty member have an average motivation score of 30.14, a 1.40 point difference. Note the range of motivation in this study was 6 to 48. The data suggests that controlling for the number of similar courses taken, students with an innovative efficiency cognitive style gap with this adaptive faculty member have lower levels of motivation. This provided evidence that as student efficiency cognitive style gap moved from adaptiveness to innovativeness, student motivation decreased in Class A. The fitted model had an adjusted R^2 of .13. That is, 13% of the variance of total motivation in Class A was from efficiency gap and was significant. See Table 4-66 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for motivation of Class A.

Table 4-66. Class A Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=57)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	29.17	1.61		18.18	.00	5.19	.01
Efficiency gap	-0.28	0.09	-.37	-2.95	.01		
Number of similar courses	0.97	0.71	.17	1.35	.18		

Note. Adjusted R^2=.13

Class B

Backward stepwise multiple regression was used to explain student stress of Class B. No significant model explained student stress given the independent variables of cognitive style gap, gender, age, number of similar classes taken and college classification.

Backward stepwise multiple regression was used to explain student motivation of Class B to find the best fitting model. One variable, efficiency cognitive style gap, explained 19% of the variance in student motivation (β=-.46, Adjusted R^2=.19). The model indicates that students in Class B with an innovative 5-point efficiency style gap with the faculty member have an average total motivation score of 27.00 as opposed to students with no efficiency style gap having a total motivation score of 29.35, a 2.35 point difference. The researcher concluded that in Class B, students with a higher innovative efficiency cognitive style gap with this more adaptive faculty member have less motivation. This finding indicated that as student efficiency cognitive style gap moved from adaptiveness to innovativeness students have decreased levels of motivation. See Table 4-67 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-67. Class B Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=45)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	29.35	0.69		42.56	.00	11.54	.01
Efficiency gap	-0.47	0.14	-.46	-3.40	.01		

Note. Adjusted R^2=.19

Class C

For Class C, backward stepwise regression was used to explain total student stress. The best fitting model left three variables including sufficiency of originality cognitive style gap (β=-.31), gender (β=-.21) and age (β=.22). Of these three independent variables, sufficiency of originality cognitive style gap was most important in explaining the dependent variable. The model provided evidence that 21 year-old female students with an innovative 5-point sufficiency of originality cognitive style gap with the faculty member in Class C had an average total stress score of 3.20 points lower than the same students with no sufficiency of originality cognitive style gap with this faculty member. The total stress scale had an 88-point range. The data suggests that controlling for age and gender in Class C, students with higher innovative sufficiency of originality cognitive style gap with this adaptive faculty member exhibited lower levels of stress. Findings from Class C indicated that as student sufficiency of originality cognitive style gap moved from adaptiveness to innovativeness students have decreasing levels of total stress while controlling for age and gender. The fitted model had an adjusted R^2 of .13 signifying that 13% of the variance of stress in Class C was from these three variables ($p<.05$). See Table 4-68 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-68. Class C Backward Stepwise Multiple Regression Explaining Student Total Stress (n=56)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	19.51	30.40		0.64	.52	3.76	.02
Sufficiency of originality gap	-0.64	0.27	-.31	-2.35	.02		
Gender	-6.49	4.31	-.21	-1.50	.14		
Age	2.07	1.23	.22	1.68	.10		

Note. Adjusted R^2=.13

Also in Class C, total student motivation was regressed with the independent variables of efficiency style gap (β=-.18), gender (β=.33) and age (β=.20). Of the three variables, gender was most important in explaining student motivation in Class C.

However, the explanation of motivation contributed by efficiency cognitive style gap was the focus of this objective. To interpret the model, students in Class C with an innovative 5-point efficiency cognitive style gap have an average 0.80 points lower total motivation score than students with no efficiency cognitive style gap while controlling for gender and age. Note that the total motivation scale has a 42-point range. The data suggests that students with a higher innovative efficiency cognitive style gap score with this more adaptive faculty member of Class C have lower levels of total motivation. That is in Class C, as student efficiency cognitive style gap moved from more adaptive to more innovative, students have lower levels of motivation. The model had an adjusted R^2 of .14 indicating that 14% of the variance of motivation in Class C was explained by these three variables ($p<.05$). See Table 4-69 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-69. Class C Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=56)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	17.18	8.99		1.91	.06	3.88	.01
Efficiency gap	-0.16	0.12	-.18	-1.38	.17		
Gender	2.88	1.21	.33	2.38	.02		
Age	0.51	0.35	.20	1.44	.16		

Note. Adjusted R^2=.14

Class D

With respect to Class D, backward stepwise multiple regression was used to explain total student stress. The best fitting model included the variables efficiency cognitive style gap (β=-.15) and the demographic variable of college classification (β=-.29). For Class D, the more important variable in explaining student stress was college classification. However, the focus of objective 4 was to examine the relationship between cognitive style gap and student stress. Students enrolled in Class D with an innovative 5-point efficiency cognitive style gap with the faculty member have an average 1.95 points lower perceived stress score than students with no efficiency cognitive style gap controlling for college classification. The total stress scale had a range of 88 points. The data suggests that students with a higher innovative efficiency cognitive style gap have lower perceived stress scores. This finding indicated that in Class D, as student efficiency cognitive style gap moved from adaptiveness to innovativeness students have decreased stress scores. This model had an adjusted R^2 of .10. That is, 10% of the variance of stress in Class D was explained by these two variables ($p<.05$). See Table 4-70 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-70. Class D Backward Stepwise Multiple Regression Explaining Student Total Stress (n=66)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	73.70	7.87		9.37	.00	4.44	.02
Efficiency gap	-0.39	0.32	-.15	-1.23	.22		
College classification	-5.89	2.40	-.29	-2.45	.02		

Note. Adjusted R^2=.10

Backward stepwise multiple regression was again used in Class D to explain total student motivation as a result of cognitive style gap and demographic variables. The best fitting model included efficiency cognitive style gap (β=-.21), but this model was not statistically significant ($p=.08$) and provided little explanation of the dependent variable (Adjusted R^2=.03).

Class E

In Class E, backward stepwise multiple regression was utilized to regress total student stress with cognitive style gap between the student and the instructing faculty member as well as demographic variables including gender, age, similar number of courses taken and college classification. However, no model was statistically significant.

For student motivation, sufficiency of originality cognitive style gap (β=.44) and gender (β=.27) contributed to a model to explain student motivation in Class E. Sufficiency of originality was a more important variable than gender in explaining student stress. To interpret, students in Class E with an innovative 5-point sufficiency of originality gap have an average total motivation score of 1.20 points higher than students with no sufficiency of originality cognitive style gap while controlling for gender. The total motivation measure used in this study had a range of 42 points. The researcher concluded that students in Class E with higher innovative sufficiency of originality gap with the faculty member also have higher total motivation scores. Said differently, as student sufficiency of originality cognitive style gap moved from more adaptive to more innovative, students have higher levels of motivation. The model had an adjusted R^2 of .13 indicating that 13% of the variance of student total motivation was explained by these two variables. See Table 4-71 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-71. Class E Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=32)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	26.69	3.18		8.39	.00	3.38	.05
Sufficiency of originality gap	0.24	0.10	.44	2.49	.02		
Gender	2.66	1.77	.27	1.50	.14		

Note. Adjusted R^2=.13

Class F

Backward stepwise multiple regression was used in Class F to explain the dependent variable of total student stress with cognitive style gap constructs and demographic variables including age, gender, number of similar courses taken and college classification. However, no models using these independent variables were found significant to explain student stress.

Considering motivation of Class F, backward stepwise multiple regression was used to explain the dependent variable total motivation. Two variables, college classification (β=-.19) and gender (β=.26) contributed to the explanation of student motivation in Class F. None of the cognitive style gap constructs significantly contribute to the model. Gender was found most important in explaining student motivation in Class F. To interpret, college females in Class F scored an average 2.20 points higher on the measure of total motivation than males while controlling for college classification. The model had an adjusted R^2 of .06 indicating that 6% of the variance of total motivation was attributed to students' college classification and gender. The researcher concluded that cognitive style gap offered no explanation of student motivation in Class F, but higher motivation scores was credited to gender. See Table 4-72 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-72. Class F Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=71)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	30.21	2.41		12.53	.00	3.31	.04
Gender	2.20	0.99	.26	2.22	.03		
College classification	-0.94	0.58	-.19	-1.61	.11		

Note. Adjusted R^2=.06

Class G

In Class G, backward stepwise multiple regression was used to explain students' total stress using variables of cognitive style gap and student demographics including age, gender, number of similar courses taken, and college classification. However, no model significantly explained student stress with these independent variables.

Total student motivation was regressed with the same independent variables to find the best fitting model. Again, no significant model had explained student motivation in Class G.

Class H

In Class H, two independent variables explained the dependent variable student stress using a backward stepwise regression analysis. They include rules/group conformity cognitive style gap (β=-.36) and number of similar courses taken by the student (β =.21). In this model, rules/group conformity cognitive style gap was more important in explaining the variance of student stress. In Class H, students with an adaptive 5-point rule/group conformity cognitive style gap have an average 2.55 points higher than students with no rule/group conformity gap while controlling for number of similar courses taken by the student. The total stress scale used in this study had an 88-point range. The data suggests that students in Class H with a higher adaptive rule/group conformity gap with this innovative faculty member have higher total stress scores. This finding indicated that in Class H, as student rule/group conformity cognitive style gap moved from more innovative to adaptive, students have higher levels of stress. The model had an adjusted R^2 of .13 indicating that 13% of the variance of stress in Class H was from these two variables ($p<.05$). See Table 4-73 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for Class H total stress.

Table 4-73. Class H Backward Stepwise Multiple Regression Explaining Student Total Stress (n=49)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	36.86	4.63		7.97	.00	4.68	.01
Rules/Group conformity gap	-0.51	0.19	-.36	-2.66	.01		
Number of similar courses	2.02	1.31	.21	1.54	.13		

Note. Adjusted R^2=.13

For motivation of Class H, backward stepwise multiple regression was used to find the best fitting model with independent variables including cognitive style gap constructs and students' gender, age, number of similar courses taken and college classification. However no models were found significant with these independent variables.

Class I

Regarding Class I, backward stepwise regression was used to explain the dependent variable, student total stress with the best fitting model and most explanation by the independent variables. Cognitive style gap constructs and student demographic variables were included in the analysis. Two variables, efficiency style gap (β =.29) and age (β =.22) accounted for 10% of the variance in explaining total student stress (Adjusted R^2=.10, $p<.05$). Of the two independent variables efficiency cognitive style gap was more important in explaining the variance of total stress in Class I. To interpret the findings concerning Class I, 21 year-old students with an adaptive 5-point efficiency cognitive style gap with this faculty member had an average total stress score of 55.85. This was compared to the same students with no efficiency cognitive style gap having an average stress score of 52.25, a 3.60 point difference. The total stress measure comprised a range of 88 points. The data suggests that students in Class I having a higher adaptive efficiency cognitive style gap with this innovative faculty member have higher total stress scores. That is, as efficiency cognitive style gap moved from more innovative to more adaptive, students exhibited higher levels of stress. See Table 4-74 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for Class I total stress.

Table 4-74. Class I Backward Stepwise Multiple Regression Explaining Student Total Stress (n=60)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	3.95	26.91		0.15	.88	4.16	.02
Efficiency gap	0.72	0.30	.29	2.37	.02		
Age	2.30	1.30	.22	1.77	.08		

Note. Adjusted R^2=.10

Considering total student motivation of Class I, the same independent variables were used in backward stepwise regression data analysis to find the best fitting model with the most explanation of student motivation. Rule/group conformity style gap (β=-.28) and gender (β=-.20) were both considered significant contributors to the model. The adjusted R^2=.08 indicating that 8% of the variance of total student motivation was explained by these two independent variables. The model was statistically significant ($p<.05$). Of the two independent variables, rule/group conformity cognitive style gap was more important in explaining the variance of student motivation in Class I. Students having an adaptive 5-point efficiency cognitive style gap with the faculty member have an average 0.70 points higher total motivation score than students having no efficiency cognitive style gap while controlling for gender. The total motivation score range was 6 to 48 points. The data suggests that students in Class I with higher adaptive efficiency cognitive style gap with the innovative faculty member have higher total motivation scores while controlling for gender. That is, as student efficiency cognitive style gap moved from more innovative to more adaptive, students have higher levels of motivation. See Table 4-75 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for Class I total stress.

Table 4-75. Class I Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=60)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	29.45	1.94		15.20	.00	3.60	.03
Rules/Group conformity gap	-0.14	0.06	-.28	-2.22	.03		
Gender	-1.52	0.93	-.20	-1.64	.11		

Note. Adjusted R^2=.08

All Students

All students participating in this study were grouped together to explain student stress based on cognitive style gap and student demographic variables. Considering all of the students, the best fitting model to explain total stress included the independent variables sufficiency of originality cognitive style gap (β =.15), college classification (β=-.11) and number of similar courses taken (β=.09). The most important variable of these three was sufficiency of originality cognitive style gap. Controlling for college classification and number of similar courses taken, students having an innovative 5-point sufficiency of originality cognitive style gap have an average 0.75 point higher stress scores than the same students with no sufficiency of originality cognitive style gap. The total stress range as measured in this study was 22 to 110. The data suggests that considering these students and controlling for college classification and number of similar courses taken, students having an innovative sufficiency of originality cognitive style gap with their faculty member have higher stress scores. That is, as student sufficiency of originality cognitive style gap moved from more adaptive to more innovative, students have higher levels of stress. See Table 4-76 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for student stress.

Table 4-76. All Students Backward Stepwise Multiple Regression Explaining Student Total Stress (n=496)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	55.51	2.90		19.12	.00	5.74	.01
Sufficiency of originality gap	0.15	0.04	.15	3.51	.00		
College classification	-1.93	0.84	-.11	-2.30	.02		
Number of similar courses	1.21	0.60	.09	2.02	.04		

Note. Adjusted R^2=.03

Considering total motivation of all students participating in this study, backward stepwise multiple regression was used to find the best fitting model with the most explanation using the independent variables cognitive style gap and student demographics. Three independent variables were found to be significant ($p<.05$) in explaining student motivation. They include efficiency cognitive style gap (β=-.08), gender (β=.12) and number of similar courses taken by the student (β=.10). Considering all the student participants and controlling for gender and number of similar courses, students with an innovative 5-point efficiency cognitive style gap have an average 0.20 point lower total motivation score than the same students with no efficiency cognitive style gap. The total motivation scale used in this study had a 42-point range. The data suggests that students participating in this study having an innovative efficiency cognitive style gap have lower total motivation scores controlling for gender and number of relevant courses. This finding indicated that among these participants, as student efficiency cognitive style gap moved from more adaptive to more innovative, students have lower levels of motivation. However, the adjusted R^2 was .03 for the model indicating that only 3% of the variance of motivation was attributed to the three independent variables. See Table 4-77 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) for explanation of motivation for all students.

Table 4-77. All Students Backward Stepwise Multiple Regression Explaining Student Total Motivation (n=502)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	27.92	0.81		34.38	.00	5.20	.01
Efficiency gap	-0.04	0.02	-.08	-1.80	.07		
Gender	0.97	0.37	.12	2.61	.01		
Number of similar courses	0.41	0.18	.10	2.29	.02		

Note. Adjusted R^2=.03

Summary of Findings for Objective Four

This study used backward stepwise multiple regression to examine if cognitive style gap contributed to the explanation of student stress and student motivation. Considering the explanation of student stress in adaptive courses, Class A provided evidence that students in these classes with a more innovative cognitive style construct had increased levels of total stress. The same was true for Class D. Note that Class D was taught by a middle score faculty member, but scored 94 for total cognitive style designating him adaptive by one point. For innovative courses, Classes H and I provided evidence that students in these classes with a more adaptive cognitive style construct had increased levels of stress. The data suggests that Kirton's (2003) A-I theory was upheld in Classes A, D, H and I as a cognitive style construct gap did explain some variance of stress in these four courses.

Class C was taught by a more adaptive faculty member, but the data suggests that students having an innovative sufficiency of originality cognitive style gap have lower stress scores. This finding conflicts with Kirton's A-I theory as applied in this context. Classes B, E, F and G found no significant explanation of student stressed based on a cognitive style gap between the student and the faculty member. The data suggests that in these four courses, cognitive style gap was not a significant contributor to the explanation of student stress.

Considering all students participating in this study, students having an innovative sufficiency of originality cognitive style gap have higher levels of stress. This makes sense as the cognitive style for all students on average was slightly adaptive.

For demographic variables associated with explaining stress, the most frequent was age. In Classes A, C and I, older students had higher levels of stress. However, considering all participating students as a group, students having a lower college classification had higher levels of stress while controlling for number of similar courses taken.

Models describing classes that found a cognitive style gap contributing to the variance of total stress had Adjusted R^2 values ranging between .10 and .20, indicating that 10% to 20% of the variance was explained. Considering all students, only 3% of the variance was explained. There was evidence that in these courses, cognitive style gap between the undergraduate student and the faculty member offered some explanation to student total stress scores.

For student motivation, Classes A, B, and C each found that students with an innovative efficiency cognitive style gap had lower total motivation scores. The amount of variance of student motivation explained in these models ranged from 13% to 19%.

Note that in the three classes taught by adaptive faculty members an innovative efficiency cognitive style gap was detrimental to student motivation.

Class I was taught by an innovative faculty member and evidence from the data suggests that students with larger adaptive rules/group conformity gap have higher levels of motivation. Findings in Class I differed from findings in Classes A, B and C in that motivation increased as students bridged their sufficiency of originality cognitive style gap. The finding in Class I may suggest evidence of coping behavior (Kirton, 2003).

Interestingly, students in Class E with an innovative sufficiency of originality cognitive style gap have increased levels of motivation. Note that the faculty member instructing Class E scored 95 points for total cognitive style placing her in the middle score teaching group. Classes D, F, G and H found no model that included a cognitive style gap construct to significantly explain student motivation.

For demographic variables contributing to the explanation of motivation, gender was the most prominent variable. In Classes C, E, and F, females had higher motivation scores. Note that these three courses were taught by women. Conversely, in Class I males had higher levels of motivation in a course taught by a young woman. Note that the other two classes taught by women (Classes A & G) did not have a gender effect in explaining motivation indicating that faculty member gender was not necessarily a factor in increasing female student motivation.

Objective Five

Explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected demographic variables.

Objective five was achieved by using backward stepwise multiple regression to explain student engagement from the independent variables of cognitive style gap constructs, student stress, student motivation and student demographics. Student demographic variables used in this study included age, gender, number of similar courses taken and college classification. Gender was the only categorical variable and was dummy coded one for males and two for females. This data analysis procedure was utilized to determine if dissimilar learning style measured by cognitive style gap can explain student engagement. Classes were coded by letter according to the faculty member's cognitive style score along the continuum of adaptiveness to innovativeness. Therefore, the most adaptive faculty member was assigned the letter "A" and the letter "I" was assigned to the most innovative faculty member.

Class A

For Class A, backward stepwise regression was used to explain student engagement. The best fitting model with the most explanation of the dependent variable left five variables including sufficiency of originality cognitive style gap (β=-.19), total motivation (β=.25), total stress (β=.39), number of similar courses (β=.26) and college classification (β=.30). In this model, the most important independent variable was total stress, however the focus of the objective for this study was to examine the relationship between cognitive style gap and student engagement. Students in Class A with an innovative 5-point sufficiency of originality gap scored an average 0.80 points lower on the measure of student engagement than students with no sufficiency of originality cognitive style gap while controlling for motivation, stress, number of similar courses and college classification. The total engagement measure had a range of 24 to 96, a scale of 72 points. Also, note that this faculty member was more adaptive. The data suggests that in Class A, controlling for motivation, stress, number of similar courses and college classification, students having a more innovative sufficiency of originality gap with the faculty member have lower total engagement scores. The model had an adjusted R^2 of .34 signifying that 34% of the variance of student engagement in the class was from these five variables ($p<.05$). See Table 4-78 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-78. Class A Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=56)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	5.64	9.45		0.60	.55	6.62	.00
Sufficiency of originality gap	-0.16	0.10	-.19	-1.57	.12		
Total Motivation	0.53	0.25	.25	2.16	.04		
Total Stress	0.27	0.08	.39	3.39	.00		
Number of similar courses	3.07	1.40	.26	2.20	.03		
College classification	2.88	1.10	.30	2.61	.01		

Note. Adjusted R^2=.34

Class B

Considering Class B, backward stepwise regression was used to explain student engagement with independent variables of cognitive style gap, total stress, total motivation and student demographic variables. The best fitting model with the most explanation of the dependent variable left two variables including rules/group conformity cognitive style gap (β=.33) and total motivation (β=.38). The most important independent variable in this model was total motivation, however the focus of this study was to examine the relationship between dissimilar cognitive style and student engagement. For students in Class B with an innovative 5-point rules/group conformity gap have an average 1.80 points higher engagement score than students with no rules/group conformity gap controlling for student motivation. Note that the scale used to measure of total engagement used in this study comprised 72 points. The data suggests that students in Class B with more innovative rules/group conformity gap have a higher total engagement score when controlling for motivation. The model had an adjusted R^2 of .20. This signifies that 20% of the variance of student engagement in the class was from these two variables ($p<.05$). See Table 4-79 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class B.

Table 4-79. Class B Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=45)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	26.69	6.23		4.29	.00	6.59	.01
Rules/Group conformity gap	0.36	0.15	.33	2.46	.01		
Total motivation	0.55	0.20	.38	2.79	.01		

Note. Adjusted R^2=.20

Class C

In order to explain student engagement of Class C, backward stepwise multiple regression was employed to find the best fitting model utilizing the independent constructs of cognitive style gap and variables total stress, total motivation and student demographics. Data analysis found that sufficiency of originality cognitive style gap (β=.20), total motivation (β=.45) and age (β=.22) best contributed to total engagement of Class C. The most important independent variable in this model was total motivation. However, the focus of this objective was to examine the relationship between cognitive style gap and student engagement. Students in Class C with an innovative 5-point sufficiency of originality cognitive style gap have an average 1.25-point higher score on the measure of student engagement used in this study while controlling for students' total motivation and age. The scale of this measure comprised 72 points. The researcher concluded that students in Class C with more innovative cognitive style gap with the faculty member have higher total engagement scores while controlling for students' total motivation and age. The model was statistically significant ($p<.05$) and the adjusted R^2 was .24. This indicated that age and total motivation contributed to explain 24% of the variance of student engagement in Class C. See Table 4-80 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class C.

Table 4-80. Class C Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=56)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	-11.88	17.61		-0.68	.50	6.66	.01
Sufficiency of originality gap	0.25	0.16	.20	1.60	.12		
Total motivation	0.21	0.06	.45	3.74	.00		
Age	1.33	0.71	.22	1.89	.07		

Note. Adjusted R^2=.24

Class D

To explain student engagement of Class D, backward stepwise multiple regression was used to determine the independent variables that best fit into a model. Data analysis found that only total motivation (β=.38) best explained student engagement of Class D. To interpret, students in Class D with a total motivation score of 32.00 have an average total engagement score of 48.71. This contrasts with students with a total motivation score of 33.00 points and have an average total engagement score of 49.44. The measurement of total engagement had a range of 24 to 96. The data suggests that students who have more motivation in Class D have more total engagement. However, there was no indication that cognitive style gap significantly explained student engagement in Class D. The model was significant ($p<.05$) and the adjusted R^2 was .13, indicating that motivation contributed to 13% of the variance in explaining student engagement of Class D. See Table 4-81 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class D.

Table 4-81. Class D Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=66)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	25.35	7.02		3.61		11.13	.00
Total motivation	0.73	0.22	.38	3.34	.00		

Note. Adjusted R^2=.13

Class E

Backward stepwise multiple regression was employed to explain student engagement in Class E given the independent variables of cognitive style gap constructs, total stress, total motivation, and selected student demographic variables. After data analysis, the best fitting model was made using three variables: number of similar courses taken by the student (β=.40), total stress (β=.27) and age (β=.45). The most important independent variable in this model was students' age. Controlling for students' number of similar courses taken and total stress, 21 year-old students have an average 0.85 points higher score than 20 year-old students in Class E. The engagement scale used in this study had a range of 24 to 96. The data suggests that students who are older have a higher engagement score while controlling for students' stress and number of similar courses the student had taken. However there was no indication that cognitive style gap significantly explained students' engagement in Class E. The adjusted R^2 of the model was .26 signifying that 26% of the variance was explained by the three variables. The model was statistically significant ($p<.05$). See Table 4-82 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class E.

Table 4-82. Class E Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=31)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	17.81	8.68		2.05	.05	4.51	.01
Number of similar courses	2.80	1.12	.40	2.49	.02		
Total stress	0.13	0.08	.27	1.72	.10		
Age	0.85	0.30	.45	2.79	.01		

Note. Adjusted R^2=.26

Class F

Regarding Class F, student engagement was explained using backward stepwise multiple regression. Independent variables included students cognitive style gap constructs, total stress, total motivation and student demographic variables. However, no model was found significant in explaining student engagement given these independent variables.

Class G

Student engagement of students in Class G was explained through the use of backward stepwise multiple regression to identify the independent variables that serve as the best fitting model. These independent variables included cognitive style gap constructs, total stress, total motivation and selected student demographic variables. After data analysis, total stress (β=.25) and total motivation (β=.38) were identified to best explain student engagement of Class G. The more important of the two independent variables was total motivation for the explanation of student engagement in Class G. Students in Class G with a motivation score of 32 points have an average total engagement score of 25.92 points controlling for student stress. This compares to students with a motivation score of 33 points have an average total engagement score of

26.73 points while controlling for student stress. Again, the measure of total engagement used in this study had a range of 24 to 96 points. The data suggests that students in Class G having higher scores on total motivation have higher scores on total engagement while controlling for student stress. However, there was no indication that cognitive style gap significantly contributed to the explanation of variance of student engagement in Class G. The adjusted R^2 for the model was .22 signifying that 22% of the variance of the dependent variable was attributed to students' total stress and total motivation. The model was significant ($p<.05$). See Table 4-83 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class G.

Table 4-83. Class G Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=63)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	17.53	7.58		2.31	.02	9.58	.00
Total Motivation	0.81	.24	.38	3.31	.01		
Total stress	0.13	.06	.25	2.24	.03		

Note. Adjusted R^2=.22

Class H

For Class H, student engagement was explained by using backward stepwise multiple regression to identify independent variables that best contribute to a fitting model. Four variables were identified that contributed to the explanation of Class H student engagement. Those independent variables include rule/group conformity style gap (β=.40) number of similar courses previously taken by the student (β=-.26), total motivation (β=.47) and total stress (β=.30). In this model, the independent variable offering the most explanation to the variance of student engagement was total motivation. However, the focus of the objective was to examine the relationship between cognitive style gap and student engagement. In Class H, students having an adaptive 5-point rules/group conformity cognitive style gap have an average 2.20 point decrease in their student engagement score than students with no rules/group conformity cognitive style gap with the faculty member, controlling for number of similar courses taken, total motivation and total stress. The total engagement score range was 24 to 96 points. Also note that the faculty member instructing Class H was highly innovative. The data suggests that students in Class H with a more adaptive rules/group conformity cognitive style gap with the faculty member have lower student engagement scores when controlling for number of similar courses the student had taken, student motivation and student stress. The model was significant ($p<.05$) and had an adjusted R^2 of .33. That is, 33% of the variance of student engagement in Class H was explained by the four independent variables listed above. See Table 4-84 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class H.

Table 4-84. Class H Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=49)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	22.89	8.45		2.71	.01	7.03	.00
Rules/Group conformity gap	0.44	0.14	.40	3.17	.01		
Number of similar courses	-1.92	0.93	-.26	-2.07	.04		
Total motivation	0.93	0.24	.47	3.91	.00		
Total stress	0.23	0.10	.30	2.34	.02		

Note. Adjusted R^2=.33

Class I

Student engagement of Class I was explained by employing backward stepwise multiple regression and finding the best fitting model with the most explanation of the dependent variable. Two independent variables were identified as a best fit for explaining student engagement in Class I. They include total motivation (β=.37), and number of similar courses taken by the student (β=.27). The most important independent variable included in this model was total motivation. Students in Class I having a total motivation score of 31.00 points and had taken 1 to 2 similar courses have an average engagement score of 50.49. This compares to the same students in Class I with a total motivation score of 32.00 points having an average engagement score of 51.27. The total engagement score range was 24 to 96. The data suggests that students in Class I with higher motivation scores have higher total engagement scores while controlling for number of similar courses the students have taken. However, cognitive style gap did not offer significant explanation to student engagement in Class I. The adjusted R^2 was .19 meaning 19% of the variance of student engagement in Class I can be explained by the two independent variables. The model was statistically significant ($p<.05$). See Table 4-85 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β) determining student engagement of Class I.

Table 4-85. Class I Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=59)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	24.00	7.59		3.16	.01	7.83	.01
Total motivation	0.78	0.25	.37	3.16	.01		
Number of similar courses	2.31	1.00	.27	2.31	.03		

Note. Adjusted R^2=.19

All Students

All of the students who participated in this study were grouped together to explain student engagement based on the independent variables of cognitive style gap constructs, total stress, total motivation and student demographics. Demographic information consisted of students' age, gender, number of similar courses taken and college classification. Student engagement in this group was explained by the variables gender (β=-.09), total motivation (β=.30), total stress (β=.14) and student age (β=.09) using a backward stepwise regression analysis. The most important independent variable contributing to the explanation of variance of student engagement was students' total motivation. Students in this study who have a motivation score increase of one point have an average 0.59-point increase on the measure of student engagement while controlling for students' gender, age and total stress. The total engagement measure consisted of a 72 point scale. The data suggests that students in this study with higher motivation scores have higher total engagement scores while controlling for students' gender, age and total stress. However, cognitive style gap between students and their faculty member had no significant explanation to the variance of student engagement. The model had an adjusted R^2 of .13 meaning that 13% of the variance of student engagement among students in this study was explained by the four independent student variables above. The model was significant ($p<.05$). See Table 4-86 for the unstandardized coefficient (B), intercept (Constant), and standardized coefficient (β).

Table 4-86. All Student Backward Stepwise Multiple Regression Explaining Student Total Engagement (n=493)

Construct	B	SE	Beta	t.	Sign.	Model F	Sign.
(Constant)	21.58	5.00		4.32	.00	18.69	.00
Gender	-1.48	0.70	-.09	-2.11	.04		
Total motivation	0.59	0.08	.30	7.08	.00		
Total stress	0.09	0.03	.14	3.31	.01		
Age	0.37	0.18	.09	2.03	.01		

Note. Adjusted R^2=.13

Summary of Findings for Objective Five

This study used backward stepwise multiple regression to examine if cognitive style gap contributed to the explanation of student engagement. The nine classes in this study were coded by letter according to the faculty member's cognitive style score along the continuum of adaptiveness to innovativeness. The most adaptive faculty member's course was coded with the letter "A" and the most innovative faculty member's course was coded with the letter "I".

For student engagement, only four of the nine classes (A, B, C and H) had a cognitive style gap construct significantly explain student engagement. In Class A, this relationship was negative indicating that students having a higher innovative gap have lower engagement. In Class H, this relationship was positive indicating that students with a more adaptive cognitive style gap have lower engagement scores. Both of the findings in these two courses provide evidence that a cognitive style construct gap inhibited student engagement.

In Classes B and C the opposite was found as a positive relationship indicated that students with an innovative cognitive style construct gap have higher levels of engagement. Classes B and C were taught by more adaptive faculty members.

The highest level of variance in student engagement explained among these models was 34%; some of which included four independent variables. Also note that in objective four, the efficiency cognitive style construct gap was predominate in explaining stress and motivation, but was not found to significantly explain student engagement in any of the nine courses.

Examining the relationships other variables, student motivation was significant in explaining student engagement in seven of the nine courses. In these seven models the relationship was positive indicating that students having higher levels of motivation have higher levels of engagement. Stress added to the explanation of student engagement in four of the nine courses; all of which indicated that students with higher levels of stress have higher levels of engagement.

For demographic variables contribution to student engagement, the number of courses previously taken that was similar to the present course significantly explained student motivation in four courses. In Classes A, E and I, evidence suggested that more courses taken that related in content to the present course was related to more student engagement. Conversely, the opposite was found in Class H; students having taken more classes have less student engagement. Although number of courses previously taken was a significant variable in explaining engagement in four courses, it was not a significant explanatory variable when compiling all students together. For all students, gender and age were the two demographic variables significant in explaining student engagement. That is, among these respondents females were less engaged when controlling for age, and older students were more engaged while controlling for gender.

Summary

This chapter presented the findings specific to the objectives of the study with details given to each specific class, as well as groups of students determined by the faculty member's cognitive style score and finally all students who participated in the study. The objectives of the study were to 1) describe selected faculty and students according to their selected demographic variables; 2) determine the cognitive style, student stress, student motivation, and student engagement of undergraduate students; 3) determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students; 4) explain undergraduate student stress and student motivation based on cognitive style gap and selected demographic variables; and 5) explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected demographic variables.

Chapter 5 will summarize the findings presented in this chapter and provide conclusions and implications based on these results. Recommendations will also be provided.

CHAPTER 5
SUMMARY AND DISCUSSION

This chapter summarizes the study and provides conclusions, implications, and recommendations derived from the results of this study. The first section of this chapter presents a summary of the problem statement, purpose and objectives, methodology and findings. The second section presents conclusions and discussion specific to each objective. The end of the chapter provides recommendations as a result of this study.

Summary of Problem Statement

Trends in undergraduate education are moving from teacher-centered classrooms to student-centered classrooms for the improvement of student engagement (Acharya, 2002). However, twenty percent of freshman and seniors in colleges and universities across the nation were still identified as disengaged (Kuh, 2003). Even though instructional techniques of faculty members have improved, student engagement in college classrooms still seems to be at a low level. In the search for variables to explain student engagement, researchers have examined the cognitive level of instructional discourse (Whittington, 1998), but few have examined the cognitive style of the instructor. That is, does a dissimilar learning style between student and faculty member contribute to explaining why some students are not engaged in the classroom?

Kirton's (2003) measure of learning style is independent of learning capability and motivation towards learning; this theoretical view is different than many other measures of learning style (Coffield, Moseley, Hall & Ecclestone, 2004). The separation of learning style from learning level is warranted to allow for the distinguished relationship and accurate measure of other classroom variables such as engagement, motivation and stress. Learning style and learning level are both employed by the student to complete the learning process (Kirton, 2003). However, most learning style theories assert that students learn best in their own learning style (Coffield et al., 2004). Students receiving instructional discourse from a faculty member with a dissimilar learning style may cause stress (Kirton, 2003) which may inhibit student engagement (Pintrich & Schunk, 2002). Separating learning style from learning level allows the researcher to examine each independently and determine the significance each has on the dependent variable. That is, if dissimilar learning style is not found to be a large contributor to student engagement, perhaps learning level is a superseding variable.

Faculty members are increasingly faced with more accountability for increasing student achievement. As student engagement is closely related to academic achievement (Kuh, 2001), faculty members need to utilize instructional strategies and curricula to increase student engagement and foster student learning. Research is needed to determine if cognitive style contributes to the explanation of student engagement. Does dissimilar learning style between students' preferred cognitive style and faculties' preferred cognitive style impair student engagement? Are students able to overcome cognitive style gap as the faculty member engages the learner?

Purpose and Objectives

The purpose of this study was to determine if significant relationships exist between cognitive style gap, student stress, student motivation, student engagement and selected demographic variables of undergraduate students at the University of Florida in the College of Agriculture and Life Sciences. The specific objectives of this study were to: 1) describe selected faculty and students according to their selected demographic variables; 2) determine the cognitive style, student stress, student motivation and student engagement of undergraduate students; 3) determine the cognitive style gap between faculty and students and to explore its relationship with student stress, student motivation, student engagement, and specific demographic variables of undergraduate students; 4) explain undergraduate student stress and student motivation based on cognitive style gap and selected demographic variables; and 5) explain undergraduate student engagement based on cognitive style gap, student stress, student motivation and selected demographic variables.

Methodology

The researcher used an *ex post facto* design one (Ary, Jacobs & Razavieh, 2002) to accomplish the objectives of the study. This design allows for the control and measure of the independent variable(s) to test hypotheses concerning variation in the dependent variable(s). Objectives one and two were accomplished using descriptive statistics (frequencies and measures of central tendency). Objective three was accomplished by finding the difference of cognitive style gap score between faculty members and their respective students. Pearson's correlation coefficient was then used to find relationships among variables identified in this study. Objectives four and five were accomplished through backward stepwise multiple regression to determine the effects of cognitive style gap on student stress, student motivation and student engagement. Student demographic variables for the study include age, gender, academic major, full-time status, college classification and number of classes similar to the course examined in this study. Students were also asked how many problem sets assigned during a week had taken more than one hour to complete to provide evidence that problem solving assignments and projects were used in the classes examined in the study.

To select undergraduate classes to participate in this study, sixty-four faculty members in the College of Agriculture and Life Sciences at the University of Florida were contacted. Faculty members were identified by contacting individuals serving as undergraduate coordinator of each department in the college. Although many times the identified faculty members believed their course did not match the criteria of the study, they often provided contact information of another faculty member within the same department whose course was better suited. In the end, 21 faculty members were willing to participate in the study. From this group, only 15 faculty members were identified as suitable for the study. Nine faculty members were chosen based on their cognitive style score. The selection of faculty members provided a range along the adaptive-innovative continuum as three faculty members had similar adaptive cognitive style scores, three faculty members had similar innovative cognitive style scores and three faculty members had similar cognitive style scores located in the middle of the adaptive-innovative continuum.

Each of the nine faculty members' courses was coded with a letter to maintain confidentiality in data presentation. In order of adaptiveness to innovativeness faculty members were coded beginning with the letter "A" and ending with the letter "I". The grouping of classes by faculty member cognitive style resulted in an adaptive teacher group (Classes A, B and C), a middle score teacher group (Classes D, E and F) and an innovative teacher group (Classes G, H and I).

Four instruments were used to collect data in order to accomplish the objectives of this study. The Kirton Adaption-Innovation Inventory (KAI) was used to determine the cognitive style of students and faculty members. It was also used in calculating the cognitive style gap that existed between students and faculty members. Cognitive style gap was calculated by subtracting the faculty member's cognitive style score from each student's cognitive style score. Constructs of the KAI include sufficiency of originality, efficiency and rules/group conformity. The Student-life Stress Inventory (SSI) was used to measure student's classroom stress and included factors of frustration, conflicts, pressures, changes and self-imposed stress. The Motivation Strategies for Learning Questionnaire (MSLQ) determined student motivation with scales of intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy for learning, and test anxiety. Finally, the National Survey of Student Engagement (NSSE) (2005) was used to determine student engagement with constructs of academic challenge, active and collaborative learning, and student-faculty interaction. The researcher also used demographic items found on the NSSE. Chapter 3 discusses how instruments were altered to meet the objectives of this study. All four instruments were used with permission.

Conclusions and Discussion

The findings and conclusions of this study are summarized in order of their respective objective. Nine undergraduate courses were used for this study and were presented in order of the faculty members' cognitive style score using the letters "A" through "I". The faculty member with the most adaptive cognitive style score was coded with the letter "A" while the faculty member with the most innovative cognitive style was coded with the letter "I". See Table 4-1 for the faculty members' specific cognitive style scores. Each class and a group using all student participants were subject to the same data analysis procedures. The reader should use caution in applying these conclusions to other populations as classes in this study were intact groups.

Objective One

The first objective described faculty and students according to their demographic variables respective of each class. First, faculty members were asked their age, gender and years of teaching experience. For students, demographic variables were taken from the National Survey for Student Engagement (NSSE) which included student's age, gender, major, college classification, full-time status, and number of courses taken similar to the subject area of the class. Furthermore, students were asked to state the number of problem sets given during a typical week that had taken more than an hour to complete. This question was asked only to provide evidence that problem solving assignments and projects existed in the classes used in the study. Conclusions for objective one will be discussed after a brief presentation of the findings.

Class A

The instructor of Class A was a 25 year-old female graduate assistant. She had three years of teaching experience at the college level, but no prior teaching experience in any other setting.

There were 100 students enrolled in Class A, of which 70 responded. Of the respondents, 55.7% (n=39) were female. For Class A, the mode age was 20 years old (32.9%, n=23). Almost half of Class A were juniors (48.6%, n=34), while 30% were seniors (n=21), and 18.6% were sophomores (n=13). Regarding the number of courses the students had taken in the subject area respective of Class A. Respondents reported 17.4% (n=12) had taken no courses, 68.1% (n=47) had taken one to two courses, 13.0% (n=9) had taken three to four courses, and 1.4% (n=1) had taken more than four courses in the subject area.

Class B

The faculty member providing instruction for Class B was a male at 54 years of age. He had taught at the University of Florida for 29 years and had no other teaching experiences.

There were 100 students enrolled in Class B, of which 72 responded. The majority of the respondents in Class B were female (81.2%, n=56). The mode age was 21 years old (37.7%, n=26). The class was only composed of juniors (50.7%, n=35) and seniors (49.3%, n=34). Students were asked how many courses were taken in the subject area respective of Class B. Respondents reported 23.2% (n=16) had taken no courses, 37.7% (n=26) had taken one to two courses, 13.0% (n=9) had taken three to four courses, and 26.1% (n=18) had taken more than four courses in the subject area. There were three students that did not answer this specific question.

Class C

The faculty member instructing Class C was a 36 year-old female. She had taught 12 years at the college level, but had no teaching prior teaching experience.

Two sections of Class C were combined to form a group total of 90 students, of which 71 responded. The majority of the students in Class C were male (71.8%, n=51). The mode age of Class C was 22 years old (35.2%, n=25). Class C comprised mostly of seniors (91.5%, n=65) with the remainder of the class being juniors (8.5%, n=6). Respondents reported 2.8% (n=2) had taken no courses, 23.9% (n=17) had taken one to two courses, 26.8% (n=19) had taken three to four courses, and 46.5% (n=33) had taken more than four courses in the subject area.

Class D

The faculty member for Class D was a 62 year-old male with 38 years of teaching experience at the college level. He had no prior teaching experience before becoming a university faculty member.

Class D enrolled 116 students of which 108 participated in this study. The majority (81.3%, n=87) in the class were female. The mode age of Class D was 21 years old (36.4%, n=39). The college classification of students in Class D comprised 60.4% (n=64) juniors, 32.1% (n=34) seniors, 6.6% (n=7) sophomores, and one freshman. Respondents reported 5.7% (n=6) had taken no courses, 32.1% (n=34) had taken one to two courses, 28.3% (n=30) had taken three to four courses, and 34.0% (n=36) had taken more than four courses in the subject area. There were two students that did not answer this specific question.

Class E

The faculty member of Class E was a 54 year-old female. She had 23 years of teaching experience at the college level. However, she had no prior teaching experience at any other level.

There were three sections of Class E which combined to form a group of 105 students, of which 48 responded. Considering gender, female students held the majority (77.1%, n=37). Student age in Class E was bimodal with 14 students (29.2%) being 21 years of age and 22 years of age. Class E was made up of mostly seniors (64.6%, n=31) and juniors (33.3%, n=16). Students were asked how many courses were taken in the subject area respective of Class E. Regarding number of classes taken relevant to Class E, respondents reported 8.3% (n=4) had taken no courses, 54.2% (n=26) had taken one to two courses, 14.6% (n=7) had taken three to four courses, and 22.9% (n=11) had taken more than four courses in the subject area.

Class F

The faculty member who taught Class F was a 46 year-old female who had taught 11 years at the University of Florida. Previous to that, she had worked as a dietician for 7 years and conducted some educational programs.

There were 150 students enrolled in Class F of which 115 participated. The majority of the course was female (69.6%, n=80). Class F students had a mode age of 21 years old (43.5%, n=50). Of the respondents, juniors made up the majority (58.3%, n=67) of Class F with seniors constituting 33.0% (n=38). Also enrolled in Class F were six sophomores (5.2%) and four freshmen (3.5%). Respondents reported 1.7% (n=2) had taken no courses, 29.6% (n=34) had taken one to two courses, 44.3% (n=51) had taken three to four courses, and 24.3% (n=28) had taken more than four courses in the subject area relevant to Class F.

Class G

The faculty member who taught Class G was a 35 year-old female. She had taught five years in her current position at the University of Florida, eight years tutoring student athletes, and two years as a cooperative extension agent.

Class G enrollment consisted of 110 students of which 85 agreed to participate. Most of the respondents in Class G were female (81.2%, n=69). Eleven respondents did not answer the question regarding demographics. Class G students reported a mode age of 21 years old (34.1%, n=29). Class G respondents were 57.6% (n=49) juniors, 30.6% (n=26) seniors, and 11.8% (n=10) sophomores. Students were asked how many courses were taken in the subject area respective of Class G. Respondents reported 2.4% (n=2) had taken no courses, 23.8% (n=20) had taken one to two courses, 41.7% (n=35) had taken three to four courses, and 32.1% (n=27) had taken more than four courses in the subject area. There were 12 students that did not answer this specific question.

Class H

The faculty member who taught Class H was a 42 year old male. He had five years of collegiate teaching experience at the University of Florida. This faculty member also reported teaching experiences with the Peace Corps and an agricultural technical college.

Class H consisted of 122 students of which 70 responded. Males held a slim majority of the respondents at 55.1% (n=38). For ages of respondents in Class H the mode age was 21 years old (31.9%, n=22). Class H respondents were primarily juniors (53.6%, n=37) and seniors (36.2%, n=25). Sophomores made up 7.2% (n=5) of the class and freshman accounted for 2.9% (n=2). Students were asked how many courses were taken in the subject area respective of Class H. Respondents reported 15.9% (n=11) had taken no courses, 34.8% (n=24) had taken one to two courses, 27.5% (n=19) had taken three to four courses, and 21.7% (n=15) had taken more than four courses in the subject area. There was one student that did not answer this specific question.

Class I

The instructor who taught Class I was a 26 year-old female graduate assistant with one year of collegiate teaching experience. Furthermore, she had less than 6 months of experience leading non-formal educational programs at a community level.

There were 100 students enrolled in Class I with 77 participating in this study. Females constituted 62.3% (n=48) of the student respondents. Concerning the ages of Class I, respondents were bimodal with 34.2% (n=26) each at 20 and 21 years of age.

Class I respondents reported their college classification as 48.1% (n=37) juniors, 26.0% (n=20) seniors, 20.8% (n=16) sophomores, and 5.2% (n=4) freshman. Students were asked how many courses were taken in the subject area similar to Class I. In response, it was found that 34.2% (n=26) had taken no courses, 46.1% (n=35) had taken one to two courses, 13.2% (n=10) had taken three to four courses and 6.6% (n=5) had taken more than four courses in the subject area.

All Participants

For all faculty members, teaching experience ranged from a graduate student employed as a lecturer to tenured faculty members. Years of experience ranged from 1 to 38 years while ages of these faculty members ranged from 25 to 62 years. Six of the nine faculty members were female. Faculty members represented six academic departments in the College of Agriculture and Life Sciences at the University of Florida.

There were 993 undergraduate students enrolled in the nine courses examined in this study, of which 716 participated. Of the student respondents, 65.7% (n=467) were female. The mode age of student participants was 21 years (33.6%, n=239). The majority of the students were juniors (48.6%, n=345) and seniors (41.4%, n=294). Considering the number of courses students had taken in the same subject area to the course of which instruments were administered, 11.5% (n=81) had taken no courses, 37.2% (n=263) had taken one to two courses, 26.7% (n=189) had taken three to four classes and 24.6% (n=174) had taken more than four courses.

Discussion for objective one

Analysis of the faculty members in the study found that six of the nine agreeing to participate were female. There was a variety of years of teaching experience among the faculty participants ranging from the faculty member for Class D who had taught 38 years to the Class I faculty member who had about six months of teaching experience. Furthermore, faculty participants' in this study ranged from a graduate student to full professor. Demographic variables of faculty members were provided only to describe the selected faculty members instructing the classes and not used in further analysis. There was no indication found in the literature that faculty member demographics greatly contribute to student stress, motivation or engagement. Furthermore, research has found that teachers give instructional discourse in their own preferred learning style despite other individual differences and situations (Dunn & Dunn, 1979; Farthing & Stubbs, 2003; Witkin, 1973). It was determined that faculty member demographic information was not needed for further data analysis.

This study used student demographic variables to describe each class used in the study and to determine if demographic variables contributed to the explanation of student stress, student motivation and student engagement (Gadzella & Guthrie, 1993; Gadzella & Fullwood, 1992; Pike, 2004). These comparisons will be made in the following objectives.

Of the student respondents, 65.7% (n=467) were female. As expected, some classes had more females than males or more males than females depending on the academic department in which the course was based. For example, females accounted for almost 70% of the participating students of Class F; a class required for nutritional science and dietetics majors of which the majority are female. Still, seven of the nine classes were mostly female.

Most of the students were classified as full-time students. The majority of participating students were also between the ages of 18 and 23 years of age, giving evidence that classes were mostly filled with traditional college students. Furthermore, the majority of students in the classes of study were either juniors (48.6%, n=345) or seniors (41.4%, n=294). This indicated that courses used in this study were of higher level. Regarding the number of courses the student had taken with similar content varied across classes. However, considering all participants, 50.7% (n=363) of the students had taken at least three classes that were similar to the course used in the study. This not only helps confirm that classes were of higher level, but also that these students had some content familiarity with the course.

Objective Two

Objective two determined the cognitive style, student stress, student motivation and student engagement of undergraduate students. Four separate instruments were used to determine student cognitive style (KAI), student level of stress (SSI), student level of motivation (MSLQ), and the level of student engagement (NSSE) specific to the class to which the instruments were administered. Conclusions for objective two will be discussed after a brief presentation of the findings.

Class A

For Class A (N=100, n=70), the total cognitive style mean of student respondents was 4.40 points more adaptive (M=90.60, SD=18.01, n=58) than the general population norm determined by Kirton (1999). Class A's total stress mean for student respondents was 52.44 (SD=10.57, n=68), 17.65 points lower than reported norms (Gadzella & Baloglu, 2001). For motivation, a mean of 29.31 (SD=3.59, n=69). This was 1.15 points lower than the norm reported by Pintrich, Smith, Garcia and McKeachie (1991). Regarding student engagement, the summed mean of the three construct scores was 48.43

(SD=7.70, n=70). This value was 15.31 points lower than the reported national mean for college seniors (Kuh, Hayek, Carini, Ouimet, Gonyea & Kennedy, 2001).

Class B

For Class B (N=100, n=72), students' total cognitive style mean score (M=92.43, SD=15.05, n=46) was 2.57 points more adaptive than the general population (Kirton, 1999). The total stress mean for student in Class B was 55.85 (SD=12.95, n=68). This score was 14.24 points lower, or one standard deviation lower than the norm (Gadzella & Baloglu, 2001). Of total student motivation of Class B, the mean was 30.65 (SD=12.95, n=68), only 0.19 point higher than test sample from the work of Pintrich et al. (1991). Class B total student engagement mean was 17.73 points lower (M=46.01, SD=7.47, n=70) than the national mean for college seniors (Kuh et al., 2001).

Class C

For Class C (N=90, n=71), the total cognitive style mean was slightly more innovative (M=100.86, SD=14.34), or 5.86 points higher than the general population mean defined by Kirton (1999). Total stress mean of participants in this class was 15.18 points lower (M=54.91, SD=12.59, n=70) than the reported test sample mean (Gadzella & Baloglu, 2001). Total motivation in this course was had a mean 0.40 points higher (M=30.86, SD=3.80, n=71) than the standardized norm (Pintrich et al., 1991). Total student engagement score mean of Class C (M=54.73, SD=9.15, n=71) was 9.01 points lower than the national mean for college seniors (Kuh et al., 2001).

Class D

For Class D (N=116, n=108), the total cognitive style mean for Class D student respondents was 93.63 (SD=17.40, n=73). This indicated students in the class were slightly more adaptive as the mean was 1.37 points more adaptive than the standard mean of typical populations defined by Kirton (1999). Total stress score mean for the class (M=52.80, SD=13.71, n=101) was 17.29 points lower than the standardized norm mean of 70.09 points (Gadzella & Baloglu, 2001). However, Class D total student motivation (M=32.42, SD=3.77, n=102) was 1.96 points higher than the norm mean reported by the instrument authors (Pintrich et al., 1991). Concerning student engagement of Class D, the total calculated student engagement mean was 48.33 (SD=7.89, n=108). That value was 15.41 points lower than the national reported mean for college seniors (Kuh et al., 2001).

Class E

For Class E (N=105, n=48), the total cognitive style mean was slightly more adaptive (M=89.41, SD=14.95, n=32), which was 5.59 points lower than the general population mean of 95.00 (Kirton, 1999). The total stress mean of Class E was 42.89 (SD=11.28, n=47) which was more than two standard deviations lower than the test sample used by Gadzella and Baloglu (2001). Considering motivation for Class E, the total score mean (M=31.20, SD=3.79, n=48) was 0.74 points higher than test sample mean (Pintrich et al., 1991). The total student engagement mean score was 47.88 (SD=5.50, n=48) which was 15.86 points lower than the national reported college senior total engagement mean (Kuh et al., 2001). Note that the faculty member instructing Class E did not encourage student participation by providing extra-credit, as the other eight faculty members did. The lack of student participation in Class E makes this class more subject to non-response error. However, no data were collected from non-responders.

Class F

For Class F (N=150, n=115), responding students were slightly adaptive (M=90.17, SD=16.28 n=71), which was 4.83 points lower than the general population mean (Kirton, 1999). The total stress score mean of respondents in Class F was 49.29

(SD=13.20, n=112). This compares to being 20.80 points lower than the test sample reported by Gadzella and Baloglu (2001). However, the total motivation mean (M=31.25, SD=3.71, n=115) for Class F was 0.79 points higher to the reported norm mean of 30.46 (Pintrich et al., 1991). Class F respondents' total student engagement mean of 47.87 (SD=7.81, n=115) was 15.87 points lower than the national mean for college seniors (Kuh et al., 2001).

Class G

For Class G (N=110, n=85), the total cognitive style mean was 93.42 (SD=15.04, n=65) indicating a slightly more adaptive group; the mean score was 1.58 points lower than the general population mean determined by Kirton (1999). The student total stress mean of Class G was 51.54 (SD=13.72, n=84), 18.55 points lower than the results published by Gadzella and Baloglu (2001). The Class G total student motivation mean score was 30.01 (SD 4.27, n=85). That is 0.45 points lower than the total motivation norm provided by Pintrich et al. (1991) indicating a slightly lower level of motivation in this class. Considering total student engagement for Class G respondents, the mean was 50.05 (SD=7.80, n=85), 13.69 points lower than the national average of 63.74 for college seniors (Kuh et al., 2001).

Class H

For Class H (N=122, n=70), the total cognitive style mean of Class H was 95.30 (SD=15.01, n=50), only 0.30 points higher than the general population cognitive style of 95 (Kirton, 1999). Student total stress mean (M=50.73, SD=11.54, n=70) in Class H was approximately 19.36 points lower than the reported normalized mean (Gadzella & Baloglu, 2001) indicating lower levels of stress. Considering student motivation in Class H, the total motivation mean score was 31.05 (SD=4.60, n=70) which was 0.59 points higher than the normalized mean reported by Pintrich et al. (1991). The total student engagement mean (M=52.28, SD=8.59, n=69) was 11.46 points lower than the national mean for college seniors (Kuh et al., 2001).

Class I

For Class I (N=100, n=70), the student total cognitive style mean of the Class I was 92.90 (SD=14.25, n=60). This indicated a slightly adaptive student group with 2.10 points lower than the general population reported by Kirton (1999). The total stress mean for Class I was 49.82 (SD=11.96, n=77), which was 20.27 points lower than the reported norm stress mean (Gadzella & Baloglu, 2001). For motivation, the student total motivation mean of Class I was 29.86 (SD=3.74, n=77). That value was 0.60 points lower than the total motivation mean reported by Pintrich et al. (1991). Student participants had a total engagement mean of 51.58 (SD=7.72, n=76), 12.16 points lower than the national mean for college seniors (Kuh et al, 2001).

All students

All participating students (N=993, n=716) of the nine classes were grouped together to determine total mean scores for cognitive style, stress, motivation and engagement. The cognitive style mean score of the total group was 93.28 (SD=15.95, n=511), which was 1.72 points lower than the general population defined by Kirton (1999). This indicated that overall, student participants were slightly adaptive. The total stress mean for all students was 51.35 (SD=12.91, n=697), 18.74 points lower than the reported norm (Gadzella & Baloglu, 2001). For total motivation, the mean was 30.81 (SD=4.04, n=706), 0.35 points higher than the norm reported by Pintrich et al. (1991). Considering all participating students the total engagement mean was 49.58 (SD=8.20, n=712) which was 14.16 points lower than the national mean for college seniors (Kuh et al., 2001).

Comparison between classes

A one-way ANOVA was conducted to examine significant differences of student stress levels between students taught by adaptive faculty members, middle score faculty members and innovative faculty members. A significant difference was found between the three groups perceived stress scores (F=8.92, p=.00) and a Bonferroni post-hoc test was conducted to further examine between group differences. The adaptive teacher group had student stress scores (M=54.51) that were significantly higher than the student stress scores of the middle score teacher group (M=49.49, p=.00) and significantly higher than student stress scores of the innovative teacher group (M=50.72, p=.01). This finding coincides with the results reported by Puccio et al. (1993) who found that courses perceived to be more adaptive had increasing levels of stress.

A one-way ANOVA was conducted to examine significant differences of student motivation scores between courses taught by adaptive teacher group, courses taught by the middle score teacher group and courses taught by the innovative teacher group. A significant difference was found between the three groups (F=10.41, p=.00). A Bonferroni post-hoc test was used to find group differences. Students in the innovative teacher group had total motivation scores (M=30.27) that were significantly lower than student motivation scores in the middle score teacher group (M=31.69, p=.00). Student respondents in the adaptive teacher group also had significantly lower motivation scores (M=30.28, p=.00) than found in the middle score teacher group. These findings indicated that these students taught by adaptive and innovative faculty on average have lower levels of motivation than students taught by faculty members with a cognitive style close to the general population mean of 95 (Kirton, 2003).

To determine if student engagement varied among adaptive faculty members and innovative faculty members, a one-way ANOVA was conducted to examine significant differences between an adaptive teacher group, a middle score teacher group and an innovative teacher group. Using total student engagement as the dependent variable, a significant difference was found between groups ($F=9.61$, $p=.00$). A Bonferroni post-hoc test was conducted to further examine group differences. Students in the innovative teacher group had total engagement scores ($M=51.22$) significantly higher than engagement scores of students enrolled in the middle score teacher group ($M=48.05$, $p=.00$). However, students in the innovative teacher group did not have significantly higher engagement scores than students in the adaptive teacher group ($M=49.75$, $p=.17$). These findings indicated that students in these classes taught by innovative faculty members tended to have higher levels of student engagement, but not significantly higher than adaptive faculty members.

Discussion for objective two

Cognitive style was determined by the KAI. Among the classes, all cognitive style score means were less than ten points away from 95 which indicates that these students on average were not highly adaptive or highly innovative. That is, these classes on average had the same cognitive style as the general population mean (Kirton, 2003). Overall, students' cognitive style mean score was 93.28 ($SD= 15.95$). Fluctuation of cognitive mean scores between classes may be attributed to the number of female students in the class. Kirton (1999) states that the total cognitive style mean score for females is 90, which is five points lower than the general population mean. In this study, the overall cognitive style mean score for females was 91.49 (n=339), while the cognitive style mean score for males was 96.81 (n=170). Therefore, classes with a larger percentage of females tended to have more adaptive mean scores.

The level of student perceived stress was determined by the SSI. All of the classes had student mean stress levels between 42.89 (Class E) and 55.85 (Class B). Overall, stress scores were low compared to the findings of Gadzella and Baloglu (2001). The lower stress scores may be explained by examining the time of year the SSI was administered. Shields (2001) found that student stress decreases during the second semester of the academic year. Data for this study were collected in the second semester of the academic year for this study, however Gadzella and Baloglu (2001) did not report the semester to which the SSI was administered. Nevertheless, student stress scores were still low. Another small contributor to lower stress scores was the removal of one frustrations stress construct item prior to data collection which would have affected the frustrations construct and the total stress score for each student.

A one-way ANOVA was conducted to examine significant differences of student stress levels between students taught by adaptive faculty members, middle score faculty members and innovative faculty members. A significant difference was found with a Bonferroni post-hoc test identifying that students enrolled in classes taught by adaptive faculty members on average had significantly higher levels of stress than students taught by other faculty members. Although this finding may not be practically significant, it confirms the results found by previous research (Puccio, Talbot, & Joniak, 1993) and indicated a relationship between student stress and courses taught by adaptive faculty members. Why does this relationship exist with adaptive faculty members and not innovative faculty members as they both tend to have students with larger cognitive style gap? Puccio et al. recommended that researchers examine faculty members' instructional discourse to identify adaptive and innovative components that may trigger stress. The researcher echoes this recommendation but would also include examining how adaptive and innovative students structure new knowledge (Kuhn, 1970). For example, Kirton's (2003) A-I theory suggests that the adaptive faculty member would have a narrow and detailed focus on course material, uses rules to solve problems and does not discuss irrelevant topics. An innovative student may find working with this adaptive faculty member stressful because he has to cope to stay focused, use rules and discuss only relevant topics in the process of learning. An adaptive student on the other hand, may learn with his own narrow focus, his own rules and his own ties to relevancy which is different than the faculty member's. Therefore the adaptive student taught by an adaptive faculty member may have increased levels of stress as the student is still forced to structure knowledge differently than he prefers (Kuhn, 1970). More research is needed to determine if this explanation is upheld in the undergraduate classroom.

The MSLQ was used to determine level of student motivation in each course. Throughout the nine courses total motivation means ranged from 29.31 (Class A) to 32.42 (Class D) with no construct mean score in any class exceeding one standard deviation from the norm (Pintrich et al., 1991).

A one-way ANOVA was conducted to examine significant differences of student motivation scores between courses taught by the adaptive teacher group, middle score teacher group and innovative teacher group. A significant difference was found between the three groups and a Bonferroni post-hoc test was conducted to further examine motivation score differences. However, the value differences may have little practical significance in the classroom. Nevertheless, the findings indicated that these students on average were less motivated in classes taught by more adaptive faculty members and more innovative faculty members than when taught by faculty members with a cognitive style score approximately at 95; the general population mean (Kirton, 2003). Kirton readily cites increased stress as a result of a large cognitive style gap, but refers to motivation as the affective component of coping behavior necessary to bridge the cognitive style gap when it is required to work with someone who has a different cognitive style. The evidence suggests that in these nine classes, student motivation is inhibited when taught by an adaptive or innovative faculty member, which makes coping behavior seem less likely. Educational practitioners that are highly adaptive or highly innovative should be made aware that they have a different problem solving style than many of their students which may inhibit student motivation. More research is warranted to determine effective coping behaviors that faculty members can implement to increase motivation in students with a different cognitive style.

Three student engagement constructs were utilized from the NSSE to determine student engagement of participating students. These constructs included academic challenge, active learning and student-faculty interaction which were summed to provide a total student engagement score. All construct mean scores of student engagement were lower than the national averages for senior college students (Kuh et al., 2001). Although this study used freshman, sophomores and seniors, there was no significant difference in engagement scores in comparing these groups.

A one-way ANOVA was conducted to examine significant differences of student engagement between the adaptive teacher group, middle score teacher group and innovative teacher group. A significant difference was found between groups (F=9.61, p=.00). A Bonferroni post-hoc test was conducted to further examine group differences. Students in the innovative teacher group had total engagement scores (M=51.22) significantly higher than engagement scores of students enrolled in the middle score teacher group (M=48.05, p=.00), but not significantly higher than the adaptive teacher group (M=49.75). This finding indicated that students in these classes taught by innovative faculty members on average have higher engagement scores than other faculty members and significantly higher than middle score faculty members. Does the extraverted tendency of innovative faculty members (Kirton, 1999) facilitate higher levels of student-faculty interaction and student engagement? Does the reliable and predictable adaptive faculty member have detailed rules (Kirton) that provide structure for student engagement? Not much can be said until more research is conducted to better determine the relationship between faculty member cognitive style and student engagement. Again, caution is given as these findings may not be practically significant.

Objective Three

The goal of objective three was to calculate a cognitive style gap found between faculty members and students for the purpose of exploring its relationship with student stress, student motivation, student engagement and specific demographic variables of undergraduate students. To identify a cognitive style gap between a student and their class teacher, the KAI was used to determine the cognitive style of the student and the faculty member. Cognitive style gap was calculated by subtracting the faculty member’s cognitive style score from each student’s cognitive style score. Correlations were used to determine the strength and direction of the relationship that cognitive style gap has with students' stress, motivation and engagement in each class. Chapter 4 provides a complete listing of all correlations found in this study. Correlations presented in this chapter include only cognitive style gap associations with student stress, motivation and engagement; the focus of this study. Objective three conclusions will be discussed after a brief presentation of the findings.

Class A

For Class A, the mean cognitive style gap score was 26.60 (SD=18.00, n=58). Total cognitive style gap was found to have a significant moderate relationship with total stress ($r=.34$, $p<.05$). Efficiency cognitive style gap had moderate correlations with stress constructs: frustrations ($r=.37$, $p<.05$), conflicts ($r=.35$, $p<.05$), and pressure ($r=.38$, $p<.05$). Furthermore, rules group/conformity cognitive style gap had moderate correlations with stress constructs: frustrations ($r=.34$, $p<.05$), and changes ($r=.33$, $p<.05$).

Total cognitive style gap was found to have a significant low relationship with total motivation ($r=-.29$, $p<.05$). Efficiency cognitive style gap scores had moderate correlations with total motivation ($r=-.33$, $p<.05$), extrinsic motivation ($r=-.36$, $p<.05$) and self-efficacy ($r=-.44$, $p<.05$). Considering the rule/group conformity cognitive style gap, moderate correlations were found with total motivation ($r=.31$, $p<.05$) and task motivation ($r=-.33$, $p<.05$).

Total cognitive style gap had a negligible correlation with total engagement ($r=.04$, $p>.05$) signifying little association between the two variables.

For demographic correlations in Class A, student age was found positively associated with total cognitive style gap ($r=.31$, $p<.05$). Student gender was found moderately related with total cognitive style gap (r=-.32, p<.05). Considering the number of collegiate courses taken related to the subject area of Class A, a correlation was found with total engagement (r=.39, p<.05). Also, college classification had a moderate association (r=.30, p<.05) with total student engagement.

Class B

The cognitive style gap mean between the faculty member and students in Class B was 24.43 (SD=15.05, n=46). No significant correlations were found between cognitive style gap constructs and stress constructs.

Cognitive style gap construct efficiency had a moderate correlation (r=-.46, p<.05) with total motivation, intrinsic motivation (r=-.30, p<.05), extrinsic motivation (r=-.36, p<.05), control of learning (r=-.35, p<.05) and self-efficacy (r=-.44, p<.05).

Total cognitive style gap was moderately correlated with total student engagement (r=.31, p<.05) and active learning (r=.44, p<.05). Likewise sufficiency of originality gap was positively correlated with total engagement (r=.33, p<.05) and active learning (r=.33, p<.05). Also rule/group conformity gap was correlated with total engagement (r=.36, p<.05), active learning (r=.48, p<.05) and student-faculty interaction (r=.32, p<.05).

Demographic questions were asked of students regarding age, gender, number of subject area courses and college classification. In Class B, students' age was found to have a positive association with efficiency style gap (r=.30, p<.05). Age was correlated with intrinsic motivation (r=-.32, p<.05).

Class C

The total cognitive style gap mean of Class C was 17.86 (SD=14.34, n=56). Considering correlations between cognitive style gap and student stress in this class, self-imposed stress had negative moderate correlations with total cognitive style gap (r=-.31,

$p<.05$) and rule/group conformity gap ($r=-.31$, $p<.05$). This finding conflicts with previous research conducted by Kirton (2003).

Moderate correlations were found between total motivation and total cognitive style gap ($r=-.34$, $p<.05$) and efficiency gap ($r=-.30$, $p<.05$). The same was found with extrinsic motivation when comparing this construct to total cognitive style gap ($r=-.34$, $p<.05$) and rule/group conformity gap ($r=-.31$, $p<.05$). Test anxiety was moderately correlated with total cognitive style gap ($r=-.49$, $p<.05$), sufficiency of originality gap ($r=-.47$, $p<.05$) and rule/group conformity gap ($r=-.41$, $p<.05$).

For correlations between cognitive style gap and student engagement, sufficiency of originality gap was correlated with active learning ($r=.31$, $p<.05$).

Examining correlations among demographics, gender had a moderate negative correlation with total cognitive style gap ($r=-.38$, $p<.05$). Student college classification of the student was found to significantly correlate with total cognitive style gap ($r=.42$, $p<.05$).

Class D

For Class D, the total cognitive style gap mean was -0.37 ($SD=17.40$, $n=73$). For correlations between cognitive style gap and stress, a correlation was found between efficiency gap and self-imposed stress ($r=-.36$, $p<.05$). This correlation was not consistent with previous research conducted by Kirton (2003).

Only one moderate correlation was found among student scores of cognitive style gap and motivation; efficiency cognitive style gap was correlated with extrinsic motivation ($r=-.38$, $p<.05$). There were no significant correlations among cognitive style gap and student engagement in Class D.

For demographic information concerning Class D, the number of collegiate courses similar to the subject area of Class D was significantly correlated to total cognitive style gap ($r=-.24$, $p<.05$). Concerning gender, there was a significant low correlation ($r=-.24$, $p<.05$) with test anxiety. College level of classification was found to have a moderately negative association ($r=-.32$, $p<.05$) with total stress.

Class E

For Class E, the total cognitive style gap score mean was -5.59 (SD=14.95, n=31). There were no significant correlations found among scores of cognitive style gap and scores of student stress in the class. Considering motivation, moderate correlations were found between sufficiency of originality gap and motivation constructs intrinsic motivation ($r=.36$, $p<.05$) and self-efficacy ($r=.38$, $p<.05$). There were no significant correlations between scores of cognitive style and scores of student engagement in Class E.

The researcher examined correlations among demographic information for Class E students. The only moderate correlation concerning demographics was between number of college courses related to the subject area of Class E and student-faculty interaction ($r=.48$, $p<.05$).

Class F

For cognitive style gap between the students and their faculty member instructing Class F, the mean was -12.83 (SD=16.28, n=71). No moderate correlations were found among scores of cognitive style gap and scores of stress, or scores of engagement. However, one moderate correlation was found between sufficiency of originality gap and extrinsic motivation ($r=-.33$, $p<.05$).

For demographic information, no significant correlations were found in Class F regarding these demographic variables and total cognitive style gap. However, age was found to be associated with extrinsic motivation, ($r=-.30$, $p<.05$). Gender was moderately correlated to total student motivation ($r=.42$, $p<.05$). Considering students' college classification, a moderate correlations was found with test anxiety ($r=-.35$, $p<.05$).

Class G

The calculated total cognitive style gap mean for Class G was -22.58 (SD=15.04, n=65). Only one moderate correlation existed among constructs of cognitive style gap and constructs of student stress. Sufficiency of originality gap was correlated with self-imposed stress ($r=.33$, $p<.05$).

No significant correlations were found between scores of cognitive style gap and scores of total motivation. However total cognitive style gap was correlated with active learning ($r=.30$, $p<.05$).

Student respondents were asked demographic questions including age, gender, number of classes taken similar to Class G and college classification. None of these demographic variables were significantly associated with total cognitive style gap. Furthermore, no moderate correlations were found among demographic variables.

Class H

Student's cognitive style gap mean score with the faculty member was -36.70 (SD=15.01, n=50) for Class H. Moderate correlations were found between rule/group conformity gap and total stress ($r=-.36$, $p<.05$), frustrations ($r=-.30$, $p<.05$) and pressures ($r=-.49$, $p<.05$). This finding was congruent with previous research conducted by Kirton (2003).

Examining relationships between cognitive style gap and motivation, moderate correlations were found between intrinsic motivation and total cognitive style gap ($r=.32$, $p<.05$), sufficiency of originality gap ($r=.35$, $p<.05$), and rule/group conformity gap ($r=.30$, $p<.05$).

Total cognitive style gap was correlated with total student engagement ($r=.40$, $p<.05$), active learning ($r=.46$, $p<.05$) and student-faculty interaction ($r=.41$, $p<.05$). Likewise, sufficiency of originality gap was correlated with total engagement ($r=.33$, $p<.05$), active learning ($r=.41$, $p<.05$) and student-faculty interaction ($r=.31$, $p<.05$). Also rule/group conformity gap was moderately correlated with total engagement ($r=.32$, $p<.05$), active learning ($r=.40$, $p<.05$) and student-faculty interaction ($r=.37$, $p<.05$).

Student respondents were asked demographic questions specific to age, gender, number of courses taken similar to the content of Class H and college classification. Answers to these questions were used to find correlations with cognitive style gap. None of these demographic variables were found to significantly correlate with total cognitive style gap in Class H.

Class I

The total cognitive style gap mean for Class I was -41.10 ($SD=14.25$, $n=60$). One moderate correlation was found between efficiency cognitive style gap and conflict stress ($r=.35$, $p<.05$); a finding that conflicts with research presented by Kirton (2003). No other cognitive style gap constructs were correlated with stress constructs, motivation constructs or student engagement constructs in Class I.

For demographic information, gender was found to have a moderate negative relationship with intrinsic motivation ($r=-.36$, $p<.05$) and control of learning ($r=-.31$,

$p<.05$). Considering the number of collegiate courses related to the subject area of Class I, a moderate correlation was found with academic challenge ($r=.44$, $p<.05$).

All Students

The mean cognitive style gap for all participants was -6.30 ($SD=28.19$, $n=511$). Examining correlations between cognitive style gap and student stress, no moderate correlations were found among total scores and construct scores for these students. There were no moderate correlations found between scales of cognitive style gap and scales of student motivation. Furthermore, no moderate correlations were found between scales of cognitive style gap and student engagement. Although there were relationships between the aforementioned scales among individual classes, the researcher concluded that accounting for all participants, measures of cognitive style gap had little association with stress, motivation and engagement in these students. This finding will be discussed further in the discussion for objective 3. For all students, no moderate correlations existed among demographic variables and the measurement of cognitive style gap, stress, motivation and engagement.

Group Comparisons

Kirton (2003) theorized and provided evidence that individuals with more than a 20-point cognitive style gap differ in the manner in which they solve problems. As the two individuals perceive the problem differently, they also differ in how they generate solutions, create change and utilize rules in their problem solving efforts. Stress is a result of the two individuals working together in solving a problem (Kirton). A two-tailed independent sample t-test was conducted to examine stress score differences between students with less than a 20-point gap and students with more than a 20-point gap with their respective instructor. No significant difference was found ($t=-.05$, $p=.96$) in total stress scores between students with more than a 20-point gap (M=51.76, n=284) and students with less than a 20-point gap (M=51.82, n=212).

The same data analysis was conducted to examine differences among students' level of motivation. A two-tailed independent sample t-test was conducted to examine motivation score differences between students with more than a 20-point gap and students with less than a 20-point gap. A significant difference was found (t=-3.13, p=.00) between motivation scores of students with more than a 20-point gap (M=30.09) and students with less than a 20-point gap (M=31.20).

Realizing that objective 2 findings included the discovery that courses taught by innovative instructors and adaptive instructors have students with significantly lower levels of motivation than students in courses taught by instructors with a cognitive style score similar to the general population mean. A two-way ANOVA was conducted to examine the interaction effect between cognitive style of the faculty member and cognitive style gap higher than 20 points on motivation. A significant difference was found (F=3.94, p=.03) for the interaction of students with more than a 20-point cognitive style gap and faculty members' cognitive style. The lowest motivation scores were found in students with a 20-point gap taught by adaptive faculty members (M=29.24), which compared to a mean score of 31.32 for students enrolled in the same courses with a cognitive style gap less than 20 points.

A t-test was conducted to examine differences of total student engagement between students with less than a 20-point gap with their instructor and students with more than a 20-point gap with their instructor. No significant difference was found.

Discussion for objective three

As expected, faculty members who were either highly adaptive or highly innovative had more students with cognitive style gap scores higher than twenty points. For example, Class E had the least number of students having a cognitive style gap of more than 20 points (n=9, 28.1%), while Class I had the most students having a cognitive style gap of more than 20 points (n=55, 91.7%). Naturally, cognitive style gap mean scores were the most adaptive in Class I (M=-41.10) and the most innovative in Class A (M=26.60). Note that every class had students with more than a 20-point cognitive style gap.

A two-tailed independent sample t-test was conducted to examine if stress scores differed between students with less than a 20-point cognitive style gap and students with more than a 20-point cognitive style gap with their respective instructor. No significant difference was found (t=-.05, p=.96) between the two groups. The data suggests that students in these classes with a 20-point gap with their faculty member do not have higher levels of stress, which does not corroborate previous research conducted by Kirton (2003). This finding is surprising, but there may be two explanations. Kirton claims that coping outside of one's preferred cognitive style is stressful and can only occur for a limited intensity and duration. However, college students may walk into a classroom with full expectations to cope outside of their preferred style as required to get their desired grade. Also note that these students were attending one of the top universities in Florida, if not the nation, suggesting higher admission standards and students with higher levels of intelligence. Kirton (1994) suggests that higher intelligence may attribute to higher levels of coping behavior. That is, these students have learned to cope and are proficient in coping outside of their preferred style. Future research should examine if students with a cognitive style gap larger than 20 points has more stress than students with a cognitive style gap less than 20 points in student populations with lower levels of intelligence.

The second explanation to why students with a cognitive style gap larger than 20 points did not have higher levels of stress may be that they did not work enough with the faculty member to recognize a need to operate outside of their preferred cognitive style. Again, coping behavior can only occur for a limited intensity and duration before the situation is too psychologically stressful (Kirton). A three credit hour class presented over a time span of one semester simply may not allow the intensity or duration for students to have higher levels of stress. Second, faculty members may be interacting with students, but not participating with students in the problem solving assignments. Said differently, faculty members assign problem sets, but do not provide feedback through the problem solving process used to complete the assignments. If students are working by themselves in completing problem solving assignments, cognitive style gap with the faculty member may be irrelevant. If students are working in groups or teams, it would be more appropriate to assess the cognitive style gap between students in the team, not the faculty member. More research is needed to determine if students with a cognitive style gap larger than 20 points contributes to student stress in different academic atmospheres in which students and faculty members work together in solving problems and in shorter time periods. Examples of these situations include smaller class sizes, independent studies, service learning projects, undergraduate research programs and three hour courses offered in interim semesters.

A two-tailed independent sample t-test was conducted to examine motivation score differences between students with more than a 20-point gap and students with less than a 20-point gap. A significant difference was found (t=-3.13, p=.00) between motivation scores of students having more than a 20-point gap and students having less than a 20-point gap. In further analysis, a two-way ANOVA was conducted to examine the interaction effect of students with a 20-point gap and students enrolled in a course taught by an adaptive faculty member. With motivation as the dependent variables, a significant interaction effect was found (F=3.94, p=.03). The lowest motivation scores on average were found in students with a 20-point gap taught by adaptive faculty members. Note that there may be little practical significance as group score differences vary little compared to the size of the motivation scale. Still, Kirton (2003) mentions that motivation is required to employ coping behavior, and that the benefits of achieving a goal must offset the stress resulting from cognitive style gap. Kirton has not specifically claimed that a reduction of motivation is related to cognitive style gap, but the finding makes sense. Students may be less motivated to learn from a faculty member that does not communicate in their preferred cognitive style and be even less motivated to learn from an adaptive faculty member that differs in cognitive style. The data does <u>not</u> suggest that a reduction of student motivation is a precursor to an increase of student stress, but this may be possible. This would correspond with the findings of Puccio et al. (1993) in that students in more adaptive courses not only are associated with higher levels of stress, but also lower levels of motivation. Further research is required to determine if the relationship between cognitive style gap and motivation. Considering the importance of motivation in increasing student engagement (Astin, 1984; Paris & Turner, 1994) this research has great implications for increasing student engagement in undergraduate classrooms in colleges of agriculture. This research would bring greater understanding to how students are affected by coping behavior.

Another t-test was conducted to examine differences of total student engagement between students with less than a 20-point gap with their instructor and students with more than a 20-point gap with their instructor. No significant difference was found ($t=1.14$, $p=.25$) between the two groups. This finding provides evidence that just as all students have the ability to solve all problems (Kirton, 2003), all students can be engaged in learning despite the fact that they are more adaptive or innovative than their faculty member. Educational practitioners should be aware that having a cognitive style gap larger than 20 points with a student has no relationship with student engagement.

Examining the correlations between cognitive style gap, student stress, motivation, engagement and demographic variables helped identify relationships between variables for further analysis in objective 4 and 5. Each class in this study had similar findings with some classes and different findings with other classes. In the end, the researcher found no consistent pattern in relationships among individual classes or groups of classes. That is, every class was unique which was evident in objective 4 and 5.

Considering all students, cognitive style gap had no moderate correlations with student stress, student motivation or student engagement, indicating little association between a dissimilar cognitive style and stress, motivation and engagement. This finding may be deceiving. Using the variables cognitive style gap and stress as an example, notice that a positive correlation indicated an innovative cognitive style gap was associated with higher levels of stress in a course taught by an adaptive faculty member. On the other hand, a negative correlation indicated an adaptive cognitive style gap was associated with higher levels of stress in a course taught by an innovative faculty member. Both positions are theoretically correct (Kirton, 2003) but require a different direction of relationship. Therefore concerning cognitive style gap, positive and negative correlations from individual classes may have canceled out when combined as a total group.

Objective Four

The purpose of objective four was to explain undergraduate student motivation and student stress based on constructs of cognitive style gap and selected demographic variables which included student age, gender, number of similar courses taken, and college classification. Backward stepwise multiple regression was used in each class to explain the variance of the dependent variable, stress. Significant findings would provide evidence that the cognitive style gap between faculty member and student contributed to student stress in the nine classes examined in the study. Then, backward stepwise multiple regression was used in each class to explain the variance of the dependent variable motivation. Significant findings would provide evidence that the cognitive style gap between faculty member and student contributed to explaining levels of student motivation in the classes studied. Finally, all students were grouped together for similar analyses. Objective four conclusions will be discussed after a brief presentation of the findings.

Class A

In Class A, student stress was explained by efficiency cognitive style gap (β=.33) and students' age (β=.31) using a backward stepwise regression analysis. The model had an adjusted R^2 of .20 indicating that 20% of the variance of students' perceived stress in Class A was contributed by these two variables ($p<.05$).

For motivation in Class A, two independent variables were best found to explain student motivation. Cognitive style gap of efficiency (β=-.37) and number of similar courses (β=.17) contributed to explaining 13% of the variance in student motivation. The fitted model had an adjusted R^2 of .13.

Class B

Backward stepwise multiple regression was used to explain student stress of Class B. No significant model was found to explain student stress given the independent variables of cognitive style gap, gender, age, number of similar classes taken and college classification.

Backward stepwise multiple regression was used to explain student motivation of Class B to find the best fitting model. One variable, efficiency cognitive style gap, was found to explain 19% of the variance in student motivation (β=-.46, Adjusted R^2=.19).

Class C

For Class C, backward stepwise regression was used to explain total student stress. The best fitting model left three variables including sufficiency of originality cognitive style gap (β=-.31), gender (β=-.21) and age (β=.22). The fitted model had an adjusted R^2 of .13 signifying that 13% of the variance of stress in Class C was from these three variables ($p<.05$).

Also in Class C, total student motivation was regressed with the independent variables of efficiency style gap (β=-.18), gender (β=.33) and age (β=.20). The fitted model had an adjusted R^2 of .14 signifying that 14% of the variance of stress in Class C was from these three variables ($p<.05$).

Class D

With respect to Class D, backward stepwise multiple regression was used to explain total student stress. The best fitting model included the variables efficiency cognitive style gap (β=-.15) and the student demographic variable of college classification (β=-.29). This model had an adjusted R^2 of .10. That is, 10% of the variance of stress in Class D was explained by these two variables ($p<.05$).

Backward stepwise multiple regression was again used in Class D to explain total student motivation as a result of cognitive style gap and demographic variables. No model provided a significant explanation of student motivation.

Class E

In Class E, backward stepwise multiple regression was utilized to regress total student stress with cognitive style gap between the student and the faculty member as well as demographic variables including gender, age, similar number of courses taken and college classification. However, no model was found statistically significant.

For student motivation, sufficiency of originality cognitive style gap (β=.44) and gender (β=.27) contributed to a model to explain student motivation in Class E. The model had an adjusted R^2 of .13 indicating that 13% of the variance of student total motivation was explained by these two variables.

Class F

Backward stepwise multiple regression was used in Class F to explain the dependent variable of total student stress with cognitive style gap constructs and demographic variables including age, gender, number of similar courses taken and college classification. However, no models using these independent variables were found significant in ability to explain student stress.

Two variables, college classification (β=.-.19) and gender (β=.26) contributed to the explanation of student motivation in Class F. The model had an adjusted R^2 of .06 indicating that 6% of the variance of total motivation was attributed to students' college classification and gender.

Class G

In Class G, backward stepwise multiple regression was used to explain students' total stress using variables of cognitive style gap and student demographics including age, gender, number of similar courses taken, and college classification. However, no model was found to significantly explain student stress with these independent variables.

Total student motivation was regressed with the same independent variables to find the best fitting model. Again, no significant model was found to explain student motivation in Class G.

Class H

In Class H, two independent variables explained the dependent variable student stress using a backward stepwise regression analysis. They include rules/group conformity cognitive style gap (β=-.36) and number of similar courses taken by the student (β =.21). The model had an adjusted R^2 of .13 indicating that 13% of the variance of stress in Class H was from these two variables ($p<.05$).

For motivation of Class H, backward stepwise multiple regression was used to find the best fitting model with independent variables including cognitive style gap constructs and students' gender, age, number of similar courses taken and college classification. However no models were found significant with these independent variables.

Class I

Regarding Class I, Two variables, efficiency style gap (β =.29) and age (β =.22) accounted for 10% of the variance in explaining total student stress (Adjusted R^2=.10, $p<.05$).

Considering total student motivation of Class I, the same independent variables were used in backward stepwise regression data analysis to find the best fitting model with the most explanation of student motivation. Rule/group conformity style gap (β=-.28) and gender (β=-.20) were both considered significant contributors to the model. The adjusted R^2=.08 indicating that 8% of the variance of total student motivation was explained by these two independent variables.

All Students

All students participating in this study were grouped together to explain student stress based on cognitive style gap and student demographic variables. Considering all of the students, the best fitting model to explain total stress included the independent variables sufficiency of originality cognitive style gap (β =.15), college classification (β=-.11) and number of similar courses taken (β=.09). However, the adjusted R^2 was only .03

Considering total motivation of all students participating in this study, backward stepwise multiple regression was used to find the best fitting model with the most explanation of the dependent variable using the independent variables cognitive style gap and student demographics. Three independent variables were found to be significant ($p<.05$) in explaining student motivation. They include efficiency cognitive style gap (β=-.08), gender (β=.12) and number of similar courses taken by the student (β=.10). However, the adjusted R^2 was .03 for the model indicating that only 3% of the variance of motivation was attributed to the three independent variables.

Discussion for objective four

This study used backward stepwise multiple regression to examine if cognitive style gap contributed to the explanation of student stress and student motivation. Considering the explanation of student stress in adaptive courses, Class A provided evidence that students in these classes with a more innovative cognitive style construct had increased levels of total stress. The same evidence was found in Class D. Note that Class D was taught by a middle score faculty member, but scored 94 for total cognitive style designating him adaptive by one point. For innovative courses, Classes H and I provided evidence that students in these classes with a more adaptive cognitive style construct had increased levels of stress. The data suggests that Kirton's (2003) A-I theory was upheld in Classes A, D, H and I as a cognitive style construct gap did explain some variance of stress in these four courses.

Class C was taught by a more adaptive faculty member, but the data suggested that students having an innovative sufficiency of originality cognitive style gap in this class have lower stress scores. This finding conflicts with Kirton's A-I theory, but why? If faculty members teach in their preferred cognitive style, as suggested in the literature (Dunn & Dunn, 1979; Farthing & Stubbs, 2003; Witkin, 1973), this adaptive faculty member may provide structure for rewarding innovativeness in her class. Note that this class was on average the most innovative class (M=100.86) in the study. The mean cognitive style score of an intact group was termed cognitive style climate by Kirton (2003). A student may also have a cognitive style gap with the group's cognitive style climate which also gives rise to coping behavior and stress if the cognitive style climate is different than the student's preferred cognitive style. Perhaps in Class C, students were not coping to work with the adaptive faculty member, but were coping to work with the innovative students. It seems logical that the faculty member may heavily influence cognitive climate in a course, as they provide instruction through their own cognitive style. However, relinquishing control of the class to students provides opportunities for cognitive style climate of the students to intervene. More research is needed to first identify perceived cognitive style climate of a course and second determine how cognitive style climate influences student stress, motivation and engagement.

Classes B, E, F and G found no significant explanation of student stressed based on a cognitive style gap between the student and the faculty member. There were no patterns found in demographic variables, or construct scores of stress and cognitive style gap to indicate that these courses were different than classes that did have significant relationships between cognitive style gap and student stress. Furthermore, Classes E and F had faculty members with cognitive style scores similar to the cognitive climate of the class, so one could not argue that cognitive style climate was a factor in these two classes. Considering that in objective 3, findings indicated that students with at least a 20 point cognitive style gap did not have higher levels of stress than students with less than a 20 point gap, it is not surprising that some classes did not find that increasing cognitive style gap contributed to higher stress levels.

For student motivation, Classes A, B, and C each found that students with an innovative efficiency cognitive style gap had lower total motivation scores in these classes taught by an adaptive faculty member. The amount of variance of student motivation explained in these models ranged from 13% to 19%. This finding coincides with results of objective 3 indicating that students taught by adaptive faculty members and have more than a 20 point cognitive style gap also have lower levels of motivation.

Also note that the efficiency construct style gap was the contributing construct in all three classes. This indicates that the narrow focus to which these adaptive faculty members approach problems is principal to decreasing student motivation.

Class I was taught by an innovative faculty member and evidence from the data suggests that students with larger adaptive rules/group conformity gaps have higher levels of motivation. A possible explanation may be that these more adaptive students were exhibiting coping behavior (Kirton, 2003). This however, does not coincide with previous findings in objective 3 which indicated that students with a cognitive style gap larger than 20 points on average had lower levels of motivation. If true, Class I marks the only class in this study which students exhibited coping behavior. There was no indication that this class was different than the other eight classes with regard to demographic variables or other group categorizations. More research is needed to fully examine the relationship between cognitive style gap and student motivation and how student coping behavior may be fostered.

In Classes D, F, G and H, a cognitive style construct did not contribute to a significant model in explaining student level of motivation. Furthermore, findings in Class E suggest that students with an innovative sufficiency of originality cognitive style gap have increased levels of motivation. However, the faculty member instructing Class E had a cognitive style score equal to the general population mean (Kirton, 2003). To state it again, more research is needed to fully examine the relationship between cognitive style gap and student motivation and how student coping behavior may be fostered.

Objective Five

Objective five was achieved by using independent variables of cognitive style gap constructs, total stress, total motivation, and student demographic variables to explain student engagement in each of the nine classes. Demographic variables included students' age, gender, number of similar courses taken and college classification. Backward stepwise multiple regression was employed for analysis of the data to provide evidence of support for the theoretical framework of this study. Said differently, data analysis will examine if student engagement in the classroom can be explained by cognitive style construct gaps, stress and motivation. Finally, all students who participated in the study were grouped together to further explain student engagement. Objective five conclusions will be discussed after a brief presentation of the findings.

Class A

For Class A, backward stepwise regression was used to explain student engagement with independent variables of cognitive style gap constructs, total stress, total motivation and student demographic. The best fitting model with the most explanation of student engagement used five independent variables including sufficiency of originality cognitive style gap ($\beta=-.19$), total motivation ($\beta=.25$), total stress ($\beta=.39$), number of similar courses ($\beta=.26$) and college classification ($\beta=.30$). The model had an adjusted R^2 of .34 signifying that 34% of the variance of student engagement in the class was from these five variables ($p<.05$).

Class B

Considering Class B, backward stepwise regression was used to explain student engagement with independent variables of cognitive style gap constructs, total stress, total motivation and student demographic. The best fitting model with the most explanation of the dependent variable left two variables including rules/group conformity cognitive style gap ($\beta=.33$) and total motivation ($\beta=.38$). The model had an adjusted R^2 of

.20. This signifies that 20% of the variance of student engagement in the class was from these two variables ($p<.05$).

Class C

In order to explain student engagement of Class C, backward stepwise multiple regression was employed to find the best fitting model utilizing the independent constructs of cognitive style gap and variables total stress, total motivation and student demographics. Data analysis found that sufficiency of originality cognitive style gap ($\beta=.20$), total motivation ($\beta=.45$) and age ($\beta=.22$) best contributed to total engagement of Class C. The model was statistically significant ($p<.05$) and the adjusted R^2 was .24.

Class D

To explain student engagement of Class D, backward stepwise multiple regression was used to determine the independent variables that best fit into a model. Data analysis found that only total motivation ($\beta=.38$) best explained student engagement of Class D. The model was significant ($p<.05$) and the adjusted R^2 was .13, indicating that the independent variable contributed 13% of the variance in explaining student engagement of Class D.

Class E

Backward stepwise multiple regression was employed to explain student engagement in Class E given the independent variables of cognitive style gap constructs, total stress, total motivation, and selected student demographic variables. After data analysis, the best fitting model was made using three variables: number of similar courses taken by the student ($\beta=.40$), total stress ($\beta=.27$) and age ($\beta=.45$). The adjusted R^2 of the model was .26 signifying that 26% of the variance was explained by the three variables.

Class F

Regarding Class F, student engagement was explained using backward stepwise multiple regression. Independent variables included students cognitive style gap constructs, total stress, total motivation and student demographic variables. However, no model was found significant in explaining student engagement given these independent variables.

Class G

Student engagement of students in Class G was explained through the use of backward stepwise multiple regression to identify the independent variables that serve as the best fitting model. These independent variables included cognitive style gap constructs, total stress, total motivation and selected student demographic variables. After data analysis, total stress (β=.25) and total motivation (β=.38) were identified to best explain student engagement of Class G. The adjusted R^2 for the model was .22 signifying that 22% of the variance of the dependent variable was attributed to students' total stress and total motivation. The model was significant ($p<.05$).

Class H

For Class H, student engagement was explained by using backward stepwise multiple regression to identify independent variables that best contribute to a fitting model. Four variables were identified that contributed to the explanation of Class H student engagement. Those independent variables include rule/group conformity style gap (β=.40) number of similar courses previously taken by the student (β=-.26), total motivation (β=.47) and total stress (β=.30). The model was significant ($p<.05$) and had an adjusted R^2 of .33. That is, 33% of the variance of student engagement in Class H was explained by the four independent variables previously listed.

Class I

Student engagement of Class I was explained by employing backward stepwise multiple regression and finding the best fitting model with the most explanation of the dependent variable. Two independent variables were identified as a best fit for explaining student engagement of Class I. They include total motivation (β=.37), and number of similar courses taken by the student (β=.27). The adjusted R^2 was .19 meaning 19% of the variance of student engagement in Class I can be explained by the five independent variables.

All Students

All of the students who participated in this study were grouped together to explain student engagement based on the independent variables of cognitive style gap constructs, total stress, total motivation and student demographics. Demographic information consisted of students' age, gender, number of similar courses taken and college classification. Student engagement in this group was explained by the variables gender (β=-.09), total motivation (β=.30), total stress (β=.14) and student age (β=.09) using a backward stepwise regression analysis. The model had an adjusted R^2 of .13 meaning that 13% of the variance of student engagement among students in this study can be explained by the four independent student variables above. The model was found to be significant ($p<.05$).

Discussion for objective five

For student engagement, only four of the nine classes (A, B, C and H) had a cognitive style gap construct significantly explain student engagement. In Class A and H, the data suggests that a larger cognitive style gap that opposes the cognitive style of the faculty member was detrimental to student engagement scores. In Classes B and C the opposite was found as positive relationships indicated that students with an innovative cognitive style construct gap have higher levels of engagement in these adaptively taught classes. These findings are inconclusive in determining the relationship between student engagement and cognitive style gap; this mimics the results of Smith, Sekar and Townsend (2002) in that every study that supports the contention that information presented in one's preferred learning style increased learning, there is a study indicating that learning from a dissimilar learning style does not affect learning. Should there be a relationship between cognitive style gap and student engagement? Given the rising attention given to increasing student engagement in undergraduate classrooms (Acharya, 2002; Lunde, Baker, Buelow & Hayes, 1995; Study Group on the Conditions of Excellence in American Higher Education, 1984), this question deserves to be answered. Further research is necessary to determine if dissimilar cognitive styles contribute to explaining student engagement.

The highest level of variance in student engagement explained among these models was 34%; some of which included four independent variables. If the researcher were to suggest what major variables account for the remaining 66% of the variance in student engagement, the most critical would be instructional methods used by the faculty member (Astin, 1993; Chickering and Gameson, 1987; Kuh, 2003; Whittington, 1998). It may be that how the faculty member employs an instructional method emphasizes components of their cognitive style more so than other instructional methods (Puccio et al., 1993). The researcher calls for qualitative research to identify cognitive style components within a faculty member's instructional discourse and how this affects student engagement. However, there may be no implications from this research as Jensen (2000) has found learning style to be irrelevant in the complex process of learning.

Concluding Discussion

The most important finding in this study was that in these classes, cognitive style gap was detrimental to motivation in courses taught by adaptive faculty members; even more detrimental if student's cognitive style gap with the faculty member was larger than 20 points. Realizing the necessity of student motivation to foster student engagement (Astin, 1984), this relationship must be further researched. Another important finding was that in these undergraduate courses, students with a 20-point cognitive style gap or higher did not have significantly higher levels of stress than students with less than a 20-point gap with their faculty member. If this relationship is confirmed with further research, this finding limits the application of Kirton's (2003) adaption-innovation theory in the undergraduate classroom. Maybe the undergraduate classroom environment is unique in that students are more conforming to the expectations of the faculty member; more so than the group dynamics of managing change for which the KAI was developed. If the undergraduate classroom is a different environment, the threshold for cognitive style gap to cause stress in undergraduate students may be higher than 20 points. Also, the undergraduate classroom environment may not offer enough individual interaction between the faculty member and each student to constitute working together to solve a problem.

This study provides evidence that dissimilar cognitive styles between students and their faculty member may contribute to student stress, student motivation and student engagement. However, results were inconclusive to why some classes found cognitive style gap contributing to these dependent variables and in other classes cognitive style gap was not a significant contributor. Said again, for every class that found cognitive style gap to be significant in explaining stress, motivation and engagement, there was a class that did not find cognitive style gap significant (Smith, Sekar & Townsend, 2002). The answer to why findings were inconsistent among classes was beyond the scope of this study. In spite of that, this study did have limitations that may have been a factor in the inconsistent findings.

The KAI experienced a high mortality rate with 29% of the self-reported cognitive style scores of students unusable for analysis. That is, 29% of the students participating in this study provided suspect scores which likely did not give a true measure of students' preferred cognitive style. The mortality rate of the KAI among college students was anticipated as Kirton (1999) estimated a 20% mortality rate for this type of population. Provided that students who are pressured or have higher levels of stress tend to have suspect scores (Kirton), there may be valuable information lost among participants who inappropriately completed the KAI. If research concerning cognitive style is to continue in undergraduate classroom, the mortality issue of the KAI must be addressed.

This study had a 9% higher mortality rate than Kirton (1999) estimated; this may be explained by examining both the instrument administrator and the population. There is evidence that individuals inexperienced in administering the KAI also have responses with higher mortality and lower internal consistency among the instrument items (Kirton). This may be the case as the researcher had only been certified as a KAI practitioner for approximately one year before data collection for this study and had limited experience.

The population of students used in this study also may have contributed to the higher mortality rate. The University of Florida is a leading research institution in the United States with high admission standards for undergraduate students. Accordingly, students attending the University of Florida have higher levels of academic skills and are expected to exhibit those skills. These high expectations may have pressured students into answering most KAI items as easy or very easy to complete a task which may not be accurate. In doing this, a student does not report their preferred cognitive style, but a mixture of both cognitive style and cognitive level (Kirton). This is also known as the halo effect, which is characterized by a respondent answering items in a way that promotes the respondent as better than his or her realistic self (Ary, Jacobs & Razavieh, 2002). All KAI scores that were found to be suspect of not accurately determining cognitive style were removed from the data (Kirton, 1999).

The efficiency construct of the KAI had a post-hoc Cronbach's alpha of .66 in determining its reliability. Yet, the efficiency construct was found as the most prominent cognitive style construct gap in explaining stress and motivation. The literature has found the KAI as a reliable and valid instrument (Kirton, 1999), but use of the KAI may have limitations with college students considering the high mortality rate and low reliability of the efficiency construct. The researcher calls for more development of the KAI for the purpose of studying undergraduate students. This development should include qualitative research to fully understand the relationship of variables in the undergraduate classroom.

Another limitation of this study was low participant response in some classes. Non-response error limited the findings of this study as not every student in these classes completed all four instruments. Although 72% of all participants responded overall, there was no way to determine the reasons for non-response. For example, students may not have responded because of higher stress levels provoked by the faculty member teaching the course. Particularly, non-response error may be higher in Class E given that only 46% of the students responded. Furthermore, considering the mortality rate of the KAI only 30% of the Class E population was examined in this study. There was no data collected concerning non-responders; thus non-response error in Class E was a limitation to this study.

Whittington (1998) found that faculty members in a college of agriculture predominately teach at lower level thinking skills. The researcher took great effort in selecting courses that required the use of problem solving assignments which encompassed higher level thinking skills. However, this study found that 60.7% (n=432) had no assignments assigned during a typical week that had taken more than one hour to complete. This finding indicated that problem solving assignments did exist in these courses, but not to the extent anticipated by the researcher. If problem solving assignments that utilize higher level thinking skills are rare in college of agriculture undergraduate courses (Whittington) there may be limitations to Kirton's A-I theory in these classrooms. That is, if problem solving learning (Gagne, 1965) was not present in the classroom, differences in problem solving style may not be a salient cognitive difference between faculty member and student. This may explain why some classes did not find cognitive style gap to be a factor of stress, motivation and engagement.

Another limitation may be that participants were from larger class sizes. Class size may be a variable to consider in the application of A-I theory to the undergraduate classroom as smaller classes tend to increase student engagement with the faculty member (McKeachie, Chism, Menges, Svinicke & Weinstein, 1994) and A-I theory requires the interaction between student and faculty member in the problem solving process (Kirton, 2003). Simply said, there may not have been enough interaction between faculty members and students in some of these classes for the realization of cognitive style gap.

The student participants examined in this study were representative of college students in the College of Agricultural and Life Sciences at the University of Florida, however these college students may not be typical of the general population identified by Kirton (2003). The University of Florida has high admission standards that not all students are able to meet. The cognitive level (intelligence) of these students are higher, allowing them to learn how to cope (operate in another cognitive style) as the situation requires. It is possible that these students were able to recognize the faculty member's expectations and meet those expectations with ease, more so than other individuals. Said differently, student engagement in these classes could be better explained by cognitive level instead of cognitive style (Kirton, 2003).

Instrument measurement error may have also contributed to the limitations of this study. In data analysis, only total scores of stress, motivation and engagement were used, each with acceptable post-hoc reliability (Schmitt, 1996). However, the measure of stress used in this study could be questioned. This study used a perceived stress instrument which was limited in ability to measure stress specifically to academics. Measures of perceived stress have been found to inadvertently measure chronic stress, or other sources of stress (Cohen, Kamarck & Mermelsein, 1983). The researcher recommends that more research be conducted to accurately measure undergraduate academic stress.

To close, learning style theories can be traced to the observational work conducted by Jung (1960) who recognized individual difference in learning. To this day, most psychologists agree that individuals each have a preferred style of learning. However, in the field of learning styles, there are an abundance of instruments with many questions of validity and reliability (Coffield et al., 2004). The next line of research to study learning styles should use qualitative methods to bring greater understanding to how dissimilar cognitive styles interact in the context of learning. This research has potential to provide practitioners with sound instructional practices that foster student engagement and provide opportunities for all students to learn.

Recommendations

The following recommendations were made based on the conclusions of this study which examined nine intact classes.

- Caution should be used in applying conclusions and recommendations beyond the populations of this study as classes were not chosen randomly.

- Greater understanding is needed to why these students have more stress in adaptive courses. Examination of how adaptive faculty members use instructional discourse may facilitate this research. Also, examining how students learn from adaptive faculty members versus innovative faculty members may show promise.

- Research indicating a relationship between adaptive faculty members and higher levels of student stress were limited to intact groups; both in this study and previous studies. More research is needed to confirm this relationship.

- Based on the findings of this study, adaptive faculty members in colleges of agriculture should be made aware that their cognitive style may incite higher stress levels in their undergraduate students and should be provided in-service to learn coping behaviors that allow the faculty member to operate in a more innovative behavior.

- High adaptive and high innovative faculty members should be made aware that their cognitive style naturally gives rise to large cognitive style gaps with students. These large cognitive style gaps may be detrimental to student motivation. In-service should be provided to instruct faculty members the proper coping behaviors to operate at cognitive styles closer to that of students.

- Much has been accomplished to create more student centered classrooms. However, students in these nine agricultural classes were still comparably low in levels of student engagement. Recognizing the need to facilitate higher order thinking skills and problem solving instructional methods in the undergraduate classroom, more in-service is needed to help faculty members become proficient in facilitating higher level thinking.

- More research is needed to determine how adaptive and innovative faculty members in the college of agriculture use instructional discourse differently to facilitate higher levels of student engagement. This may provide greater understanding to improving student engagement.

- In this study (n=511), student participants with a cognitive style gap higher than 20 points did not have higher levels of stress than students with less than a 20 point gap with their respective faculty member. Future research should examine if student populations with lower levels of student intelligence have the same finding.

- More research is needed to determine if students with a cognitive style gap larger than 20 points contributes to student stress in different academic atmospheres in which students and faculty members work together in solving problems and in shorter time periods. Examples of these situations include smaller class sizes, independent studies, service learning, undergraduate research programs and three hour courses offered in interim semesters.

- This study found that these students on average had lower motivation scores in courses taught by adaptive faculty members and when cognitive style gap was higher than 20 points with the instructing faculty member. There was also an interaction effect between the two variables upon examining these nine courses. Further research is warranted to understand the relationship of student coping behavior and student motivation. Emphasis should be placed on Kirton's efficiency construct.

- Based on these findings, faculty members should be in-serviced with instructional techniques that help students increase motivation despite the faculty member's cognitive style.

- More research is needed to first identify perceived cognitive style climate of a course and second determine how cognitive style climate influences student stress, motivation and engagement.

- Based on this study, educational practitioners should be made aware that having a dissimilar cognitive style greater than 20 points does not affect student engagement.

- More research is needed to fully examine the relationship between cognitive style gap and student motivation and how student coping behavior may be fostered.

- Further research is necessary to determine if dissimilar cognitive styles contribute to explaining student engagement. Given the rising attention given to increasing student engagement in undergraduate classrooms, this question deserves to be answered.

- The researcher calls for qualitative research to identify cognitive style components within a faculty member's instructional discourse and how a cognitive style gap affects student engagement.

- Qualitative research is needed to fully understand the relationships between variables that may inhibit or facilitate student engagement with regard to adaption-innovation theory.

- The mortality of the KAI was high when administered to undergraduate students and must be addressed to facilitate the measurement of problem solving cognitive style to better study adaption-innovation theory in the context of learning and improving student engagement.

Summary

Chapter 5 summarizes the entire study. More details concerning the problem statement, limitations, assumptions, significance of the study and definitions can be found in chapter 1. Chapter 2 presents theoretical and empirical literature pertinent to the study. The methodology including details of the instrumentation, population, and data collection procedures can be found in chapter 3. Data from each class were fully presented and organized by objective in chapter 4. This chapter closes with discussion of findings from the data and provides implications and recommendations.

APPENDIX A
INTERNAL REVIEW BOARD SUBMISSION FORM

UFIRB #2006-U-78

1. TITLE OF PROTOCOL:
Effects of Cognitive Style on Undergraduate Student Engagement, Stress, and Motivation.

2. PRINCIPAL INVESTIGATOR(s):
Curt Friedel
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3. SUPERVISOR (IF PI IS STUDENT):
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Ph: 352-392-0502 x230,
rrudd@ufl.edu,
Fax: 352-392-9585

4. DATES OF PROPOSED PROTOCOL:
From February 1, 2006 To July 30, 2006

5. SOURCE OF FUNDING FOR THE PROTOCOL:
No outside funding will be used for this research. All funding is internal from the Department of Agricultural Education and Communication.

6. SCIENTIFIC PURPOSE OF THE INVESTIGATION:
To determine the effects of dissimilar cognitive styles on student engagement, motivation, and stress of undergraduate students enrolled at the University of Florida in respect to demographic information.

7. DESCRIBE THE RESEARCH METHODOLOGY IN NON-TECHNICAL LANGUAGE.

Faculty in the College of Agriculture and Life Sciences at the University of Florida will be administered the Kirton Adaption-Innovation Inventory (KAI) (measure of cognitive style). Faculty members will be determined as a participant based on their KAI score. Once a sample of faculty members is determined, students in the faculty members' respected courses will be recruited as participants for this study.

Students at the University of Florida will be administered the Kirton Adaption-Innovation Inventory (KAI) (measure of cognitive style), National Survey of Student Engagement (NSSE) (measure of student engagement), Motivated Strategies for Learning Questionnaire (MSLQ) (measure of motivation and use of learning strategies), and Student-Life Stress Inventory (SSI) (measure of stress). The instruments will be packaged together prior to the study to maintain anonymity and confidentiality of the responses while still allowing to look for relationships between specific student responses between instruments. All instruments are attached.

8. POTENTIAL BENEFITS AND ANTICIPATED RISK.

There are no direct benefits to the participants themselves. There may be benefits for developing future curriculum and courses to promote the recognition and use of cognitive style effects in the classroom. There are no known risks associated with this study.

9. DESCRIBE HOW PARTICIPANT(S) WILL BE RECRUITED, THE NUMBER AND AGE OF THE PARTICIPANTS, AND PROPOSED COMPENSATION (if any):

Faculty members will be recruited as instructors based on their KAI scores. A maximum of 20 faculty members will be recruited and all participation will be voluntary. Age of faculty participants is 30 to 65 years of age. No compensation will be provided to faculty members.

Students will be recruited from faculty members' respective classes at the College of Agriculture and Life Sciences at the University of Florida. A maximum of 900 students will be recruited and all participation will be voluntary. Age of student participants is 18 years to 60 years of age, with the majority of students from 18 to 22 years of age. No compensation will be provided to students. However, some students may or may not receive extra credit points for participation in this study. The allocation and amount of extra credit points will be determined by the course instructor.

10. DESCRIBE THE INFORMED CONSENT PROCESS. INCLUDE A COPY OF THE INFORMED CONSENT DOCUMENT (if applicable).

Please use attachments sparingly.

See attached form.

____

Principal Investigator's Signature

____

Supervisor's Signature

I approve this protocol for submission to the UFIRB:

________________________ __________

Dept. Chair/Center Director Date

APPENDIX B
FACULTY INFORMED CONSENT

UFIRB #2006-U-78

Informed Consent (Faculty)

Protocol Title: Effects of Cognitive Style on Undergraduate Student Engagement, Stress and Motivation

Purpose of the research study: To determine the effects of dissimilar cognitive styles on student engagement, motivation, and stress of undergraduate students enrolled at the University of Florida in respect to demographic information.

What will you be asked to do in the study: Please complete the Kirton Adaption-Innovation Inventory (KAI).

Time required: Approximately 15 minutes.

Risks: There are no known risks associated with this study.

Benefits/Compensation: There is no compensation, monetary or otherwise, for participation in this study. There are no direct benefits for participating in this study.

Confidentiality: Your identity will be kept confidential to the extent provided by the law. Your responses to the instruments will be anonymous.

Voluntary participation: Your participation is completely voluntary. There is no penalty for not participating. You can stop at any time without penalty and you do not have to answer any question you do not want to answer.

Whom to contact if you have questions about the study:
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PO Box 110540
310 Rolfs Hall,
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Fax: 352-392-9585
rrudd@ufl.edu

Whom to contact about your rights in the study:
UF IRB Office
PO Box 112250
University of Florida
Gainesville, FL 32611-2250
Phone: 352-392-0433

Agreement:
I have read the procedure described above. I voluntarily agree to participate in the procedure and have received a copy of this description.

Participant: ______________________________ Date: ___________

Principal Investigator: _______________________ Date: ___________

APPENDIX C
STUDENT INFORMED CONSENT

UFIRB #2006-U-78

Informed Consent (Student)

Protocol Title: Effects of Cognitive Style on Undergraduate Student Engagement, Stress and Motivation

Purpose of the research study: To determine the effects of dissimilar cognitive styles on student engagement, motivation, and stress of undergraduate students enrolled at the University of Florida in respect to demographic information.

What will you be asked to do in the study: Please complete the Kirton Adaption-Innovation Inventory (KAI), National Survey of Student Engagement (NSSE), Motivated Strategies for Learning Questionnaire (MSLQ), and Student-Life Stress Inventory (SSI).

Time required: Approximately 45 minutes.

Risks: There are no known risks associated with this study.

Benefits/Compensation: You may or may not receive compensation in the form of extra credit points in this course for participating in this study. The allocation and amount of extra credit points will be determined by the course instructor. Other than allocation of extra credit points, there is no compensation, monetary or otherwise for participation in this study. There are no direct benefits for participating in this study.

Confidentiality: Your identity will be kept confidential to the extent provided by the law. Your responses to the instruments will be anonymous.

Voluntary participation: Your participation is completely voluntary. There is no penalty for not participating. You can stop at any time without penalty and you do not have to answer any question you do not want to answer.

Whom to contact if you have questions about the study:
Curt Friedel
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Whom to contact about your rights in the study:
UF IRB Office
PO Box 112250
University of Florida
Gainesville, FL 32611-2250
Phone: 352-392-0433

Agreement:
I have read the procedure described above. I voluntarily agree to participate in the procedure and have received a copy of this description.

Participant: ___________________________________ Date: _____________

Principal Investigator: ___________________________ Date: _____________

APPENDIX D
EXAMPLE ITEMS OF KIRTON'S ADAPTION-INNOVATION INVENTORY

Directions: Mark an "X" to signify how easy or difficult do you find it to present yourself, consistently, over a long period as:

	Easy	Hard
1. A person who likes to solve problems inductively	....	
2. A person who likes to solve problems deductively	....	

 For information regarding the KAI, please contact:

KAI Distribution Centre
55 Heronsgate Rd
Chorleywood
Hertfordshire WD3 5BA
UK

Telephone: 01923 286999 (From USA: 01144-192-328-6999)
Fax: 0870 0527901 (From USA: 01144-870-052-7901)
E-mail: dist@kaicentre.com

APPENDIX E
EXAMPLE ITEMS OF STUDENT-LIFE STRESS INVENTORY

Directions: Respond to each statement using this 5-point scale which indicates the level of your experiences *in this course.*

1 = Never, 2 = Seldom, 3 = Occasionally, 4 = Often, 5 = Most of the time.

	N	S	Oc	Of	M
As a student in this course:					
1. I have experienced stress in reaching my goal.	1	2	3	4	5
2. I have found that problems in setting goals.	1	2	3	4	5
3. I have been deficient in resources	1	2	3	4	5

 For information regarding the SSI, please contact:

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APPENDIX F
EXAMPLE ITEMS OF MOTIVATED STRATEGIES FOR LEARNING QUESTIONNAIRE

<u>Directions:</u> In answering the following questions, think about your motivation for this course you are currently taking. Using the scale below, please answer the following questions. Please remember to answer accurately as there are no wrong or right answers.

1. In a class like this, I prefer challenging coursework.

Not at all true of me	☐	☐	☐	☐	☐	☐	☐	**Very true of me**
	1	**2**	**3**	**4**	**5**	**6**	**7**	

2. Studying aptly will help me succeed in learning course material.

Not at all true of me	☐	☐	☐	☐	☐	☐	☐	**Very true of me**
	1	**2**	**3**	**4**	**5**	**6**	**7**	

3. When taking an exam, I worry about doing poorly.

Not at all true of me	☐	☐	☐	☐	☐	☐	☐	**Very true of me**
	1	**2**	**3**	**4**	**5**	**6**	**7**	

 For information regarding the MSLQ, please contact:

Marie Bien
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610 E. University Ave.; Room 1323
Ann Arbor, MI 48109-1259

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APPENDIX G
EXAMPLE ITEMS OF NATIONAL SURVEY OF STUDENT ENGAGEMENT

<u>Directions:</u> In your experience in this course, how often have you done each of the following? Mark your answers in the boxes below.

Part 1		**Very often** ∇	**Often** ∇	**Some-times** ∇	**Never** ∇
a.	Participated by asking questions	☐	☐	☐	☐
b.	Worked with other students in class	☐	☐	☐	☐
c.	Discussed assignment grades with teacher or other students	☐	☐	☐	☐

National Survey of Student Engagement
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BIOGRAPHICAL SKETCH

Curtis Friedel was born in Norfolk, Nebraska, in April of 1976. He grew up on the family farm located south of Stuart, Nebraska. Curtis graduated from Atkinson West Holt High School in May of 1995.

Curtis attended Northwest Missouri State University in Maryville, Missouri, to obtain a Bachelor of Science in agricultural education. He fulfilled his student teaching requirements at Randolph Public Schools in Randolph, Nebraska, under the direction of Dennis Bazata and Dr. Marvin Hoskey. He completed his degree in May of 1999 with the honor of cum laude.

After the completion of his B.S. degree, Curtis accepted a position as an agricultural instructor at Laurel-Concord Public Schools in Laurel, Nebraska. There he started an agricultural education program after a sixty year absence of high school agricultural instruction of any form. After four years, the program had won national awards, but more importantly had created opportunities for high school students to become successful.

In June, 2003, Curtis accepted a graduate student assistantship in the Department of Agricultural Education and Communication at the University of Florida to obtain a Doctor of Philosophy degree. The degree includes specializations in teaching and learning, leadership and volunteer development, and a minor in food and resource economics. His work at the University of Florida included serving as a co-instructor of undergraduate and graduate courses, as well as conducting research in creative and critical thinking.

Curtis is married to Elisabeth Friedel. He remains active in community and church and many professional organizations.