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A Comparison of Chiropractic Students' Learning Styles Based on Admission Status

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Abstract

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Scott F. Donaldson

DC, Los Angeles College of Chiropractic, 1990

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Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Due to recent regulation, Chiropractic Colleges admit students with less than standard science courses and less than standard GPA. These students require tracking and support. How these students learn compared to standard admissions students is not understood. Researchers have demonstrated that students' learning approaches, strategies, and preferences vary based on educational background and culture and are related to performance. The purpose of this study was to better understand chiropractic students learning styles based on admissions status informing supportive efforts. The theoretical framework was based on Curry's work describing elements of learning on a spectrum from stable to flexible. In this cross-sectional quantative study, data were collected using 3 validated instruments (Approaches and Study Skills Inventory for Students (ASSIST), Learning and Study Strategies Inventory (LASSI), and the Visual, Aural, Read/Write, and Kinesthetic (VARK) questionaire). The sample included all incoming students over 4 consecutive terms;195 entrants with 165 participants. Consistent with prior studies, analysis utilizing Pearson chi-square test of independence, revealed students with less science tend toward some surface learning approaches including: a significant difference in ASSIST subscale unrelated memorizing *(p* =.023) and a difference approaching significance for subscale syllabus boundness (*p* = .058). For students with a lower GPA, report frequencies of significance or approaching significance as a relative strength include: LASSI scale self-regulation (*p* =.029), and subscales concentration (*p* =.023) and use of study aids (*p* =.051). Admitting students from varying educational backgrounds, enables chiropractic colleges to include more underrepresented students. This study provided needed information to support these students.

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Section 1: The Problem

Chiropractic education is changing in the United States over the last few years. In 2013, the Council on Chiropractic Education (CCE) introduced new standards which included admissions standards. For the first time, the admissions standards included options to admit students with less than the traditionally required science background recognizing that there may be students with a variety of backgrounds sufficiently prepared to become a chiropractor and make a difference in practice. With the introduction of new admissions standards comes the responsibility of the institutions to support these students and together work toward their success (CCE, 2015, p. 16).

However, the institution is now admitting students with less than the standard required science courses and less than the standard GPA. These students require additional support toward their success. How these students learn compared to those that meet standard admissions requirements is not understood. In this study I reviewed the differences in the ways that these students learn compared to the traditional or standard admission students. To provide adequate academic and other supportive systems, institutions must understand the differences in these students especially as it relates to their learning styles including approaches, strategies, and preferences. In this section the problem is defined and literature reviewed relative to the problem providing justification for the study and considering the implications and significance especially to chiropractic education and educators.

Definition of the Problem

The problem addressed by this project was that the institution is now admitting students with less than the standard required science courses and less than the standard GPA. Research was needed to determine how best to support these students. These students require additional support toward their success, but how these students learn compared to those that meet standard admissions requirements is not understood.

In January 2013, the CCE altered the admissions standards of entering students such that the current educational background of incoming students is greatly varied. Standard admission requires a science based background, completion of at least 90 semester units, and at least a 3.0 GPA (CCE, 2013, p. 20). As of January 2013, students can also be admitted on an alternative admissions track plan (AATP) with at least 90 units at the undergraduate level (but no bachelor's degree), a GPA of 2.75, and no science background (CCE, 2015, p. 16). These students require additional tracking and transitional and academic support programs to optimize their ability to succeed in the program (CCE, 2015, p. 16). Specifics regarding how to support the AATP students are left to the colleges.

The addition of AATP students over the last 5 years has likely broadened the range of learning styles (including approaches, strategies, and preferences) that exist in the current student body at the institution. Since the introduction of AATP students to the student body, college faculty have reported a change in the classroom environment, but have not been able to distinguish what is different (Faculty Senate, personal

communication, Spring 2014). Some speculate that the AATP students are not prepared for the rigors of the chiropractic curriculum. The college has data; however, that indicate no statistical difference in the GPA or academic pace of AATP students and students with standard admission (Department Chairs, personal communications, April 14, 2015 and July 14, 2015). However, data from the Institutional Research Office indicate that the AATP students are not performing the same as the standard admission cohorts on National Board of Chiropractic Examiners (NBCE) examinations. First time pass rates are calculated and compared based on standard admission, AATP-Science (those entering with less than minimal science requirements) and AATP-GPA (those entering with less than the standard 3.0 GPA). As of the Fall 2015, administration of the NBCE examinations, for students entering in the 2012-13 academic year, Part 1 NBCE pass rates were as follows: standard (*N* = 56) 82.1%, AATP-Science (*N* = 18) 88.9%, and AATP-GPA (*N* = 6) 50% (Director of Institutional Research, personal communication, February 2016). For the students entering in the 2013-14 academic year, Part 1 NBCE pass rates were as follows: standard (*N* = 93) 87.1%, AATP-Science (*N* = 18) 88.9%, and AATP-GPA (*N* = 18) 66.7% (Director of Institutional Research, personal communication, February 2016). The Part 1 NBCE test is reflective of the basic science curriculum at all chiropractic colleges. As of the Fall 2015, administration of the NBCE examinations for students entering 2012-13 academic year, Part 2 results are as follows: standard (*N* = 24) 79.2%, AATP-Science (*N* = 6) 66.7%, and AATP-GPA (*N* = 2) 100% (Director of Institutional Research, personal communication, February 2016). The

NBCE Part 2 examination is about chiropractic diagnosis, critical and clinical thinking, and decision making. As of the Spring 2016, administration of the NBCE exams for the 2012-13 cohort, an additional 17 students of the 56 standard admissions students who had made it through Part 1 of the exams qualified for and took Part 2 for a total of 41 standard admissions students with a pass rate of 70.7% (Director of Institutional Research, personal communication, June 2016). Seventy three percent of the original cohort of standard admissions students has made it to this benchmark. For the 2012-13 AATP-science, one additional student qualified for the Part 2 examination and passed the exam during the Spring 2016 administration (Director of Institutional Research, personal communication, June 2016). No additional AATP-GPA students qualified for the Part 2 exam by the Spring 2016 administration (Director of Institutional Research, personal communication, June 2016). In total, only nine of 24 AATP students admitted during 2012-13 who met the NBCE Part 1 benchmark have qualified for and taken Part 2 of the examination by Spring 2016. Only 37.5% of AATP students had progressed to this point compared to 73% of the standard admissions students from the same admissions cycle. Additionally, 2017 data from the IR department shows a general downward trend for pass rates in both the spring and fall NBCE Part 2 scores. AATP students still struggle in this area compared to standard admission students, but all are generally declining (Director of Institutional Research, personal communication, February 2018).

While the sample sizes are small, it is significant that those entering with a lower GPA are struggling on NBCE assessments. Also significant is the fact that the AATP-

Science students perform as well or slightly better on the science based examination, but struggle with the Part 2 assessment. These are comprehensive assessments that require different skills and deep learning and retention. Also significant is that only 37.5% of the AATP students that made it to the Part 1 examination benchmark made it to the Part 2 examination benchmark. Meanwhile 73% of the standard admissions cohort qualified for and made it to this benchmark. The qualifications include progression through the curriculum completing specific courses that are required for these tests. It seems apparent that the AATP-science students move through the basic science curriculum and the basic science benchmark NBCE exam as easily as their standard admissions counterparts. It is also apparent that they are having difficulty progressing through the clinical science curriculum to qualify for and pass the NBCE Part 2 examination.

One of the primary outcomes of prior study relating to learning styles has been that it informs institutions and their faculty regarding the use of multiple pedagogies, curriculum development, and student advising and supportive activities (Breckler, Joun, & Ngo, 2009, p. 35; Flowers, Bridges & Moore III, 2012, p. 147; Loewen & Jelescu-Bodos, 2013, p. 1; Lujan & DiCarlo, 2006, p. 15; Mitchell, James, & D'Amore, 2015, p. 166; Urval et al., 2014, pp. 219-220). Hawk and Shah (2007) stated that most faculty employ a teaching style based on their own learning preference and the way that they were instructed (p. 1). They also reported that many faculty members are unfamiliar with learning styles, their potential impact on student learning, and may be uncomfortable changing as it takes them out of their comfort zone (Hawk & Shah, 2007, p. 1).

Researchers have shown that understanding learning styles are related to outcomes in chiropractic students, including NBCE results, and other health science students (May, Chung, Elliott, & Fisher, 2012, pp. 239-240; Schutz, Gallagher, & Tepe, 2011, p. 9). It is important to recognize that students' differing backgrounds affect how they learn, that learning style should inform pedagogy, and that learning style has been connected with how well health science students relate material to patient care interventions (James, D'Amore, & Thomas, 2011, p. 417; Urval et al., 2014, p. 220; Wagner, 2014, p.350). Andreou, Papstavrou, and Merkouris (2014) conducted a review of nursing literature and determined that there is a link in learning styles and critical thinking skills (p. 369). It is important that this current generation of chiropractic learners and their potential differences based on admissions status and prechiropractic educational background is better understood in terms of learning styles (Breckler et al., 2009, p. 36; D'Amore, James, & Mitchell, 2012, p. 506; Meehan-Andrews, 2009, p. 31; Prajapati, Cunne, Bartlett, & Cubbidge, 2011, p. 69; Williams, Brown, & Etherington, 2013, p 116). Understanding AATP chiropractic students in terms of learning styles informs the institution and faculty such that the required and much needed support systems can be developed and implemented.

Rationale

Evidence of the Problem at the Local Level

College faculty have reported a change in the classroom environment and some have reported challenges helping students understand since the introduction of the AATP

students (Department Chairs, personal communications, Spring and Summer 2015). The programmatic accreditor requires that the college provide transitional and academic support for the AATP students, but does not provide guidelines for doing so (CCE, 2015, p. 16). Breckler et al. (2009) found that prehealth science students exhibited more multi-modal preferences than other nonscience majors (p.30). Tarabashkina and Lietz (2011) followed 114 students through their undergraduate experience and found students in their last year enrolled in the natural sciences employed more deep learning approaches than their counterparts enrolled in the social sciences (p. 228). Some researchers have indicated that the educational process or the curriculum in which a student is enrolled can have an effect on the learning preference (Gurpinar, Bati, & Tetik , 2011, p. 310; Mitchell et al., 2015, p.164 – 165).

There is a lack of understanding regarding the differences in learning styles of generally admitted students and AATP students at the institution. There is a lack of understanding among college faculty regarding the relationship of learning styles and pedagogy. Faculty members are too dependent on traditional lecture pedagogy and assume success is indicated by course grades (Department Chairs, personal communications, Spring and Summer 2015). AATP advisors and mentors rely only on their own experience with traditional chiropractic students and so there is a lack of understanding in how to provide the best supportive structures including materials, advising, scheduling and study skills to current AATP students. Current data on AATP students demonstrate that they do not perform the same as their standard admission

counterparts in NBCE assessments. To create appropriate supportive structures and advise students properly, learning styles research is indicated (Halbert, Kriebel, Cuxxolino, Coughlin & Fresa-Dillon, 2011, p. 332; Loewen & Jelescu-Bodos, 2013, p. 1; Marek, 2013, p. 48; Ocepek, Bosnic, Serbec, & Rugelj, 2013, p. 353)

Evidence of the Problem from the Professional Literature

From a survey of the limited chiropractic educational literature, one study demonstrates that chiropractic student learning preferences may differ from other health sciences. The authors recognized that the study was done in Australia where chiropractic education is only conducted at the undergraduate level, unlike the United States where all programs are doctorate professional practice level education (Whillier et al., 2014, p.26). There appear to be no other studies to demonstrate whether chiropractic students are similar or different to other health science students regarding learning styles. All U.S. chiropractic colleges are under the same mandate to provide support for AATP students.

Studies from other health and prehealth science fields demonstrate the need to understand the learning styles of students and also demonstrate that the students' background can affect the learning style of the students. Breckler, Joun, and Ngo (2009) found that prehealth science students exhibited more multimodal preferences than other nonscience majors (p.30). Some studies indicate that the educational process or the curriculum in which a student is enrolled can have an effect on the learning preference (Gurpinar, Bati, and Tetik , 2011, p. 310; Mitchell, James and D'Amore, 2015, pp.164 – 165) and another indicated that educational background affects learning approaches

(Tarabashkina and Leitz, 2011, p. 228). James D'Amore and Thomas (2011) concluded that it was the recent increased diversity in nursing students that accounted for a change in the learning preferences seeing a greater percentage of students that preferred visual learning (p. 417). The next year, the same authors again recognize increasing diversity in nursing as a factor in teaching and learning (D'Amore et al., 2012, p. 506). Prajapati, Cunne, Bartlett and Cubbidge (2011) in studying 270 optometry students, acknowledged the range of educational background from no undergraduate degree, to bachelor's degrees and both international and domestic students affecting the range of learning styles with those holding a bachelor's degree outperforming all others (p. 76). Other researchers have suggested that cultural background may have affected a difference from other similar institutions showing prevalence toward aural learning in a group of medical students in Karnataka, India (Urval et al., 2014, p. 217). Dunn, Honigsfeld, and Doolean (2009) as cited in Marek (2013) stated that the study techniques applied by students in non-science courses can be ineffective when applied to the science curriculum (p. 43).

As most studies recognize the importance of studying learning styles related to its impact on pedagogy, it is important to consider what the effect may be when considering such a study. Meehan-Andrews (2009) demonstrated that while most students in the health sciences prefer either kinesthetic or visual learning and most are multi-modal, traditional pedagogy focuses on lecture based presentations (p. 31). The authors concluded that the nursing students in the study were more satisfied and had better academic outcomes when lecture courses also included practical experiences (Meehan-

Andrews, 2009, p. 31). Basing learning activities on a high preference for kinesthetic learning, Wagner (2014) demonstrated that aligning the teaching method with the learning style does improve test scores and the ability of the student to link the course material to both clinical and critical thinking skills during clinical experiences (pp. 350-351). Marek (2013) found that when faculty members are informed by learning styles, they can provide mentoring and advisement that better assists the student with their study skills and learning outcomes (p. 48). Results of these studies demonstrate that understanding student learning styles can influence pedagogy and mentoring and supportive structure that improves learning outcomes and student satisfaction.

The purpose of this project study was to understand the learning styles (approaches, strategies and preferences) of chiropractic college students at one United States institution and to understand the differences that exist in the learning styles of the range of students including AATP students now admitted to the program. The data from this study was used to create recommendations informing the practices of faculty, academic counselors, and the institution in their supportive efforts relative to the AATP students.

Definitions

Alternative admissions track plan (AATP): Doctor of Chiropractic programs who accept students who lack the minimum admissions criteria as noted in Section 2.G of the CCE standards, develop an AATP that addresses, alternative criteria, but not less than 90 semester units, and not less than 2.75/4.0 cumulative GPA, Transitional and academic

support programs, process for acceptance of AATP students, and term-by-term tracking to assess performance (CCE, 2015, p. 16).

Matching is the practice of assessing the learning style of the student and then matching the teaching modality or instructional strategy (Bostrom & Hallin, 2013, p. 22).

Minimum admissions standards for Doctor of Chiropractic programs (DCP): Completion of at least 90 semester units at an institution accredited by an agency recognized by the United States Department of Education (USDE) or foreign equivalent, GPA of at least 3.0/4.0, and at least 24 semester hours in life or physical science courses half of which must include a lab (CCE, 2013, p. 20).

Learning approach: Learning approaches have been described initially by Marton and Saljo (1976) and later developed by Entwistle and Ramsden (1983) and categorized as deep, surface, and strategic (May et al., 2012, p. 236; Richardson, 2010, p. 288). A deep approach to learning has been described as a personal interest in learning and understanding, attempts through critical thinking, and relating learning to prior knowledge or experience (Abedin et al., 2013, p. 550; Byrne, Flood, & Willis, 2004, p. 450). A surface approach to learning focuses on memorization of facts and fails to personally interact with the material (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450). The strategic approach includes intentional focus on learning and activities with an aim on achieving marks as high as possible and doing whatever it takes to get maximal results (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450).

Learning strategy: Citing Weinstein, Husman, and Dierking (2000) Cano (2006) described learning strategy in functional terms as "any thoughts, behaviors, beliefs or emotions that facilitate the acquisition, understanding or later transfer of new knowledge and skills" (p. 1023). Flowers et al., (2012) described learning strategies as skills (p. 147). The skills described are also functional (Flowers et al., 2012, p. 147; West, & Sadoski, 2011, p. 697).

Learning preferences: Learning preferences are described as sensory input or the way that a student prefers to receive information (Whillier et al. 2014, p. 21; Mitchell et al., 2015, pp. 159-160; Samarakoon, Fernando, Rodrigo, & Rajapakse, 2013, p. 2; Urval et al., 2014, p. 216). Whillier et al. (2014) described learning preference not only as input, but also as information processing preferences (p. 21). According to Mitchell et al. (2015), this element is the least stable or the most susceptible to change based on experiences including learning experience (p. 21).

Significance

This study has built on past research in other health science education fields, but not yet considered for chiropractic education. Chiropractic educational institutions in the United States are now admitting students without the strict science background that has been historically required (CCE, 2015, p. 16). The college has collected data over 2 years that shows no significant difference in academic outcomes and markers such as GPA (Life Chiropractic College West, 2015). However, analysis of NBCE results show that when AATP student results are segregated into the two subcategories of AATP, that

the students admitted with a lower GPA struggle significantly compared to all others on Part 1 NBCE assessments and students admitted with less than the standard science requirements are struggling with the Part 2 NBCE assessment (Director of Institutional Research, personal communication, February 2016). Historically, students that succeed on Part 1 will also succeed on Part 2, and so forth.

There is a gap in the knowledge about how these students, who have been admitted with a broader disciplinary background, experience learning. Breckler et al., (2009) suggests that students with a science background and other non-science backgrounds have different learning preferences. Tarabashkina (2011) studied 114 students through their undergraduate experience and found that in the final year, students of the natural sciences showed a significantly higher level of deep approaches to learning compared to their peers in the social sciences (p. 228). Manolis, Burns, Assudani, and Chinta (2013) studied 253 undergraduate students and found that their learning preferences can change through their educational experience (p. 50). It has been suggested that educational background and demographics influence learning (Gurpinar et al, 2011, p. 310; James et al, 2011, p. 420; Mitchell et al, 2015, p.164 – 165), and perhaps there may be cultural influences as well (Asiabar et al., 2015, p. 5; Boland, Sugahara, Opdecam and Everaert, 2011, p. 258; Urval et al., 2014, p. 217). Hill, Tomkinson, Hiley, and Dobson (2014) studied 757 students enrolled in either engineering or social science undergraduate programs and found that the engineering students showed a strong preference for logical styles while the social studies students preferred a social

environment (p. 11). These same authors also compared students from the United Kingdom and Malaysia and found that the students from the United Kingdom preferred social environments while the Malaysian students were more solitary (Hill et al., 2014, p. 11).

Not only is there a gap in the knowledge in general about the learning styles of chiropractic students, but there is a gap in the knowledge as it pertains to the learning styles of students admitted traditionally and under AATP. This gap in knowledge translates to a gap in practice with regard to providing appropriate transitional and academic support for the AATP students. Without this new knowledge, chiropractic colleges can do no better than to guess when creating supportive systems. Also, understanding the learning styles of chiropractic students will inform chiropractic faculty regarding the need to move to a more learner-centered environment and consider improving and developing learning methods and pedagogies. Findings of this study have the potential to benefit both current and future students, especially as the population of chiropractic students continues to grow with regard to diversity. It is important to ensure that these students succeed and expand their influence as health care providers including underserved populations (Johnson et al., 2012, pp 3 & 9; Lacy, McCann, Miller, Solomon, & Reuben, 2012, p. 523; Komaromy et al., 1996, p. 1308). As all chiropractic colleges fall under that same mandate, the findings of this study will be of significance to chiropractic education nationally. The findings of this study should also be significant to the CCE (programmatic accreditor) as they consider current and future standards.

Guiding/Research Questions and Hypotheses

Research in many fields of health science education regarding the learning styles of students has been done or is underway. Chiropractic education has, however, not yet researched students sufficiently to understand the possible dominance of variability of learning styles. Additionally, since 2013, chiropractic educational institutions, per CCE regulation, have admitted students that do not meet the traditional standard requirements that include a prescribed science background. Understanding that there may be a difference in the learning styles of AATP students and under a regulatory requirement and an educational obligation to provide appropriate support to AATP students, it was important to study these students with regard to learning styles. This study was guided by the following research questions:

Research Question 1: How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA all differ with regard to learning approaches?

$H_0 1_a$: Students admitted as AATP for lack of science will demonstrate no differences in their learning approaches compared to students admitted per standard admissions.

$H_1 1_a$: Students admitted as AATP for lack of science will demonstrate differences in their learning approaches compared to students admitted per standard admissions.

$H_0 1_b$: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning approaches compared to students admitted per standard admissions.

$H_1 1_b$: Students admitted as AATP with a lower than standard GPA will demonstrate differences in their learning approaches compared to students admitted per standard admissions.

RQ2: How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA all differ with regard to learning strategies?

$H_0 2_a$: Students admitted as AATP for lack of science will demonstrate no differences in their learning strategies compared to students admitted per standard admissions.

$H_1 2_a$: Students admitted as AATP for lack of science will demonstrate differences in their learning strategies compared to students admitted per standard admissions.

$H_0 2_b$: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning strategies compared to students admitted per standard admissions.

$H_1 2_b$: Students admitted as AATP with a lower than standard GPA will demonstrate differences in their learning strategies compared to students admitted per standard admissions.

RQ3: How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA, all differ with regard to learning preferences?

$H_0 3_a$: Students admitted as AATP for lack of science will demonstrate no differences in their learning preferences compared to students admitted per standard admissions.

$H_1 3_a$: Students admitted as AATP for lack of science will demonstrate differences in their learning preferences compared to students admitted per standard admissions.

$H_0 3_b$: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning preferences compared to students admitted per standard admissions.

$H_1 3_b$: Students admitted as AATP with a lower than standard GPA will demonstrate differences in their learning preferences compared to students admitted per standard admissions.

Variables

The independent variables in this study are the admissions status of first year students at the institution. Specifically, standard admission, AATP for lack of science and AATP for lower than standard GPA. The dependent variables can be categorized by the outcomes of three learning styles assessments that measure, learning approaches, learning strategies and learning preferences. For each student in the study, there is one outcome per each of these categories or learning style or three measures associated with

each student. The independent variable is easily determined as admissions status is determined through the admissions process and a permanent record kept with the registrar's office. The dependent variables were measured via established instruments or surveys completed by each participant. The tools included the Approaches and Study Skills Inventory for Students (ASSIST), the Learning and Study Strategies Inventory (LASSI), and the VARK (Visual, Aural, Read/Write, and Kinesthetic) questionnaire. These tools are described below in detail in the Instrumentation and Material section.

Review of the Literature

Theoretical Foundation

Learning styles have been studied for many decades. The precise origins are difficult to determine. In 1937, Allport differentiated cognitive style, the typical way a person thinks and solves problems and learning style as more of the application of cognition in a learning environment (Cassidy, 2004, pp. 420-421). Cassidy also recognizes that research has been active for at least 5 decades and spans the fields of psychology, health sciences, management, industry, vocational training, and many levels of education (2004, p. 419). Hall, McLean, and Jensen (2012) recognized the later part of the last century as the time when learning and learning cultures began to shift from teacher centered to a more learner-centric paradigm (p. 179). The authors also suggest that during this time and since, there has been an increased awareness that no method is equally effective for all students (Hall et al., 2012, p. 179). The most thorough analyses of the theories and models in the learning styles field was conducted by Coffield,

Moseley, Hall, and Ecclestone published in 2004. At the time, the authors identified 71 models that were currently in use but categorized these into 13 models they felt were most influential at the time with the remaining models considered as adaptations of the 13 reviewed (Coffield et al. 2004, p. 1). The authors also considered the field to not be unified but divided into at least three areas including, theoretical, pedagogical and commercial (Coffield et al. 2004, p. 1).

Some authors place the framework for the work of learning styles as founded by the theory of Multiple Intelligences (MI) (James et al., 2011, p. 418). Others see the framework for studying learning styles as founded on the constructivist approaches (Bolliger & Supanakorn, 2011, p. 470; Ocepek, et al., 2013, p. 343). Describing his theory of Multiple Intelligences, Gardner proposed that species such as human beings, exhibit at least seven different forms of thinking and reasoning (Gardner & Hatch, 1989, p. 5). From the educational perspective, Gardner states that schools have relied on two forms of symbol use (or teaching and learning), linguistic symbolization and logical-mathematical symbolization (Gardner & Hatch, 1989, p 5). MI theory's principle value, according to the authors, is related to its potential contributions to education and educational reform (Gardner & Hatch, 1989, p. 6). Gardner & Hatch (1989) argue that intelligences are independent of each other, are distinct, and require assessment in order to be an advantage and to reliably identify strengths and weaknesses of the student (p. 6). Constructivist learning theory supports the idea that the student constructs knowledge through his or her interactions with the learning environment and does so in their own

way, meaning teachers cannot just transfer knowledge to students (Ocepek et al. 2013, p. 343).

Those studying learning styles and theories must also consider the competing ideas of learning styles as traits that are relatively fixed or as flexible and easily influenced by the environment. Gardner's MI theory and the constructionist perspective would both suggest that learning is more complex than simple. James, D'Amore, and Thomas (2011) citing Keefe (1979) and Smith (1982) suggest that learning styles are characteristic of and incorporate cognitive, affective, physiological and environmental factors (p. 417). Learning style has also been described as the gathering, processing, interacting with and interpreting of information or experiences (Abedin, Jaafar, Husain, & Abdullah, 2013, pp. 549-550; Samarakoon et al., 2013, p. 1; Whillier et al., 2014, p. 21). Recently, Mitchell, James and D'Amore (2015) cited Curry (1983) when they described learning styles as layers including cognitive personality, social interaction and instructional preference as the elements (p. 159). In 1987 Curry updated the model to include four layers including; cognitive personality, information processing, social interaction, and instructional preference (Cassidy, 2004, p. 422-423). Cognitive style is at the center and consider the most stable perhaps even personal trait with instructional preference as the outer most layer and most susceptible to influence by the environment (Cassidy, 2004, pp. 422-423; Coffield et al., 2004, p. 8; Mitchell et al., 2015, p. 159).

Vermunt (1998) described an alternative model in an attempt to differentiate learning processes (Coffield et al., 2004, p. 8; Richardson, 2015, p. 291). This model

considers mental learning models and learning orientations some of which are considered relatively stable and some of which are determined contextually (Coffield et al. 2004, p. 8). In their review of learning styles, Coffield et al. (2004) propose their own model known as families of learning including: constitutionally based cognitive structure, stable personality type, flexibly stable learning preferences, and learning approaches or orientations (Coffield et al. 2004, p. 9). Both Vermunt's model and the Coffield model also rely on a continuum of stable to flexible or influenced by environment (Coffield, 2004, pp. 8-10). All three of the models and theories have the concept of stable characteristics and characteristics that are subject to environmental influence in common. One recent study concluded that a student's conception of learning and themselves as a learner is somewhat stable, but learning approaches and strategies may change over time and with experience (Richardson, 2010, p. 288).

Both MI theory and constructivist theory recognize learning is complex and develops over time and with experience. Curry's model of an onion with layers that are more stable on the inside and more flexible or influenced on the outside provides a simple representation of the complex individual. Curry's model also demonstrates the need to examine multiple elements to better understand how different individuals learn and perhaps why with different experiences and cultural influences, learning styles may differ. Therefore, in this study it was important to examine multiple elements of learning style in the three populations in question.

Review of Current Literature on the Problem

In addition to reviewing topics related to theories and origins, this literature review focuses on three elements of learning style, specifically, learning approaches, learning strategies, and learning preferences. Also reviewed were learning styles research in the health sciences and literature that considers differences in learning styles based on educational background or experience and cultural background. During the literature review, it was discovered that there is some controversy around the use of learning styles data relative to academic achievement, so additional review was conducted seeking articles that may bring understanding to any controversy in this area. Some of the terms associated with the search include: learning, learning styles, learning approach, learning strategy, learning preference, chiropractic, nursing, dentistry, optometry, medicine, osteopathy, health science, science, basic science, ASSIST, LASSI, and VARK. The literature search was conducted using Walden library resources, and Google Scholar. Additionally, articles located via the initial search were also used searching for specific sources that had cited the article or that were cited within the article. The latter was especially useful in discovering common sources for those doing learning styles research and for finding seminal and important works.

In 2004, both Cassidy and Coffield et al. recognized that there is some controversy in the study of learning styles. Coffield et al. recognized that there are three linked areas of activity in learning styles: theoretical, pedagogical and commercial (p. 1). Coffield et al. also describes some of the challenges that some instruments have had with

validity and reliability (p. 2). Given the nature of some characteristics described by Curry (1983, 1987) that are flexible or influenced by the environment (Cassidy, 2004, pp. 422-423; Coffield et al., 2004, p. 8; Mitchell et al., 2015, p. 159) this is not surprising. Cassidy (2004) ascribes some of the controversy to the number of studies in the area both research and practitioner based and therefore the variety of definitions, positions, interpretations and even measures (p. 420).

Some have studied learning styles in an effort to inform pedagogy and some are for the practice of matching. Matching is the practice of assessing the learning style of the student and then matching the teaching modality. Recent efforts to provide an evidence base for or against the practice of matching have shown that there is little evidence supporting the practice (Kirschner & van Merrienboer, 2013, p. 169; Rogowsky, Calhoun, & Tallal, 2014, p. 64; Wolcott-Doyle & Jacobs, 2012, p. 250). All of these studies compared learning preferences with matching. Studies reviewed compared some aspect of learning preference with the outcomes. One study researched whether learning preferences would change or remain the same when employing a game based learning activity. The results showed that some of the students' preferences did change (Soflano, Connolly, & Hainey, 2015, p. 105). Another study compared learning preference, either auditory or visual, with learning aptitude and instructional method failing to show any significant relationship (Rogowski, Calhoun, & Tallal, 2015, p. 64). Using Honey and Mumford's instrument, Wilkinson, Boohan, and Stevenson (2014) failed to show any significant relationship to academic performance and learning

preference in an anatomy course (p. 304). Studies comparing more stable aspects of learning style as described by Curry and performance have not been identified.

When referring to learning styles models suggested by Curry, Vermunt and Coffield et al., there are multiple layers or categories with varying levels of stability, each of which may be applied to any learner. Learning is certainly more complex than most instruments can assess yet most studies only consider one aspect of learning style. Recently researchers have demonstrated the value of using multiple tools such that results achieve increased validity and greater depth in understanding the learner on multiple levels (Bostrom & Hallin, 2013, p. 35; Hawk & Shah, 2007, p. 16; Lemke-Westcott & Johnson, 2013, p. 70; Ocepek et al., 2013, p. 352; Samarakoon et al., 2013, p. 3; Wuilliams, Brown, & Etherington, 2013, p. 110). Ocepek et al. (2014) used four different tools as each measured a different aspect of learning creating more reliable and informative findings (p. 352). The authors concluded that there is an obvious need to combine learning styles models and tools to get a wider view of the student characteristics better informing educators and developing programs (Ocepek et al., 2013, p. 353). Bostrom and Hallin (2013) concluded at the end of their study, that using multiple tools strengthens results (p. 25). Williams, Brown, and Etherington (2013) stated using three tools in their study as preferences are not fixed but influenced by previous life experiences, education values and previously played roles (p. 116).

There are many approaches to measuring learning styles. According to Coffield et al. (2004) at least 71 instruments that represent 13 types of instruments (p. 10). An

accurate account of the total number of tools currently in use was not available. Using Curry's model of four layers with the inner layer of cognitive personality being stable, the information processing layer being very stable, and the social interaction and instructional preference layers being flexibly stable and considering recent research suggesting the use of multiple instruments, tools that will measure the broad nature of student learning should be considered together. Three elements commonly measured are learning approaches, learning strategies and learning preferences.

Learning approaches have to do with a student's intention and learning process used to carry out a task (May et al., 2012, p. 236; Abedin et al., 2013, p. 550; Byrne, Flood, & Willis, 2004, p. 450). Learning approaches have been described initially by Marton and Saljo (1976) and later developed by Entwistle and Ramsden (1983) and categorized as deep, surface, and strategic (May et al., 2012, p. 236; Richardson, 2010, p. 288). A deep approach to learning has been described as a personal interest in learning and understanding, attempts through critical thinking, and relating learning to prior knowledge or experience (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450). A surface approach to learning focuses on memorization of facts and fails to personally interact with the material (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450). The strategic approach includes intentional focus on learning and activities with an aim on achieving marks as high as possible and doing whatever it takes to get maximal results (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450). While educators would prefer that all learning were deep, learning approach has been associated with the student's

study skill (May et al., 2012, p. 237) and as such is considered to some extent, natural ability or a stable trait.

There is some evidence that suggests that students who demonstrate a more positive conception of learning and take an active role employ deep approaches while those who take a more negative conception and employ a passive role employ more surface approaches (Richardson, 2010, pp. 289-290). Another study considers students' performance in basic science courses at a medical school. Findings indicated that students that employed deep approaches performed better in basic science courses (McNulty, Ensminger, Hoyt, Chandrasekhar, Gruener, & Espiritu, 2012, pp. 8-9). Tarabashkina and Lietz (2011) found a relationship between students that employ a deep approach and a higher GPA, but also found that with an increased work load, students that normally employ a deep approach will change and use a strategic approach (p. 227). There was no such finding for those who normally employ a surface approach.

While the learning approach has been associated with study skill, learning strategy has been associated the actions taken by a student to learn. Citing Weinstein, Husman, and Dierking (2000) Cano (2006) described learning strategy in functional terms as "any thoughts, behaviors, beliefs or emotions that facilitate the acquisition, understanding or later transfer of new knowledge and skills" (p. 1023). Flowers, Bridges, and Moore III, (2012) describe learning strategies as skills (p. 147). The skills described are also functional (Flowers et al., 2012, p. 147; West, & Sadoski, 2011, p. 697) and are

differentiated from the skill described by May et al. (2012) associated with learning approach.

Learning preferences are described as sensory input or the way that a student prefers to receive information (Whillier et al. 2014, p. 21; Mitchell et al., 2015, pp. 159-160; Samarakoon et al., 2013, p. 2; Urval et al., 2014, p. 216). This element appears frequently in the literature perhaps because it is easier to measure. Whillier et al. (2014) describe learning preference not only as input, but also as information processing preferences (p. 21). According to Mitchell et al. (2015), this element is the least stable or the most susceptible to change based on experiences including learning experience (p. 21).

Learning styles research is limited in chiropractic education. In recent years, three studies have been identified. Two studies compared learning strategies with outcomes. In one study, learning strategies were compared to students with higher and lower GPA, finding a correlation with two types of strategies, affective strategies and goal strategies and higher GPA (Schutz et al., 2011, p. 6). Another study compared learning strategies with outcomes on the National Board of Chiropractic Examiners (NBCE) Part 1 results. This study also found a correlation with affective strategies and goal strategies and success on the NBCE examination (Schutz, Dalton, Tepe, 2013, p. 9). A third study looked at the learning preferences of chiropractic students during their first 3 years of study. Findings show that there was prevalence for multimodal learning (Whillier et al., 2014, p. 26). Multimodal means that of the four possible preferences or

modes (Visual, Aural, Read/Write, or Kinesthetic) students included more than one mode in their preference (Breckler et al., 2009, p. 30; James et al., 2011, p. 418; Mitchell et al. 2015, p. 159; Urval et al., 2014, p. 216; Whillier et al. 2014, p. 26). The findings of these studies are similar for other health science fields including nursing, mid-wifery, medicine, pharmacy and dentistry (Asiabar et al., 2015, pp. 4-5; James et al., 2011, p. 422; Lujan, & DiCarlo, 2006, p. 15; May et al., 2011, p. 9; Urval et al., 2014, pp. 218-219; West & Sadoski, 2011, p. 701).

There are some studies that suggest that there are differences in learning style based on educational background, demographics, culture and exposure to a specific curriculum. Manolis, Burns, Assudani, and Chinta (2013), studying 253 students found that their learning preferences can change with educational experience (p. 50). Hill, Tomkinson, Hiley, and Dobson (2014) studied 757 students enrolled in either engineering or social science undergraduate programs (p. 5). Engineering students showed a strong preference for logical over visual, verbal, aural and solitary styles, while the social studies students preferred a social environment (Hill et al., 2014, p. 11). The authors also found that students from the United Kingdom preferred social environments while Malaysian students were more solitary demonstrating a cultural difference (Hill et al., 2014, p. 11). Boland Sugahara, Opdecam and Everaert (2011) conducted a study comparing the learning styles of students from Japan, Australia, and Belgium and found that the Japanese students prefer learning by watching and are more diverging while the Australian and Belgium students were more individualistic and prefer learning by doing

(p. 258). Another study conducted by Tarabashkina and Lietz (2011) followed 114 students from 2004 to 2007 during their undergraduate experience and considered learning approach, gender and academic achievement (p. 210). Results demonstrated an association with using a deep approach and academic success and that female students were more successful than males in both (Tarabashkina, 2011, p. 227). Also important was the finding that students of the natural sciences showed a significantly higher level of utilizing deep approaches compared to their peers in the social sciences during their last year (Tarabashkina, 2011, p. 228).

Most authors studying the health sciences agree that the majority of health science students are multimodal learners with a predominance of kinesthetic learning preference. Breckler et al., (2009) studying undergraduate students found that while the preferences of the prehealth science students had similar preferences to those studying health sciences, non-science students were much less multimodal (p. 34). James et al. (2011), studying 334 first year nursing and midwifery students found that while the cohort was mostly multimodal and kinesthetic, there was a much higher prevalence for visual learning when compared to similar cohorts (p. 419). The authors associated this with the fact that the cohorts had become much more diverse due to recent changes allowing greater access and students with more diverse backgrounds (James et al., 2011, p. 417). Crawford, Alhreish and Popvich (2012) conducted a study that included 59 faculty in a pharmacy program (p. 4). Results showed that clinical faculty differed from tenure track faculty in that clinical faculty demonstrate more concrete sequential approaches while

tenure track (lecture) faculty demonstrate more abstract sequential approaches (Crawford et al., 2012, p. 4). The authors were hesitant to conclude why there was a difference, but acknowledge that their findings were consistent with the findings of other studies (Crawford et al., 2012, p. 5).

Nursing education is becoming more diverse including admissions of more international students and students with an arts backgrounds (D'Amore et al., 2012, p. 507). Wagner (2014) reported that nursing student populations are becoming more diverse consisting of various ages, cultures, and educational backgrounds (p. 348). She stated that this has become a challenge to faculty needing to tailor didactic sessions and to meet the needs of a variety of students and outcomes (Wagner, 2014, p. 348). D'Amore et al. (2012) studied 285 nursing and midwifery students and found that the diverse cultural background represented a diverse learning styles background but also found a significant difference in learning style among Nursing students being more divergers and students with a liberal arts background being more assimilators (p. 514). In another study Bostrom and Hallin (2013), compared 78 nursing to 78 teaching students for learning preferences (p. 25). The authors found significant differences in the two groups for motivation, kinesthetic learning, need for authorities and persistence (Bostrom & Hallin, 2013, p. 28). Lemke-Westcott and Johnson (2013) conducted a study to specifically compare the learning style differences of Canadian faculty and Middle Eastern students at a nursing program in Qatar (p. 66). The authors concluded that the Canadian faculty tended towards abstract thinking preferring lectures and logical

processing while the Qatary students preferred practical hands-on learning (Lemke-Westcott & Johnson, 2013, p. 82). The authors attribute the difference to cultural backgrounds with the students entering the program directly from their Middle Eastern education system (Lemke-Westcott & Johnson, 2013, p. 82). These results are similar to those from other health science disciplines including: a study of 270 optometry students with varying cultural and educational background including students without a bachelor's degree (Prajapati et al., 2011, pp. 75-76) and a study of 70 Indian dental students that demonstrated 29.3% were uni-modal and most were auditory both of which differ from most studies of health science students (Shenoy & Shenoy, 2013, p. 1684). The authors in the latter conclude cultural influences as the possible cause of these findings (Shenoy & Shenoy, 2013, p. 1685).

As previously discussed, there has been some controversy over how to use the findings of learning styles studies to improve student outcomes. One, method known as matching, the pairing of learning style or preference with teaching methods, has been suggested by some as useful (Bostrom & Hallin, 2013, p. 22). Recent studies have not supported this practice (Dincol, Ternel, Oskay, Erdogan, & Yilmaz, 2001 p. 858; Kirschner & van Merrienboer, 2013, p. 169; Rogowsky et al., 2014, p. 64; Wolcott-Doyle & Jacobs, 2012, p. 250). Loewen and Jelescu-Bodos (2013) studied 29 pharmacy residents in Canada and found that these were more passive than their counter parts in medicine, nursing and other health fields concluding that, rather than matching their preference, more active learning was needed during the residency (p. 5). Alghasham

(2012) studied 75 first year medical students placing them in small groups based on learning style during problem-based learning sessions (p. 14). The groups were formed homogenously as either active or reflective learners. While the findings demonstrated differences in the two types of learners regarding participation, independent study, and team work, they findings also indicated that arranging groups more heterogeneously would be advantageous (Alghasham, 2012, pp. 18-19). Conversely, Kyprianidou, Demetriadis, Tsiatsos, and Pombortsis (2011) conducted a study that included 50 undergraduate students that were placed in small groups for project based work based on a heterogeneous design per learning styles (p. 83). The students were open about their own learning styles honoring differences and considering all as talented and competent (Kyprianidou et al., 2011, p. 106). The authors conclude that for small group work, understanding the students learning styles does affect pedagogy and supportive strategies (Kyprianidou et al., 2011, p. 106).

Another topic which has been somewhat controversial is that of pedagogy in the classroom. A faculty member cannot specifically teach to any one preference or style as all likely exist in the classroom and therefore, most researchers suggest that faculty employ a variety of methods or a mixed classroom (Hill et al, 2014, p. 36; Prithishkumar & Michael, 2014, p. 186; Wolcott-Doyle & Jacobs, 2012, p. 250). Manolis et al. (2012) citing prior studies (Abdulwahed & Nagy, 2009, Gaur, Kohli, & Khana, 2009, Pfeifer & Borozan, 2011) demonstrated that addressing multiple learning styles by employing a variety of pedagogies improves student learning and flexibility within the students

learning preferences (p. 50). The authors also noting the ability of their subjects to adapt that it is best practice to both match the style at times and stretch them at others (Manolis et al, 2012, p. 51).

Many researchers and scholars agree that learning styles are useful for advising students and for supportive activities. Marek's (2013) study included 16 nursing students that participated in a quasi-experimental study that combined the VARK instrument with mentoring (p. 43). The findings indicated that mentoring with the understanding of learning preferences is useful (Marek, 2013, p. 48). Ocepek et al. (2013) studied 272 undergraduate students comparing learning styles to preferred multimedia and concluded that the findings will help to implement a general adaptive learning environment (p. 353). Loewen and Jelescu-Bodos (2013) compared learning styles of pharmacy students to the clinical faculty and found that the way learning occurs matters and that knowledge of learning styles enhances the faculty – student encounters (p. 1). Having found pharmacy residents to be passive learners, the authors concluded that it is the responsibility of the program to guide residents toward active learning (Loewen & Jelescu-Bodos, 2013, p. 5). Halbert, Kriebel, Cuxxolino, Coughlin and Fresa-Dillon (2011) studied 236 osteopathic students comparing learning styles with supplemental materials (p. 332). Findings indicated that there is a correlation between the learning style and preferred supplemental learning materials (Halbert et al., 2011, p. 332). The authors conclude that learning style assessment enables preclinical educators to devise learning algorithms and resources to best assist students toward success (Halbert et al., 2011, p. 333). Sanderson (2011)

completed a critical review of the literature on learning styles and among her conclusions advised librarians and educators that knowing more about how people learn can help in student motivation, develop self-awareness and take more control of their own learning (p. 383).

Based on a review of this literature it is clear that there is value to the study of learning styles for the purpose of assisting students toward success academically and clinically. It is unclear that the differences based on educational background are based on the experience associated with the education or if certain fields attract certain types of students, but it is clear that there are differences based both on educational background and cultural background. These need to be considered. While it is not clear in the literature that matching is a good practice, using learning styles research to inform pedagogy, develop appropriate academic support and for advising and mentoring is useful.

Additionally, it is clear that learning is complex and many authors conclude that using multiple tools across the dimensions of learning styles improves validity and provides for richer findings. This supports Curry's onion model with layers that represent varying levels of stability in the elements of learning. Learning styles research is limited in chiropractic education, but the limited research includes positive findings linking learning styles to learning outcomes including NBCE results. None has been done that considers the differences based on current admissions standards.

Implications

As described earlier, the institution is required per the programmatic accreditor to provide support to the AATP students admitted to the program (CCE, 2015, p. 16). Efforts are being made, but need to be enhanced and informed by the findings of this study such that the institution better ensures the success of students admitted per this program. The findings of this study provide much needed information to the faculty and academic counselors and advisors who work collectively to support these students. The findings of this report is provided to these individuals in a summary report and informs efforts to design a first year experience, the efforts of the academic counseling department, study strategies and approaches, and the efforts of the chair of clinical sciences who has assumed the major responsibility to coordinate all supportive efforts relative to AATP students. The project resulting from this study is an executive summary report including policy recommendations addressed to the academic leadership including department chairs and academic counselors and advisors. The report outlines the findings of the study and recommendations to policy, revisions to the first year, AATP supportive strategies, and recommended training for faculty and support staff.

Summary

Since January 2013, the instituion has been admitting students under the AATP program and is required provide additional academic and transitional support for these students. The institution attempts to do so, but the department chairs, faculty, and academic counselors and advisors have only their prior experience with students who

have been admitted with a good science based educational foundation. The literature is clear that there is a difference in the learning styles of students based on educational experience and background and culture. While there is no significant difference in GPA, when the AATP students are segregated based on admissions status of either AATP for lower GPA or AATP for lack of a science background, NBCE results vary. It is not surprising that the students admitted with a lower GPA struggle. The institution needs to learn more about these students to understand how to support them. What is surprising is that AATP students admitted with less than the average science background do well on the basic science based assessment (Part 1 NBCE), but are struggling with the clinical and critical thinking Part 2 NBCE assessments. The institution needs to better understand these students.

While learning styles may be considered controversial by some, it is important to understand how the findings are to be used. Learning styles are more complex than one element. Many authors only consider one of the elements described by Curry (1982, 1987), Vermunt (1998) and Coffield et al. (2004) (Coffield et al., 2004, pp 8-9). The literature is also clear that it is important to consider multiple elements and to use multiple tools. For this study, Curry's Onion model is considered. Elements which are more stable and that are flexibly stable are considered to obtain a more complete view of the student. Considered important for this study are learning approaches, learning strategies and learning preferences. The findings of this study are be used to inform educators, counselors and advisors at the institution to better support the AATP students

being accepted to the program and result in an executive summary report including recommendations to policy change, revisions to the first year program, AATP supportive strategies, and recommended training for faculty and support staff. Not only is the institution mandated to do so by the programmatic accreditor, but also has an educational obligation to its students to provide the best support possible to the success of the student educationally and into professional practice. The results of this study are also useful to all other chiropractic colleges in the United States and to the programmatic accreditor as it considers current and future regulation. Results will be submitted for consideration of presentation during the profession's annual educational conference.

Section 2: The Methodology

In this section I describe the methodology employed during this study. The research design and approach are described and justified including the instruments employed. The setting and sample are described relative to the local problem identified as understanding the learning styles of entering students based on admissions status in support of developing supportive mechanisms for the AATP students. The three instruments utilized are described including the concepts measured and studies relating to validity and reliability of the instruments. Data collection and analysis is described including a statement of the protection of participants. This is always important, but in this case extremely so as the study was conducted by an administrator of the site. Protection of the participants is reiterated as a part of the methodology emphasizing the importance of anonymity.

Research Design and Approach

This was a quantitative study conducted using cross-sectional survey methodology that incorporated multiple survey instruments to assess students' learning style (Creswell, 2012, pp. 377-378). The study incorporated multiple survey instruments to assess three varying elements of learning style including: learning approaches, learning strategies, and learning preferences. This design was used to compare the independent variables based on admissions status and the three elements of learning style (dependent variables) being measured. The instruments selected include: ASSIST for learning approaches, LASSI for learning strategies, and the VARK questionnaire for learning

preferences. These tools were selected as each measures a specific element of learning style on the scale of stable to flexible. Stable elements are less susceptible to change and flexible elements are more susceptible to change over time and with environmental influence (Coffield et al., 2004, pp. 8-10; Mitchell et al., 2015, p. 159). Each of these tools has been used in studies conducted for learning in higher education including the health sciences. Both the LASSI and VARK questionnaires have been used in the limited research in chiropractic education. These tools including validity and reliability are described below. As the problem is founded in the differences of entering students based on admissions status and therefore educational and cultural background, understanding how the three cohorts differ based on learning styles was measured using these three tools.

Setting and Sample

The population under consideration for this study includes chiropractic students currently enrolled at the institution. The sample to be studied included the new incoming students collected over four consecutive terms. These students all participate in a first year orientation program during their first term at the institution which provided an excellent environment to collect data from all entering students. As previously demonstrated, the educational environment can have an effect on the learning preferences, so collecting data soon after entrance was preferred to collecting data from students that have been enrolled at the institution for 1, 2 or more years (Gurpinar et al., 2011, p. 310; Mitchell et al., 2015, pp. 164-165; Tarabashkina & Leitz, 2011, p. 228).

All entering students from the four cohorts were asked to complete the survey including all three instruments. This study sought to compare students accepted as AATP-science (who lack science requirements compared to standard admissions), AATP-GPA (have a lower than standard GPA on admissions) and standard admissions students. As this study sought to compare the entering students based on admissions status, there were no exclusion criteria other than those who voluntarily elected to not participate. During the collection period from October 2016 to July 2017, there were four cohorts that entered the insttution for a total of 195 students. Of these, 165 participated representing 84.6% of those admitted during the study period. Of those participating, 30 were admitted as AATP-Science and 22 as AATP-GPA.

To calculate the minimum number required for the sample, the final analysis of the data was considered. In this case Pearson's chi-Square test of independence is appropriate. This test is for two or more independent samples when the null hypothesis would demonstrate no difference in proportion between groups (Franke et al., 2012, p. 450-451). As the outcomes for ASSIST are *deep, strategic,* or *surface learning* and for LASSI are *skill, will,* or *self-regulation,* and as there are three groups within which to measure these outcomes, the resulting contingency tables are both three by three. Each results in four degrees of freedom for calculating the minimum sample size. When considering the VARK findings, participants can be unimodal or multimodal in terms of learning preferences. Prior studies, including one in chiropractic education, have identified each participant by the major preference identified among the four possibilities

and then calculated significance using chi-square methods (Asiabar et al., 2015, p. 2; Breckler et al., 2009, p. 31; Whillier et al, 2014, p. 23). In this case the contingency table is three by four resulting in six degrees of freedom. Using the on line tool G-Power (Faul, Erdfelder, Buchner, & Lang, 2009, p. 1149), a moderate effect size, and alpha of 0.05, and power at 80, the minimum sample size needed with four degrees of freedom (for both ASSIST and LASSI) is 133 participants. When the formula is altered to include six degrees of freedom required for the VARK tool, the minimum number of participants is 152. Therefore for this study the minimum number of participants was calculated to be 152.

Students were asked to participate during their first year extended orientation course requesting their permission to participate and notifying them of the option to not participate as participation is voluntary. The purpose of the study along with instructions, privacy protections and the voluntary nature of the study was provided to all potential participants.

Instrumentation and Materials

Approaches and Study Skills Inventory for Students (ASSIST)

ASSIST was developed based on research done by Entwistile, Tait, and McCune (2000) and identifies the students approach to learning, *deep*, *surface*, and *strategic* (p. 33). Permission for the use of this tool is included as Appendix B and a copy of the complete instrument as Appendix C. Understanding students' approaches to learning is important to this study as part of understanding how students with varied educational

backgrounds differ. Researchers have shown connections to a deep study approach and academic performance (McNulty et al., 2012, pp. 8-9; Tarabashkina & Lietz, 2011, p. 227). Those that employ a deep approach have a personal interest and attempt to link learning to prior knowledge or experience (Abedin et al., 2013, p. 550; Byrne et al., 2004, p. 450). Understanding students in this way provides information needed for academic counselors and the development of support programs.

Concepts measured. ASSIST is designed as a survey instrument that includes 52 questions. The participants rank themselves using a scale of one to five for each question. Analysis then provides a score in each scale, deep, strategic, and superficial and in 13 subscales including: seeking meaning, relating ideas, use of evidence, interest in ideas, monitoring effectiveness, organized studying, time management, achieving, alertness to assessment demands, lack of purpose, unrelated memorizing, fear of failure, and syllabus-bound (focus on minimum requirements) (Abedin et al., 2013, p. 553). There are four questions related to each of the subscales in ASSIST. Each is rated by the participant and then a total score given for each subscale and scale. While a numerical score is generated, the numbers demonstrate the individual's alignment with the concepts related to the scales and subscales. The scales are not ordered but rather characteristic of categories and as such are nominal data (Triola, 2012, p 13).

Validity and reliability. Byrne, Flood, and Willis conducted a study in 2004 using 298 US and 437 Irish accounting students to assess the validity of ASSIST. The authors quote Guilford (1956) and Gorsuch (1983) stating that a minimum sample size

needed for factor analysis is 200 and that this study exceeds that minimum (Byrne et al., 2004, p. 453). Cronbach alpha values were calculated for the main scales and subscales to test internal reliability. Alpha values for the main scales were reported as follows: Deep; US, 0.82, Irish, 0.84, Strategic; United States, 0.87, Irish, 0.87, and Surface Apathetic; US, 0.80, Irish, 0.83, indicating high levels of internal consistency (Byrne et al., 2004, pp. 453–454). Factor analysis of the subscales was performed to determine relevance to main scales, noted as loading by the author found that subscales for both deep and surface apathetic scales loaded as either high or moderately high in the main scales as predicted (Byrne et al., 2004, p. 454). One of the four subscales identified with the strategic scale (monitoring effectiveness) loaded for both deep and strategic scales while all other subscales associated with the strategic scale loaded as high for strategic (Byrne et al, 2004, p. 454). The authors concluded that ASSIST yields valid and reliable scores when assessing learning approaches (Byrne et al., 2004, p. 456).

Abedin, Jaafar, Husain, and Abdullah (2013) conducted a study using 112 MDAB (Mengubah Distini Anak Bangsa, which translates to Changing the Destination of Nations) students to assess the validity of ASSIST. Data was analyzed using Path Diagram Analysis utilizing both SPSS and AMOS software (Abedin et al., 2013, p. 552). Goodness of fit per the structural model was measured using Absolute Fit Index (AFI), Incremental Fit Index (IFI) and Parsimonious Fit Index (PFI) (Abedin et al., 2013, p. 552). Cronbach's alpha was calculated and found that six of the 13 scales were above 0.6 with the remaining scales very close to 0.6 (Abedin et al., 2013, p. 553). With the p =

0.05 there was no significant difference between the population and sample covariance across the subscales revealing that the model is consistent (Abedin et al., 2013, p. 553). As in the prior study, factor loadings were high and the authors concluded that ASSIST is an appropriate instrument with valid results indicated by scores obtained in both the main scales and subscales of the instrument (pp. 555-556).

Learning and Study Strategies Inventory (LASSI)

LASSI was developed based on research by Weinstein was originally published in 1987 and has been used extensively in educational settings (Flowers et al., 2012, p. 147). The LASSI is designed to provide diagnostic and student self-perception regarding study skills and learning orientation (Flowers et al. 2012, p. 147). West and Sadoski (2011) suggest that study skills (strategies) are better predictors of success in medical school than entering GPA or MCAT scores (p. 697). The authors found that for the 106 students studied, scores in some of the LASSI subsets were good predictors of academic success (West & Sadoski, 2011, p. 702). Understanding the strategies used by students is important in this study as it results in better information for academic counselors and advisors when working with students. Permission for the use of this tool is included as Appendix D and a copy of the complete instrument as Appendix E.

Concepts measured. LASSI includes 10 scales related to study strategies including: Attitude, motivation, time management, anxiety, concentration, information processing, selecting main ideas, study aids, self-testing, and test strategies (Flowers et al, 2012, p. 152). Weinstein and Palmer (2002) the authors of the LASSI instrument, state

that each of the scales is related to one of the three components of strategic learning, specifically, skill, will and self-regulation (p. 4). Cano (2000) reported that the items for this instrument have been selected using a functional approach and are closely related to students' learning methods (p. 1024). The instrument contains 80 items across the 10 scales each measured by the participant on a Likert scale one (not at all like me) to five (very much like me) (Cano, 2000, p. 1027). Scores across the scales are calculated and identify those strategies the student is most likely to engage. The data are nominal as the categories cannot be compared numerically or in any other order (Triola, 2012, p. 13).

Validity and reliability. Cano conducted a large scale study in 2006 to assess the validity of LASSI using two college freshmen cohorts of 527 and 429 participants each representing 10 facilities (p. 1023). Factor analysis demonstrated that all three scales, effort-related activities, goal orientation, and cognitive activities, were all related to the subscales as described by LASSI's author (Cano, 2006, p. 1028–1029). Confirmatory factor analysis revealed goodness of fit (GFI) = 0.96, adjusted goodness of fit (AGFI) = 0.1 and comparative fit index (CFI) = 0.95 indicating no modification is needed in the model (Cano, 2006, p. 1031). All estimated parameters were considered statistically significant with *t* values greater than 2.0. With the exception of Test Strategies ($t = 3.94$) and Information Processing ($t = 2.74$) all subscales had *t* values over 4.45 (Cano, 2006, p. 1031). Lastly, the author compared the strategies with academic performance and found statistical significance with academic performance and Affective Strategies and Goal Strategies but not with Comprehension Monitoring strategies (Cano, 2006, p. 1033).

Flowers, Bridges, and Moore (2012) conducted a study involving 81 African American students looking specifically at the validity of LASSI reported as a follow up to the work done by Cano (2006) and Weinstien (2002) reporting appropriate reliability and internal consistency (p. 149). ACT scores were utilized as academic markers and correlation to these measured. In assessing LASSI's 10 subscales, Cronbach's alpha ranged from 0.73 to 0.87 across all 10 subscales (Flowers et al., 2012, p. 152). Correlation coefficient *r* was calculated and found to be significant for two subscales, Anxiety at $r = .278$ and Test Strategies at $r = .280$ relating these two subscales to success on ACT scores (Flowers et al., 2012 p. 152). The authors concluded that LASSI is an appropriate measure for programs focusing on learning strategies and skills (Flowers et al., 2012, p. 153).

VARK (Visual, Aural, Read/Write, and Kinesthetic) Questionnaire

VARK was designed by Fleming (1995) to gather data regarding learning preferences (pp. 1-2). The VARK questionnaire is designed to identify a student's preference in sensory learning or input and have been used to inform pedagogy (Breckler et al., 2009, p. 35; Lujan and DiCarlo, 2006, p. 15; Mitchell et al., 2015, p. 166; Urval et al., 2014, p. 219-220).

While some studies suggest that there may be no statistical correlation between learning preferences and outcomes as measured on exams or course assessments (Rogowsky, Calhoun, & Tallal, 2015. p. 77; Wilkinson, Boohan, Stevenson, 2014, p. 308) it should be remembered that the primary purpose of VARK is to inform students

and faculty regarding appropriate learning strategies and methods. James et al. (2011) referencing Fleming's work in 2009, reports that the VARK tool can distinguish between 23 possible combinations of unimodal and multimodal learners in terms of learning preferences (p. 418). While learning preferences are much more flexible than other elements of learning style, that is they are affected by the environment, understanding learning preferences has been shown useful to educators. The institution seeks to improve supportive programs and structure per the findings of this study. Specifically, VARK findings are useful to mentors and counselors working with students to direct their specific learning needs. Marek (2013) found understanding learning preferences useful in mentoring students (p. 48). Ocepek et al. found understanding learning preferences useful in advising students regarding multimedia supplemental learning materials (p. 353). Permission for the use of this tool is included as Appendix F and a copy of the complete instrument as Appendix G.

Concepts measured. The VARK instrument measures student preferences in the way that material is delivered or taken in. It is about sensory input or the way the student prefers to receive information (Mitchell et al., 2015, pp. 150-160; Samarakoon et al., 2013, p. 2, Urval et al., 2014, p. 216; Whillier et al., 2014, p. 21). The types of input are visual, aural, read or written, and kinesthetic (Fleming, 1995, pp. 1-2). The VARK questionnaire includes 16 questions and the student is directed to select the answer that best explains their preference, multiple answers can be selected (James et al., 2011, p. 418). This tool does not use a Likert-type scale, but each response is associated with one

of the four preferences. Analysis demonstrates the prevalence in the individual and if there is more than one preference, what those are. Students can have purely one type of preference, but often students are found to have multiple preferences with a dominance of one style. This data cannot be arranged in any order and is only categorical and is therefore nominal (Triola, 2012, p. 13) however, when comparing one scale across cohorts, mean scores can be calculated so an independent *t* test can be used for this purpose.

Validity and reliability. Leite, Svinicki, and Shi (2010) utilizing data from the VARK website, analyzed the responses of 14,211 respondents who had identified themselves as US students and first time participants during the month of January 2007 in an effort to validate VARK items (Leite et al., 2010, p. 337). Because VARK allows the option of selecting multiple answers to each question, the model for analysis is complicated (Leite et al., 2010, p. 328). To account for this, a correlated trait-correlated uniqueness model (CTCU) was selected (Leite et al., 2010, p. 332 - 333). This model provides that each subscale aligns with one scale and that individuals completing the instrument primarily align with a major scale based on answers provided. This model has been used in other studies conducted using the VARK instrument (Asiabar et al., 2015, p. 3; Breckler et al., 2009, p. Urval et al., 2014, p. 217, Whillier, 2014, pp. 23 – 24). Using the CTCU model, the VARK factor mean loadings included: visual 0.51, aural 0.47, read/write 0.50 and kinesthetic 0.41 all interpreted at moderate in size (Leite et al, 2010, p. 333). Also reliability scores for the VARK scales included: visual $r = 0.85$, aural $r =$

0.82, read/write $r = 0.84$ and kinesthetic $r = 0.77$ all of which are considered adequate (Leite et al., 2010, p. 334). The authors concluded that for use as a diagnostic tool in efforts to direct teaching and learning methods, VARK is a reliable and valid tool (Leite et al., 2010, p. 336). For use in research relative to predicting academic outcomes, VARK is not a reliable tool (Leite et al., 2010, p. 336). This is consistent with other researchers and the intended use of the tool which is to direct the students learning efforts.

Use of the ASSIST, LASSI, and VARK questionnaires in combination can provide the understanding regarding learning style needed to inform development of an academic support structure for the AATP students at the institution and can provide much needed information for academic counselors and advisors that work directly with these students. Figure 1, compares measured characteristics of these three tools and considers potential overlaps.

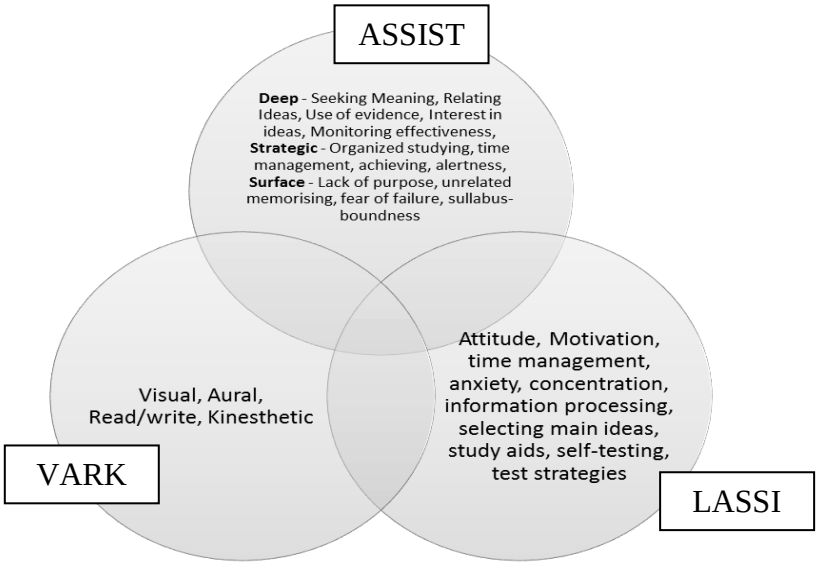

Figure 1. Venn diagram compares elements of ASSIST, LASSI, and VARK tools

Other than time management being measured in both ASSIST and LASSI, none of the measured characteristics are direct overlaps. Elements of ASSIST (relating ideas, use of evidence, and interest in ideas) and LASSI (information processing and selecting main ideas) have some overlapping concepts. The way the information is used from the overlapping concepts differs. ASSIST associates the concepts with approaches or cognitive functioning (Entwistile, Tait, and McCune, 2000p. 33). LASSI measures the extent to which each strategy is used (Flowers et al., 2012, p. 147). Figure 1 demonstrates that using all three tools provides a broader picture of the learning style based on approaches, strategies and preferences than any one tool may provide alone. Hawk and Shah (2007) report, diagnostic use of two or more instruments to assess learning style should results in better results including academic performance of adult students than using just one learning style instrument (p. 15).

Data Collection and Analysis

To understand how learning styles of standard admission students, AATP-Science and AATP-GPA students differs, the three instruments previously listed (ASSIST, LASSI, and VARK) were administered to the incoming first year students during their first year extended orientation course during four consecutive terms. The surveys were be administered during class time following full disclosure of the purpose of the study, the intended use of the results, appropriate confidentiality, informed consent, and the voluntary nature of the study. Appendix I is a copy of the informed consent that was provided to the participants of this study. The Vice President of Academic Affairs

(VPAA) as the main author of the study was not disclosed at the time of data collection or since. The institution employed the director of Institutional Research (IR) and the IR staff to collect data and provide protection of the students including anonymity. Raw data are held in the IR department. Each of the three instruments addresses hypotheses presented earlier providing the data needed to either reject or fail to reject the null hypotheses which include:

- Null Hypothesis 1a: Students admitted as AATP for lack of science will demonstrate no differences in their learning approaches compared to students admitted per standard admissions.
- Null Hypothesis 1b: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning approaches compared to students admitted per standard admissions.
- Null Hypothesis 2a: Students admitted as AATP for lack of science will demonstrate no differences in their learning strategies compared to students admitted per standard admissions.
- Null Hypothesis 2b: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning strategies compared to students admitted per standard admissions.
- Null Hypothesis 3a: Students admitted as AATP for lack of science will demonstrate no differences in their learning preferences compared to students admitted per standard admissions.

- Null Hypothesis 3b: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning preferences compared to students admitted per standard admissions.

Data from each of the three tools results in nominal data as each is interpreted as categorical distinction and not data that can be ordered. Histograms and frequency tables are important to demonstrate potential visual differences between findings per the three independent variables including scales and subscales for each tool. Tests were applied and calculated to test the hypotheses related to the three admissions based groups and the three learning style measures. As the data are nominal in nature, a Pearson's chi-square test of independence (Franke, Ho, & Christie, 2012, p. 451) was calculated to consider the differences in the three admissions based groups and outcomes of the three instruments. While the outcomes are categories and cannot be arranged in order, the occurrence of a specific learning approach, strategy or preference can be calculated per the admissions based groups to consider frequency and prevalence. In order to gain a better understanding of the differences in response frequencies in learning strategies and approaches a deeper analysis was included using Chi-Square for independence for each of the subscales. For this study, the scale frequencies of both ASSIST and LASSI were first compared using Chi-Square test for independence. Then individual subscale frequencies were compared also using Chi-Square test for independence. It is also important to note that while all three instruments yield nominal data, the VARK instrument provides total scores per individual per scale that also yields a mean score per

cohort. Therefore an independent *t* test was also utilized to compare the mean total scale scores of the VARK instrument.

More specifically, ASSIST scales include deep, superficial and strategic learning. The occurrence of each of these types of learning as measured per admissions category is represented in terms of frequency. ASSIST also uses 13 subscales (at least four per scale) and these are also measured in terms of frequency within each scale. LASSI includes the categories of Will, Skill, and Self-Regulation with 10 subscales. Frequency of each of the three categories and also the 10 subscales are measured and reported. VARK outcomes are four categories of learning preference with no subcategories or scales, but participants may identify with multiple categories of learning preference so may identify as multi-modal learning preference. The admissions categories are compared to frequencies in the four modes (visual, aural, read or write, and kinesthetic) and to multi-modal preferences.

Assumptions, Limitations, Scope, and Delimitations

Assumptions include that there is a difference in learning styles including approaches, strategies, and preferences, based on admissions status. It is also assumed that if there are differences that these may contribute to the learning outcomes. The weaknesses of this study include the sample size and the distribution of the three groups of students being studied. AATP students typically make up 25 to 30% of the college's student population. During the collection phase of this study, equal distribution of these students could not be controlled and among the AATP students the distribution of AATP-

science and AATP-GPA could not be controlled, such that even with a target sample of at least 152 participants, the sample is a convenience sample. During the collection phase, 165 new chiropractic students participated in this study. Thirty students were AATP-science and 22 were AATP-GPA representing approximately 32% of the participants.

The independent variables include three categories of student admissions status. This study compares these on three measures of learning styles. These measures results in nominal data which cannot be ordered so statistical analysis is mostly limited, but nonparametric tests such as chi-square will help in the analysis. The study was limited to incoming students as the literature reviewed indicates that some elements of learning style, especially learning preference are subject to change per the educational setting or curriculum (Gurpinar et al., 2011, p. 310; Mitchell et al., 2015, pp. 164-165; Tarabashkina & Leitz, 2011, p. 228). Including students only in their first term limited the effect regarding learning style that the institution could have had on the students and more clearly measures the students as they arrived. This study is also limited to the institution's students as the local problem has been defined at this specific site.

Protection of Participants' Rights

As it was the intent of this study to consider how the institution can do better, there was no effort to only collect or report positive data. A problem had been identified and data that would provide appropriate information to improve was needed.

Participants of this study were provided with a statement of purpose, confidentiality, and informed consent as part of the introduction to the study. As this

study took place at a chiropractic college in the United States, conflict of interest on the part of the researcher and the issue of any possible coercion was addressed. The study was identified clearly in terms of purpose to the participants. The VPAA as the main author of the study was not disclosed at the time of data collection or since. The institution employed the director of IR and the IR staff to collect data and provide protection of the students including anonymity. The director of IR reports directly to the Executive Vice President who reports directly to the president of the college. Therefore, there is no supervisory relationship with the primary investigator and the director of IR or the IR staff. The IR department regularly conducts data collection through IR for issues such as course and instructor evaluations and climate surveys. The IR department collects student and academic performance data and protects students' privacy in compliance with the Family Educational Rights and Privacy Act (FERPA) (Life Chiropractic College West, 2016, pp. 8-9). In general, the following is a description of data management for protected academic performance data.

- The IR Department would receive a request (or petition) from an investigator with the specific data and type of statistical analyses that are desired.
- This written request must align with the research plan and be appropriate to address the stated research question. Statistical design regarding sampling, power, biases, and the appropriate analyses should be conducted ahead of submitting the request and research plan.

- IRB review and approval of the proposed research is required before proceeding with the extraction and accessing of the student academic data.
- The IR Department would ensure the protection of the identities of the individual students when preparing summative, or aggregate, results that address the written request from the investigator.
- The completed analyses and reporting of the analytical results would be provided to the investigator from the IR Department without identifiers of the individual students. The investigator would not have had access to the original datasets containing the protected individual academic performance data. (Director of Institutional Research, personal communication, March 29, 2016)
- The instruments will be administered and collected by the director of IR. The director of IR has access to the student information system (SIS) with admissions status of participants. The IR department will ensure that the data collected and the admissions status of the student completing the instruments are aligned, but no other identifying information will be reported to the researcher or any other individual outside of IR.

On September 12, 2016, the Institutional Review Board (IRB) at the site approved the project for data collection. On October 10, 2016, the Walden University IRB approved of this action (IRB approval number 10-10-16-0454615) indicating that the site's IRB would serve to oversee data collection and that the Walden University IRB would provide oversight for data analysis and reporting.

Implications for Social Change

Access to first professional degrees in health science, including chiropractic, for underrepresented populations, specifically African American and Hispanic students appear to be much lower than for other types of education including other doctorate (PhD) studies. IPEDS data from the U.S. Department of Education for 2009-10 shows that enrollment and graduation of African American and Hispanic students decreased significantly from Associate education through Doctorate education (U.S. Department of Education, National Center for Education Statistics, 2012). At the doctorate level, first professional enrollment (medical, osteopathy, naturopathy, dental, and chiropractic) were lower than for PhD and EdD enrollments, with chiropractic being significantly lower than other first professional degrees for both African American and Hispanic students (U.S. Department of Education, National Center for Education Statistics, 2012).

Studies demonstrate that people of color prefer and have more trust in a health care provider of the same race (Johnson et al., 2012, pp. 3 & 9; Komaromy et al., 1996, p. 1308; Lacy et al., 2012, p. 523;). However, providers of both African American and Hispanic ethnicities are far too rare. In medicine, only 3% of providers are African American and 5% are Hispanic, while for chiropractic only 1% is African American and 3% are Hispanic (Johnson et al 2012, pp. 3 & 9; Komaromy et al, 1996, p. 1308; Lacy et al, 2012, p. 523).

In order to make a positive difference in underserved communities, chiropractic colleges must attract and enroll students from a greater variety of educational and cultural

backgrounds. The new CCE regulations allow the institution to expand recruiting effort including two year colleges. IPEDS data shows that a majority of first year college students of color in California enroll in community colleges (U.S. Department of Education, National Center for Education Statistics, 2012). In order to provide appropriate support to students with these varying cultural, ethnic and educational backgrounds, the insttution must understand their learning approaches, strategies and preferences.

Data Analysis Results

At the end of data collection, the IR department ensured that all hard copy questionnaires where only identified by the study participant number. Then these original questionnaires were turned over to the research department. A double blind data entry format was used to enter all data from the questionnaires to excel spreadsheets. Two research assistants were donated from the research department to do the entry. Each completed a spread sheet entering the participant by study identification number and admissions status along the left and individual questions from the three instruments along the top. Each had the same format but entered data independently. Then an institutional research statistician created an algorithm to merge the two spread sheets to ensure data entry accuracy. Of course there were cells that did not match or were blank. Fortunately these were few. The final step was for the researcher to cross check cells that did not match or were blank with the original hard copy questionnaires. The discrepancies in entry were resolved and in a few cases, blank entries were also resolved. In cases where

cells were blank due to the fact that a participant had not answered a question, the participant's questionnaire for the specific instrument that was incomplete, was eliminated from the study. So while there were 165 total participants, there were 158 participants that completed all sections of the ASSIST instrument that were included in the study, 155 participants that completed all sections of the LASSI instrument that were included in the study, and 165 participants that completed all sections of the VARK instrument that were included in the study. As described earlier, minimum participation for the ASSIST and LASSI instruments needed was 133 and for the VARK instrument was 152.

ASSIST Results

Participants using the ASSIST instrument are instructed to respond to the statements by either agreeing or disagreeing. The scale is a five point likert with 1 being disagree, 2 somewhat disagree, 4 somewhat agree and 5 agree. A score of 3 is considered unsure and the instructions ask that the participants not use three unless they are truly unsure (Appendix C). The intent is to demonstrate either agreement or disagreement with the concepts across the scales and subscales. Scores can be aggregated and also interpreted as agreement or disagreement with the context of the scale or subscale. A higher score would be associated with agreement and a lower score with disagreement. Figure 2, is a graphical representation of the mean scores for all three cohorts across the three scales of the ASSIST instrument, namely, deep learning approaches, strategic learning approaches, and surface learning approaches.

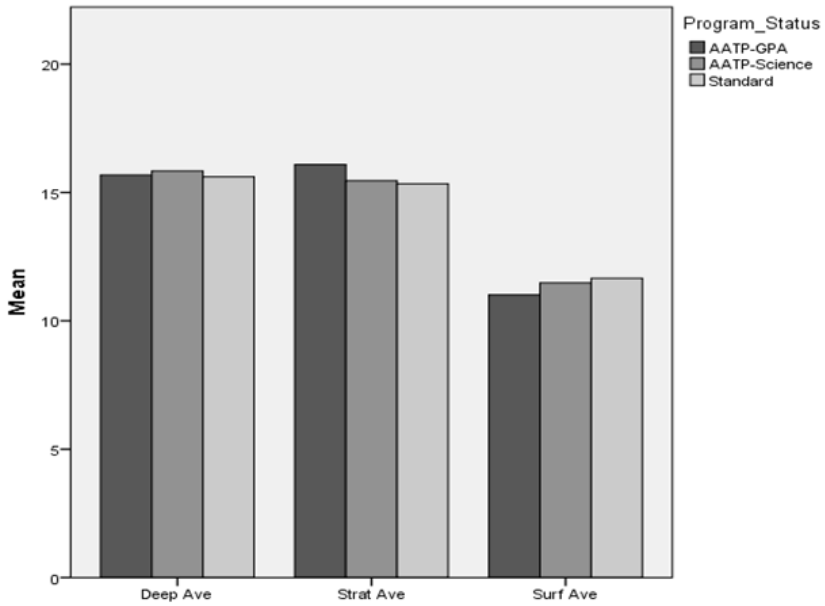

Figure 2. Mean scores for study cohorts and ASSIST scales.

Note. Deep Ave = Mean scores for deep learning approaches, Strat Ave = Mean scores for strategic learning approaches, Surf Ave = Mean scores for surface learning approaches.

While a visual analysis of Figure 2 does not demonstrate that there may be any significant differences within the scales of the ASSIST instrument across the cohorts, it does demonstrate that all three cohorts more closely agree with deep learning approaches and equally disagree with surface learning approaches. It is also interesting to note that the AATP-GPA students have a slightly higher agreement with strategic approaches.

Each participant's scores were totaled with questions aligning to both scales and subscales to determine where possible, either agreement or disagreement with the concepts within each scale and subscale. As anticipated, there were some scores that totaled within the neutral range. Table 1 shows the percentage of participants from each cohort whose responses aligned with agree, neutral or disagree within the three scales associated with ASSIST.

Table 1

Frequency of Responses per Cohort on the ASSIST Scales

	Standard, n = 115			AATP-Science, n = 24			AATP-GPA, n = 19		
	Deep	Strategic	Surface	Deep	Strategic	Surface	Deep	Strategic	Surface
Agree	89.6	86.1	27.8	87.5	87.5	33.3	100	100	5.3
Neutral	10.4	10.4	32.2	12.5	12.5	16.7			47.4
Disagree		3.5	40			50			47.4

Note. Deep = deep approaches, Strat = strategic approaches, Surf = surface approaches

Table 1 shows general agreement across all three cohorts with both deep and strategic approaches to learning and general disagreement with surface approaches to learning. This would seem to demonstrate that students in this study differ from those considered in past studies as those students entering this chiropractic college with less science and lower GPA seem to employ deep approaches at a high level and avoid surface approaches at a high level.

Using the Chi-square test of independence via SPSS software comparing the response frequencies of the standard admission students and the AATP-science students, there was no significant difference for the ASSIST scales, deep $X2$ (1, N = 139) = .088, p =.767 (Table 2), strategic $X2$ (2, N = 139) = .918, p =.632 (Table 3), or surface $X2$ (2, N = 139) = 2.304, p =.316 (Table 4) learning approaches. The null hypothesis, $H_{0(1a)}$: Students admitted as AATP for lack of science will demonstrate no differences in their learning approaches compared to students admitted per standard admissions, cannot be rejected.

Table 2

Chi-Square Tests, Standard v. AATP-science, ASSIST Deep

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.088[a]	1	.767
Likelihood Ratio	.085	1	.771
N of Valid Cases	139		

Note. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.59.

Table 3

Chi-Square Tests, Standard v. AATP-science, ASSIST Strategic

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.918a	2	.632
Likelihood Ratio	1.596	2	.45
N of Valid Cases	139		

Note. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .69.

Table 4

Chi-Square Tests, Standard v. AATP-science, ASSIST Surface

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.304a	2	.316
Likelihood Ratio	2.517	2	.284
N of Valid Cases	139		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.91.

Using the Chi-square test of independence via SPSS software comparing the response frequencies of the standard admission students and the AATP-GPA students, there was no significant difference for the three scales, deep *X2* (1, *N* = 134) = 2.18, *p* =.140 (Table 5), strategic *X2* (2, *N* = 134) = 3.00, *p* =.223 (Table 6), or surface *X2* (2, *N* = 134) = 4.68, *p* =.096 (Table 7) learning approaches. The null hypothesis, $H_{0(1b)}$: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning approaches compared to students admitted per standard admissions, cannot be rejected.

Table 5

Chi-Square Tests, Standard v. AATP-GPA, ASSIST Deep

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.178a	1	.14
Likelihood Ratio	3.86	1	.049
N of Valid Cases	134		

Note. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.70.

Table 6

Chi-Square Tests, Standard v. AATP-GPA, ASSIST Strategic

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.002a	2	.223
Likelihood Ratio	5.239	2	.073
N of Valid Cases	134		

Note. 3 cells (50.0%) have expected count less than 5. The minimum expected count is .57.

Table 7

Chi-Square Tests, Standard v. AATP-GPA, ASSIST Surface

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.683[a]	2	.096
Likelihood Ratio	5.937	2	.051
N of Valid Cases	134		

Note. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.68.

The scales of ASSIST are broken into subscales including: for deep approaches; selecting main ideas, relating ideas, using evidence, interest in ideas, and monitoring effectiveness; for strategic approaches; organizing studying, time management, achieving, and awareness of assessment; and for surface approaches; lacking purpose, unrelated memorizing, fear of failure, and syllabus boundness. Tables 8, 9, and 10 shows the percentage of participants from each cohort whose responses aligned with agree, neutral or disagree within the subscales associated with ASSIST.

Table 8

Frequency of Responses per Cohort on the Subscales Associated with the ASSIST Scale for Deep Learning Approaches

	Deep														
	SM			RI			UE			II			ME		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Agree	73	75	78.9	75.7	66.7	73.7	83.5	83.3	78.9	80	79.2	84.2	84.3	91.7	100
Neutral	20.9	16.7	15.8	20.9	33.3	26.3	13	12.5	21.1	14.8	16.7	15.8	14.8	8.3	0
Disagree	6.1	8.3	5.3	3.5			3.5	4.2		5.2	4.2		0.9		

Note. SM = selecting main ideas, RI = relating ideas, UE = using evidence, II = interest in ideas, ME = monitoring effectiveness. Stand = Standard, AATP-S = AATP-Science, AATP-G = AATP-GPA, Standard, n = 115, AATP-Science, n = 24, AATP-GPA, n = 19

Table 9

Frequency of Responses per Cohort on the Subscales Associated with the ASSIST Scale for Strategic Learning Approaches

	Strategic											
	OS			TM			AC			AS		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Agree	69.6	70.8	63.2	77.4	79.2	94.7	92.2	83.3	94.7	70.4	75	73.7
Neutral	16.5	29.2	21.1	10.4	4.2	5.3	7	16.7	5.3	21.7	12.5	26.3
Disagree	13.9		15.8	12.2	16.7		0.9			7.8	12.5	

Note. OS = organized studying, TM = time management, AC = achieving, AS = awareness of assessment. Stand = Standard, AATP-S = AATP-Science, AATP-G = AATP-GPA, Standard, n = 115, AATP-Science, n = 24, AATP-GPA, n = 19

It may be important to note, that AATP-GPA students demonstrated a high degree of agreement in the Time Management subscale (Table 9) such that the neutral cell had only 5.3% (one response) and no responses for the disagreement cell. Chi-square

requires responses of at least five per cell for at least 80% of cells. This could account for a lack of significance in the subscale.

Table 10

Frequency of Responses per Cohort on the Subscales Associated with the ASSIST Scale for Surface Learning Approaches

	Surface											
	LP			UM			FF			SB		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Agree	5.2	8.3		23.5	45.8	15.8	42.6	41.7	47.4	63.5	37.5	47.4
Neutral	19.1	20.8	5.3	38.3	12.5	47.4	22.6	12.5	26.3	22.6	41.7	26.3
Disagree	75.7	70.8	94.7	38.3	41.7	36.8	34.8	45.8	26.3	13.9	20.8	26.3

Note. LP = lacking purpose, UM = unrelated memorizing, FF = fear of failure, SB = syllabus boundness. Stand = Standard, AATP-S = AATP-Science, AATP-G = AATP-GPA, Standard, n = 115, AATP-Science, n = 24, AATP-GPA, n = 19

When comparing the response frequencies for the subscale unrelated memorizing (Table 10) for the cohorts standard and AATP-science, Chi-square results demonstrated a significant difference, $X2$ (2, N = 139) = 7.586, p =.023 (Table 11). When comparing the response frequencies for the subscale syllabus boundness (Table 10) for the cohort's standard and AATP-science, Chi-square results were approaching a significant difference but did not achieve significance $X2$ (2, N = 139) = 5.686, p = .058 (Table 12). As demonstrated in the frequency tables (Table 10), a higher percentage of AATP-science students agreed with the concepts related to unrelated memorizing. While there was no significant difference in the response frequencies for the scale surface learning, there was a significant difference in the subscale unrelated memorizing with the subscale syllabus

boundness approaching a significant difference. The literature suggests that students whose education includes less science are more likely to engage in surface approaches (McNulty et. al, 2012, pp. 8-9; Tarabashkina & Lietz, 2011, p. 228). This is consistent for the subscales unrelated memorizing and syllabus boundness. Of interest, referring again to the frequency table (Table 10) a higher percentage of standard students agreed with the concepts associated with syllabus boundness than AATP-science students. This finding differs from the expectation based on the literature reviewed.

Table 11

Chi-Square Tests, Standard v. AATP-science, ASSIST Unrelated Memorizing

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	7.586a	2	.023
Likelihood Ratio	8.112	2	.017
N of Valid Cases	139		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.56.

Table 12

Chi-Square Tests, Standard v. AATP-science, ASSIST Syllabus Boundness

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.686a	2	.058
Likelihood Ratio	5.565	2	.062
N of Valid Cases	139		

Note. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 3.63.

It is also important to note the distribution of responses in the Fear of Failure subscale (Table 10). In this subscale, as in others for surface learning, a low degree of agreement would be preferable. However, across the three cohorts there is an equally high degree of agreement. While not significantly different across cohorts, it is important to note in planning for all student success.

Table 13

ASSIST Subscale Chi-Square Significance (p)

	Standard v AATP-science	Standard v. AATP-GPA
	N = 139, df = 2	N = 134, df = 2
	Significance (*p*)	Significance (*p*)
SM	.844	.859
RI	.303	.640
UE	.985	.487
II	.955	.595
ME	.626	.179
OS	.080	.847
TM	.562	.185
AC	.280	.884
AS	.496	.435
LP	.808	.167
UM	.023	.677
FF	.441	.767
SB	.058	.303

Note. SM = selecting main ideas, RI = relating ideas, UE = using evidence, II = interest in ideas, ME = monitoring effectiveness, OS = organized studying, TM = time management, AC = achieving, AS = awareness of assessment, LP = lacking purpose, UM = unrelated memorizing, FF = fear of failure, SB = syllabus boundness.

There were no significant differences when comparing response frequencies for standard students and AATP-GPA for the 13 subscales of ASSIST (Table 13). Sample size may have an effect on the results.

With regard to research question one (RQ1) How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA all differ with regard to learning approaches? Data analysis demonstrates no significant differences in the response frequencies related

to the scales of ASSIST; deep, strategic, and surface learning approaches, but does demonstrate significant differences in the response frequencies between standard admissions students and AATP-science students for the subscale unrelated memorizing with the subscale syllabus boundness approaching significance. Data analysis also demonstrates no significant difference in the response frequencies between standard admission students and AATP-GPA students in any of the 13 subscales. While not demonstrating significant differences in response frequencies, table 9 demonstrates that time management may be important to AATP-GPA students. Finally, there is no significant difference in the subscale fear of failure (table 10) as all three cohorts report equally high percentage of agreement in this area where disagreement would be preferred.

LASSI Results

Participants using the LASSI instrument are instructed to respond to the questionnaire statements in terms of how typical the statement is to the participant by answering A, B, C, D, or E, where A = not at all typical of me, B = not very typical of me, C = somewhat typical of me, D = fairly typical of me, and E = very much typical of me. Once the survey is complete, each answer translates to a number. For some responses, the range is A = 1 and E = 5 and for others the range is A = 5 and E = 1. The key is provided at the end of the survey (Appendix E). Each question aligns with one of the 10 subscales. Scores are added for a total in each subscale. Subscales are added for a score in each scale. Attached to the LASSI instrument is a table with possible scores in

each subscale arranged based on responses compared to typical United States college students. Scores that fall in the range of the 75th percentile and above are considered relative strength. Scores that fall in the range of the 50th percentile to the 74th percentile are considered needs improvement. Scores below the 50th percentile are considered weakness. Higher scores are associated with strength and lower scores with weakness across the scales and subscales. The scales for LASSI are skill, will, and self-regulation. Figure 3, is a graphical representation of the mean scores for all three cohorts across the three scales of the LASSI instrument, namely, skill strategies, will strategies, and self-regulation strategies.

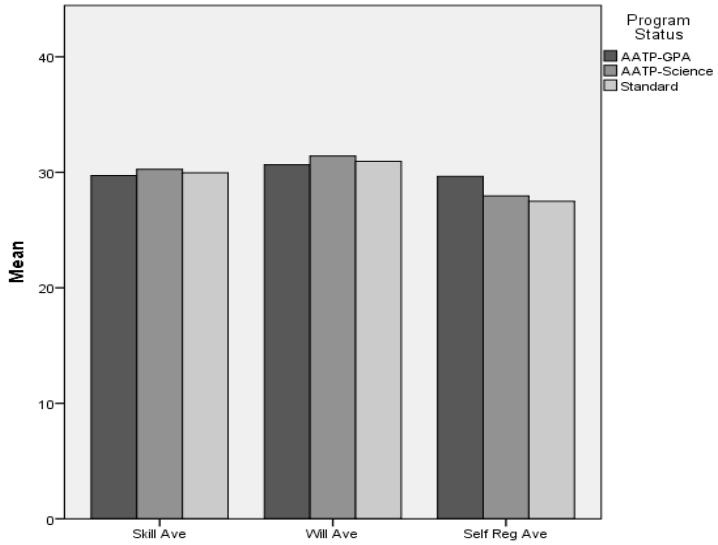

Figure 3. Mean scores for study cohorts and LASSI scales

Note: Skill Ave = Mean scores for skill strategies, Will Ave = Mean scores for will strategies, Self Reg Ave = Mean scores for self-regulation strategies.

A visual analysis of figure 3 demonstrates fairly equal distribution across the three scales of the LASSI instrument. The mean score for self-regulation for AATP-GPA appear greater than for both of the other cohorts.

Each participant's scores were totaled and compared to the table determining relative strength, needs improvement, and weakness per scale and subscale. Table 14 shows the percentage of participants from each cohort whose responses aligned with either relative strength, needs improvement or weakness across all three LASSI scales.

Table 14

Frequency of Responses Related to Strength per Cohort on the LASSI Scales

	Standard, n = 112			AATP-Science, n = 25			AATP-GPA, n = 18		
	Skill	Will	Self-Reg	Skill	Will	Self-Reg	Skill	Will	Self-Reg
Relative Strength	33	21.4	29.5	36	28	40	38.9	11.1	55.6
Needs Improvement	27.7	33.9	29.5	32	40	32	33.3	50	16.7
Weakness	39.3	44.6	41.1	32	32	28	27.8	38.9	27.8

Note. Skill = skill strategies, Will = will strategies, Self-Reg = self-regulation strategies

Table 14 shows general agreement across most of the scales. Of additional importance is to note is that most students' scores fall in the needs improvement or weakness categories across all three scales. The one exception is that AATP-GPA scores for self-regulation fall mostly in the area of relative strength. In addition to understanding the differences in these three cohorts, it is also important to recognize that

students in this study are mostly in the needs improvement or weakness rankings, both of which require support.

Using Chi-square tests of independence via SPSS software comparing the response frequencies of the standard admission students and the AATP-science students, there were no significant differences for any of the LASSI scales, Skill *X2* (2, *N* = 137) = .473, *p* =.789, Will *X2* (2, *N* = 137) = 1.377, *p* =.502 or self-regulation *X2* (2, *N* = 137) = 1.669, *p* =.434 strategies. As the categories of needs improvement and weakness both require student support and the purpose of this study is to understand how to better support students, the categories of needs improvement and weakness were combined and the statistical analysis was repeated. Utilizing this formula, there were no statistically significant differences in response frequencies across the three scales skill *X2* (1, *N* = 137) = .081, *p* =.777 (Table 15), will *X2* (1, *N* = 137) = .478, *p* =.789 (Table 16), and self-regulation *X2* (1, *N* = 137) = 1.053, *p* =.305 (Table 17) of LASSI when comparing standard and AATP-science students. The null hypothesis, $H_{0(2a)}$: Students admitted as AATP for lack of science will demonstrate no differences in their learning strategies compared to students admitted per standard admissions, cannot be rejected.

Table 15

Chi-Square Tests, Standard v. AATP-science, LASSI Skill

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.081a	1	.777
Likelihood Ratio	.08	1	.778
N of Valid Cases	137		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.39.

Table 16

Chi-Square Tests, Standard v. AATP-science, LASSI Will

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.504a	1	.478
Likelihood Ratio	.485	1	.486
N of Valid Cases	137		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.66.

Table 17

Chi-Square Tests, Standard v. AATP-science, LASSI Self-Regulation

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.053a	1	.305
Likelihood Ratio	1.02	1	.313
N of Valid Cases	137		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.85.

Using Chi-square tests of independence via SPSS software comparing the response frequencies of the standard admission students and the AATP-GPA students, there were no significant differences for any of the LASSI scales, Skill *X2* (2, *N* = 130) = .876, *p* =.645, Will *X2* (2, *N* = 130) = 2.050, *p* =.359 or self-regulation *X2* (2, *N* = 130) = 4.807, *p* =.090 strategies. As the categories of needs improvement and weakness both require student support and the purpose of this study is to understand how to better support students, the categories of needs improvement and weakness were combined and the statistical analysis was repeated. Utilizing this formula, there were no statistically significant differences in response frequencies across the LASSI scales skill *X2* (1, *N* = 130) = .237, *p* =.626 (Table 18) and will *X2* (1, *N* = 130) = 1.032, *p* =.310 (Table 19). Combining the categories needs improvement with weakness and comparing the response frequencies for Self-Regulation there was a significant difference noted, *X2* (1, *N* = 130) = 4.769, *p* =.029 (Table 20). The null hypothesis, $H_{0(2b)}$: Students admitted as AATP

with a lower than standard GPA will demonstrate no differences in their learning strategies compared to students admitted per standard admissions, can be rejected as there is a significant difference in the response frequencies for one LASSI scale.

Table 18

Chi-Square Tests, Standard v. AATP-GPA, LASSI Skill

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.237a	1	.626
Likelihood Ratio	.233	1	.629
N of Valid Cases	130		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.09.

Table 19

Chi-Square Tests, Standard v. AATP-GPA Will

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.032a	1	.31
Likelihood Ratio	1.161	1	.281
N of Valid Cases	130		

Note. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.60.

Table 20

Chi-Square Tests, Standard v. AATP-GPA Self-Regulation

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	4.769a	1	.029
Likelihood Ratio	4.496	1	.034
N of Valid Cases	130		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.95.

The scales are broken into subscales including: for skill strategies, information processing, selecting main ideas, and test strategies; for will strategies, anxiety, attitude, and motivation; and for self-regulation strategies, concentration, self-testing, study aids, and time management. Tables 21, 22, and 23 shows the percentage of participants from each cohort whose responses aligned with relative strength, needs improvement, and weakness within the subscales associated with LASSI.

Table 21

Frequencies of Responses per Cohort of the LASSI Subscale Skill

	Skill								
	INP			SMI			TST		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
RelativeStrength	59.1	64	50	23.2	16	38.9	37.5	44	38.9
Needs Improvement	20.5	4	38.9	32.1	48	27.8	20.5	32	16.7
Weakness	19.6	32	11.1	44.6	36	33.3	42	24	44.4

Note. INP = information processing, SMI = selecting main ideas, TST = test strategies, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA, Standard, n = 112, AATP-Science, n = 25, AATP-GPA, n = 18

Table 22

Frequencies of Responses per Cohort of the LASSI Subscale Will

	Will								
	ANX			ATT			MOT		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
RelativeStrength	36.6	44	22.2	22.3	32	16.7	35.7	40	33.3
Needs Improvement	19.6	24	27.8	34.8	28	55.6	33	36	33.3
Weakness	43.8	32	50	42.9	40	27.8	31.3	24	33.3

Note. ANX = anxiety, ATT = attitude, MOT = motivation, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA, Standard, n = 112, AATP-Science, n = 25, AATP-GPA, n = 18

It is important to note that while there was no significant difference in comparison of the response frequencies of the subscales anxiety, attention, and motivation (Table 22), all related to the scale will, and the subscale selecting main ideas (Table 21), a majority of all three cohorts fell into the needs improvement or weakness categories. An

assumption that the standard admission students would more likely align within these subscales as strengths while AATP students may demonstrate weakness is not true. It is possible that the reason there is no significant difference is because all cohorts demonstrate weaknesses equally. The institution will need to be prepared to support all students as it appears that entering students generally scored themselves low compared to other college students in the United States across several LASSI subscales (Appendix E, p. 11, LASSI Scoring Directions).

Table 23

Frequencies of Responses per Cohort of the LASSI Subscale Self-Regulation

	Self-Regulation											
	CON			SFT			STA			TMT		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
RelativeStrength	24.1	32	50	52.7	44	72.2	46.4	68	55.6	25.9	44	50
Needs Improvement	28.6	24	16.7	19.6	32	11.1	24.1	12	27.8	25	16	16.7
Weakness	47.3	44	33.3	27.7	24	16.7	29.5	20	16.7	49.1	40	33.3

Note. CON = concentration, SFT = self-testing, STA = study aids, TMT = time management, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA, Standard, n = 112, AATP-Science, n = 25, AATP-GPA, n = 18

When comparing the response frequencies for the subscale study aids for the cohorts standard and AATP-science and considering needs improvement and weakness as one category, Chi-square results were approaching a significant difference, but did not demonstrated significance $X2$ (1, N = 137) = 3.804, p =.051 (Table 24). As note in the frequency tables (table 23), a higher percentage of AATP-science students demonstrated a relative strength in use of study aids. When comparing the response frequencies for the

subscale time management for standard and AATP-science, the Chi-square results were approaching a significant difference, but did not demonstrate significance *X2* (1, *N* = 137) = 3.242, *p* =.072 (Table 25). As noted in the frequency tables (table 23), a higher percentage of AATP-science students demonstrated a relative strength for time management.

Table 24

Chi-Square Tests, Standard v. AATP-science, LASSI Study Aids

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.804a	1	.051
Likelihood Ratio	3.879	1	.049
N of Valid Cases	137		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.41.

Table 25

Chi-Square Tests, Standard v. AATP-science, LASSI Time Management

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3.242a	1	.072
Likelihood Ratio	3.061	1	.08
N of Valid Cases	137		

Note. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.30.

When comparing the response frequencies for the subscale concentration for cohorts standard and AATP-GPA, Chi-square results demonstrated a significant difference $X2$ (1, N = 130) = 5.192, p =.023 (Table 26). As noted in the frequency tables, (table 9) a higher percentage of AATP-GPA students demonstrated a relative strength for concentration.

Table 26

Chi-Square Tests, Standard v. AATP-GPA, LASSI Concentration

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	5.192a	1	.023
Likelihood Ratio	4.735	1	.030
N of Valid Cases	130		

Note. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.98.

Table 27

LASSI Subscale Chi-Square Significance (*p*)

	Standard v AATP-science	Standard v. AATP-GPA
	N = 137, df = 1	N = 130, df = 1
	Significance (*p*)	Significance (*p*)
INP	.699	.433
SMI	.430	.156
TST	.546	.910
ANX	.491	.234
ATT	.306	.588
MOT	.687	.900
CON	.413	.023
SFT	.433	.122
STA	.051	.472
TMT	.072	.109

Note. INP = information processing, SMI = selecting main ideas, TST = test strategies, ANX = anxiety, ATT = attitude, MOT = motivation, CON = concentration, SFT = self-testing, STA = study aids, TMT = time management.

With regard to research question two (RQ2) How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA all differ with regard to learning strategies? Data analysis demonstrates a significant difference in the response frequencies for the scale self-regulation for standard admissions students and AATP-GPA students. Data analysis also demonstrates a significant difference in the response frequencies for subscale concentration for standard admission students and AATP-GPA students. Data analysis demonstrates that the response frequency for the subscale use of study aids was approaching significance comparing standard admission students and AATP-science

students. Data analysis also demonstrated that the response frequencies for the subscale time management were approaching significance when comparing standard and AATP-science students. Also it is important to note that the AATP-GPA students in these two subscales actually demonstrated relative strength to a higher degree and that across all three cohorts needs improvement and weakness is demonstrated at a high level in several subscales (Tables 21 and 22). This could explain the lack of greater significance per this study and will be important to the institution in its planning. Results that are approaching significance, though not demonstrating significance, are important as the purpose of this study is to provide solutions to the problem identified in this study. Including information that approaches significance will be useful in creating solutions.

VARK Results

Participants using the VARK instrument are instructed to respond to each question or statement in the questionnaire that best describes them. Participants may respond with more than one answer and are encouraged to do so if the statement resonates. There are 16 questions in the VARK instrument. Each response corresponds to one of the four scales; V = visual learning preference, A = aural learning preference, R = read/write learning preference, and K = kinesthetic learning preference. Results were recorded as one for each answer that aligns with one of the four scales. These were tallied for total scores in each scale. Figure 4 includes the means scores for each of the four VARK scales across the three cohorts.

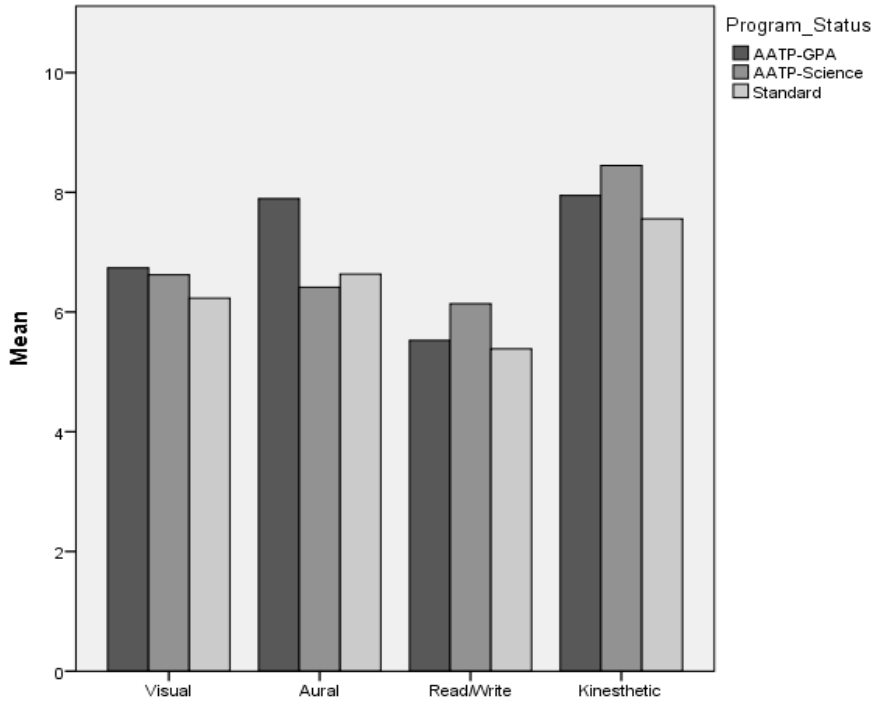

Figure 4. Mean scores for study cohorts and VARK scales

Visual analysis demonstrates a prevalence of the kinesthetic preference across all three cohorts. This is consistent with other health science research (Breckler et al., 2009, p. 34; James et al., 2011, p. 419). It also demonstrates prevalence for the aural preference for the AATP-GPA students.

Based on the total scores per scale and using the highest score for each participant, the dominant preference is determined. In cases where the highest score is equal for two or more of the preferences, the participant is determined to be multimodal. Table 28, shows the percentage of dominant preferences across all three cohorts and considers the four scales of VARK and the additional scale multi-modal.

Table 28

Frequencies of Prevalence per Scale and per Cohort from the VARK Instrument

	Standard n = 117	AATP-Science n = 29	AATP-GPA n = 19
Visual	13.6	20	20
Aural	18.6	6.7	20
Read/Write	10.2	10	0
Kinesthetic	35.6	40	30
Multi-Modal	21.2	20	25

As each scale has a total score for each student within the cohort, the mean scores for each scale are easily analyzed using an independent *t* test. There was not a significant difference in visual scores for standard admissions (M=6.23, SD=3.265) and AATP-science (M=6.62, SD=2.718); t(144)=-.594, p=.554. There was not a significant difference in aural scores for standard admissions (M=6.63, SD=3.242) and AATP-science (M=6.41, SD=2.758); t(144)=.114, p=.739. There was not a significant difference in read/write scores for standard admissions (M=5.38, SD=3.441) and AATP-science (M=6.14, SD=3.749); t(144)=-1.037, p=.302. There was not a significant difference in kinesthetic scores for standard admissions (M=7.56, SD=3.041) and AATP-science (M=8.45, SD=3.101); t(144)=-1.410, p=.161. The null hypothesis, $H_{0(3a)}$: Students admitted as AATP for lack of science will demonstrate no differences in their learning preferences compared to students admitted per standard admissions, cannot be rejected.

There was not a significant difference in visual scores for standard admissions (M=6.23, SD=3.265) and AATP-GPA (M=6.74, SD=3.942); t(134)=-.608, p=.554. There was not a significant difference in aural scores for standard admissions (M=6.63, SD=3.242) and AATP-GPA (M=7.89, SD=4.241); t(134)=-1.504, p=.135. There was not a significant difference in read/write scores for standard admissions (M=5.38, SD=3.441) and AATP-GPA (M=5.53, SD=3.062); t(134)=-.169, p=.866. There was not a significant difference in kinesthetic scores for standard admissions (M=7.56, SD=3.041) and AATP-GPA (M=7.95, SD=2.896); t(134)=-.524, p=.601. The null hypothesis, $H_{0(3b)}$: Students admitted as AATP with a lower than standard GPA will demonstrate no differences in their learning preferences compared to students admitted per standard admissions, cannot be rejected.

With regard to the research question three (RQ3) How do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA, all differ with regard to learning preferences? Data analysis demonstrates no significant differences related to the scales of VARK; visual, aural, read/write, and kinesthetic learning preferences. It is important to note that all students demonstrated some level of multi-modal learning preferences. Also of note is that all three cohorts demonstrated preference associated with kinesthetic learning consistent with other health science students.

Conclusion

The institution has been accepting students with varied admissions status since 2013. Per regulation, the institution has to provide transitional and academic support to the students admitted under the AATP program. The research question; how do students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA, all differ with regard to learning styles (approaches, strategies, and preferences) provides a guide for the methods described above. Valid and reliable instruments were identified. The literature indicates that the use of multiple tools provides for a deeper and broader understanding of the student. Utilizing the three tools, ASSIST, LASSI, and VARK, analyzed data has provided the necessary information to inform department chairs, faculty and academic counselors such that effective support can be developed and provided the AATP students. As the study has been conducted on site, ethical considerations have been made and protections employed to provide a safe environment for the student participants. The study is limited in scope by the size of the population being studied, but has the capacity to provide informed procedures and practices to better assist AATP students toward success in their chiropractic education.

Data analysis summarized includes findings for how standard admission students differ from AATP-science and AATP-GPA students as well as information that will be beneficial in supporting all students admitted to the institution. Of significance for the standard versus AATP-science students: There was a significant difference in the

response frequencies for unrelated memorizing subscale of the ASSIST instrument with the AATP-science students demonstrating a higher level of agreement with these concepts. The response frequencies for the syllabus boundness subscale of the ASSIST instrument were approaching significance with the standard students demonstrating a higher level of agreement with these concepts. The response frequencies for the use of study aids subscale of the LASSI instrument were approaching significance with the AATP-science students demonstrating a higher level of relative strength. The response frequencies for the time management subscale of the LASSI instrument were approaching significance with AATP-science students demonstrating a higher percentage of relative strength.

Of significance for the standard versus AATP-GPA students is that there were no significant differences across the ASSIST scales, but it is interesting to note, that the AATP-GPA students had a slightly higher preference toward strategic approaches. Strategic approaches are defined as those specifically to achieve higher marks. There was a significant difference in the response frequencies for the self-regulation scale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength. There was a significant difference in the response frequencies for the concentration subscale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength.

Also important from the data analysis, all three study groups reported equally agreement with the subscale fear of failure of the ASSIST instrument. As a surface

learning subscale, it is preferable that there be greater disagreement with this concept. All three study groups also demonstrated equal levels of needs improvement or weakness in the subscales anxiety, attitude and motivation of the will scale of the LASSI instrument. While not demonstrating a difference among students by admissions status, it does demonstrate an important concept for the institution to address as its incoming students are demonstrating high levels of fear and anxiety on entering their graduate education. All three study groups were equally weak in the subscale selecting main ideas of the scale skill of the LASSI instrument. These findings were unexpected and must be considered in planning for student success and support.

The data collected and analyzed provide information to develop a student support program for the institution. The final product will be produced as a report to the institution administration and leaders reporting the background need for the study, findings of the research, and recommendations based on literature review. While it is important per regulation to describe needed support for AATP students, based on the data analysis, it is equally important to address additional support for all students enrolled at this institution. Data analysis suggests that students participating in this study across all three admissions statuses enter with some level of anxiety and fear, and need support in a variety of areas. The final report will provide literature based recommendations specific to the AATP students, but also recommendations to general support of the institution's students. This final project will be provided as an executive summary report.

Section 3: The Project

Introduction

In this section I will describe the details of the project associated with the study conducted to better understand the differences in learning approaches, strategies, and preferences of students admitted per standard admissions, AATP-science and AATP-GPA at the institution during the study period. The project is described relative to the findings of the research and is also based on a review of the literature reported in this section. Recommendations are provided to the institution concerning support for students including AATP students. These recommendations include peer-assisted learning, informed advising, and case-based learning. The rationale for these elements of the project is presented and is followed by a review of the literature. This review includes a theoretical foundation and literature review for each of the modalities recommended in the project. An implementation strategy including proposed timelines is provided as well as some discussion regarding existing resources and potential barriers to this proposal. These are all presented in terms of the components or initiatives within the proposal. A project evaluation is discussed at both the institutional and initiative level. Implications for social change are addressed and include issues raised in sections one and two and the psychosocial issues that became apparent through data analysis.

Description and Goals

The project that has resulted from this study is reported in an executive summary of the problem, the findings, and recommendations to the institution where the study was

conducted. The problem identified in Section 1 is that the institution is now admitting students with less than the standard required science courses and less than the standard GPA. These students require additional support toward their success, but how these students learn compared to those that meet the standard admissions requirements is not understood. This study looked at the differences in the ways that these students learn compared to the traditional or standard admission students. To provide adequate academic and other supportive systems, institutions must understand the differences in these students especially as it relates to their learning styles including approaches, strategies, and preferences.

The results of the research conducted in this study demonstrated differences in the students based on admission status, but also identified some important information about all three student cohorts studied that need to be addressed. Of significance for the standard versus AATP-science students was there was a significant difference in the response frequencies for the unrelated memorizing subscale of the ASSIST instrument (p = .023) with the AATP-science students demonstrating a higher level of agreement with these concepts. The response frequency for the syllabus boundness subscale of the ASSIST instrument were approaching significance (p = .058) with the standard students demonstrating a higher level of agreement with these concepts. The response frequency for the use of study aids subscale of the LASSI instrument were approaching significance (p = .051) with the AATP-science students demonstrating a higher level of relative strength.

Of significance for the standard versus AATP-GPA students: There were no significant differences across the ASSIST scales, but it is an interesting note, that the AATP-GPA students had a slightly higher preference toward strategic approaches. There was a significant (p = .029) difference in the response frequencies for the self-regulation scale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength. There was a significant (p = .023) difference in the response frequencies for the concentration subscale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength.

Also important from the data analysis, all three study groups' response frequencies demonstrated agreement for the subscale fear of failure on the ASSIST instrument. As a surface learning subscale, it is preferable that there be greater disagreement with this concept. All three study groups also demonstrated equal levels of needs improvement or weakness in the subscales anxiety, attitude and motivation of the will scale of the LASSI instrument. While not demonstrating a difference among participating students by admissions status, it does demonstrate an important concept for the institution to address as its incoming students are demonstrating high levels of fear and anxiety on entering their graduate education. All three study groups' response frequencies were equally weak in the subscale selecting main ideas of the scale skill of the LASSI instrument. These findings were unexpected, but must be considered in planning for student success and support at this institution.

To address the problems identified in the study and especially those of significance based on the data analysis, literature-informed recommendations are made to policy and the program. These include; peer-assisted learning specifically, supplemental instruction and peer mentoring, informed advising, and case-based learning. The following recommendations including benefits as related to the outcomes of this study are provided to the program and are included in the executive summary.

Peer-Assisted Learning

The institution should design and implement two programs, a supplemental instruction (SI) program and a peer mentoring program. These are described below.

Supplemental Instruction (SI). The institution has already identified the most highly failed course in each of the first eight terms (2 calendar years). SI should be organized through the Center for Excellence in Teaching, Learning and Technology (CETLL). The programs should be designed based on the current pedagogy used in the primary course (designed with different and interactive approaches) and to ensure group participation. The SI courses should be sure to address the identified needs both strengths and weaknesses of AATP students, namely, unrelated memorizing as a weakness, must make the material relevant; syllabus bound, again make material relevant to learners; use of study aids as a strength, identify appropriate study aids for the supplemental course as part of the design and teach study skills as part of the course. The institution will need to plan the development and implementation of these programs based on budget needs and constraints and human resource capacity. If possible, design

the first four courses and implement and then add one per term until all eight are in place. Citing Arendale, 2004; Amstutz, Wimbush, and Snydet, 2010; Arendal, 2005; and Shook and Keup, 2012, Ticknor et al. (2014) identify best practices for SI to include mandatory attendance and peer led settings (p 53). As the institution has a requirement to support AATP students, these SI courses should be mandatory for all AATP students, but open to all students who desire or need the additional support.

Benefits of SI relative to the support of AATP students based on the results of this research include the following. The SI courses will support the AATP-science students with higher unrelated memorizing results by providing course content relevance to self and professional pursuit. SI courses will support AATP-science students with lower syllabus bound results (desired) by helping them to focus on what is important in the course. SI courses will support the strength of AATP-science students use of study aids by providing additional aids. SI courses support the need for multiple pedagogies per VARK results of multi-modal learners. SI supports AATP-GPA students that demonstrated strength in self-regulation, specifically in concentration as SI has proved useful in support of the concentration subscale of LASSI (Malm et al., 2105, p. 363). SI courses will support the overall need for students with weakness in anxiety, attitude, and motivation (Hoops et al, 2015, p. 136; Malm et al., 2015, p 363)

Peer Mentoring. A review of the literature demonstrates that institutions have successfully implemented a number of peer mentoring models. Aligning a successful senior student with a small group of students has proven successful and could work for

the institution (Chester, Burton, Xenos & Elgar, 2013, p. 30; Hryclw, Tangalakis, Supple, & Best, 2013, p. 84; Zaniewski & Reinholz, 2016, p. 8). The institution has in place a clinical internship program as a capstone experience. The institution has plans to add clinical observations to the learning of new students to its curriculum. The new observational program could be arranged and managed through a senior clinical intern as the facilitator. Rather than random assignments of senior and more junior students for observation only, the institution should consider matching senior student mentors (clinical interns) to small groups of incoming students and provide the mentor groups with opportunities to meet and talk about specific issues. The senior mentor can also work with the junior students to ensure that observations are arranged. Having studied successful mentor programs, Zaniewski and Reinholz (2016) suggested the following: first give participants choice in pairing with a mentor, second make the mentor and mentee accountable to each other, third monitor relationships for concerns, fourth take community into account in building the program and fifth enable informal and food-centric meetings (p. 10). Again, this program may be mandatory for AATP students and available to others, but given the outcomes of the research demonstrating a need across all entering cohorts toward psychosocial support, such a program may be beneficial to all. This effort will take considerable coordination and resources. To begin, perhaps start with the incoming AATP students (usually no more than 20 students and often less). Then test the results over time and consider whether expansion is indicated.

Benefits of peer mentoring relative to the support of AATP students based on the results of this research include. Peer mentoring supports the AATP-science students with a high association to unrelated memorizing as it can provide successful strategies to supplement learning especially helping students understand the relevance of the material (Chester et al., 2013, pp. 33-34). Peer mentoring supports the strengths of the AATP-science students in syllabus bound and use of study aids as mentors have succeeded in the program and can help in these areas (Chester et al., 2013, pp. 30). Peer mentoring will similarly provide support for AATP-GPA students with strength in concentration and supports all students needs to academically and socially integrate (Chester et al. 2013, p. 30; Hryclw et al., 2013, p. 80). Additionally, peer mentoring supports learners challenged by content-focused courses by providing a contextual understanding (Good, Ramos, & D'Amore, 2013, p. 85).

Informed Advising/Counseling

Currently, AATP students have mandatory meetings with the AATP advisor and the academic counselor at least during the first term of matriculation. Training both of these parties on the correct use of the LASSI and ASSIST instruments will be required. The institution should consider purchasing licenses for one or both tools as an online offering (the assessment is done immediately). If budget constraints limits to the use of one of the tools, it is recommended that the LASSI instrument be utilized as it demonstrated more results on this study that were significant to advising. While there were only limited data that proved significantly different for the cohorts studied,

individuals within this study had very different results demonstrating the need to consider each student individually when it comes to advising. Using the computer-based LASSI, results would be immediate and so advising incoming AATP students would be easier for the advisors and counselors. Additionally, follow-up could be done using the same tools as the student progresses through the program.

Benefits of informed mentoring relative to the support of AATP students based on the results of this study include. Informed advising supports the individual student around his or her own needs (Hoops et al., 2015, p. 142). This study has demonstrated some identified differences in the standard and AATP students, but has also identified some serious needs that are common to all and that each student is an individual. The informed advising/counseling initiative supports the needs of the individual.

Case Based Learning (CBL)

Developing and implementing CBL is a considerable undertaking that includes the need for planning resources and training. First, the institution should consider which courses in the first 2 years (preclinical) training would benefit from the addition of CBL. Faculty will require training in the development and use of CBL. The CELTT along with department chairs should lead this initiative. As the clinic has been in operation for over 35 years, cases can be identified from the current clinical archives of the college health center. Specifically, the type of case needed in a course has to be identified, and then case/s must be located. The clinic has in place a program known as *Clinical Case of the Week* that utilizes case based learning for interns in their final year. Senior interns

participate in this program weekly as part of their clinical training that provides broad exposure to a variety of patient presentations. This program and its rubrics can be adapted to earlier course work. Aligning the current *Case of the Week* program with a new CBL program will accomplish not only getting CBL in the classroom, but will also better prepare students for their clinical capstone experience.

Benefits of case-based learning relative to the support of AATP students based on the results of this study include. CBL provides support for multiple pedagogies needed to reach all learners. CBL improves and develops strategic and deep approaches in learners (Baeten et al., 2012, pp. 6-7; Kantar & Massouh, 2015, p. 13).

Goals of the Project

The goals of this project are related to the problem statement and to some of the data supporting the need for this project and ultimately will be measured as outcomes of the program. The goals include:

- Provide better support to AATP students admitted to the institution.
- Improve NBCE-related outcomes for AATP students admitted to the institution.
- Provide both cognitive and psychosocial support.
- This last goal is added as students in this study, across all three cohorts. demonstrated a fear of failure (per the ASSIST instrument findings) and anxiety (per the LASSI instrument findings) to a greater extent than those represented in the grading rubric on the LASSI tool (Appendix E, p. 11). As such, both cognitive and psychosocial

support is needed. The project addresses these needs and provides support for AATP and other students.

Rationale

This project, recommendations to policy and the program at the institution, was chosen based on a review of the literature that identified successful initiatives for addressing both cognitive and psychosocial needs of diverse groups of students. The problem identified in section one and the data analysis completed in section two provided a foundation of information that describes the differences of the AATP-science students and the AATP-GPA students when compared to the standard admission students. Also, the data provided significant information regarding all three cohorts specifically as it relates to the psychosocial aspects of the project.

As described above, data analysis defined specific differences in the cohorts that will be addressed in the building of supplemental instruction courses and the process of informed advising for AATP students. Supplemental instruction and peer mentoring also provide the opportunity to address the cognitive issues, but have been shown to greatly affect the psychosocial issues as well (Arendale & Hane, 2014, p. 13; Chester et al., 2013, p. 31; Zaniewski & Reinholz, 2016, p. 6). Also described in the problem statement is the issue of pedagogy. Faculty members have been working to improve, but tend, as do others, to deliver courses in the way they were taught and have a difficult time changing. Supplemental instruction will give the institution the opportunity to introduce multiple methodologies into learning and to align these with needed learning strategies.

Also, the initiative to introduce case-based learning (CBL) throughout the curriculum has been shown to be useful in health sciences to shift toward deep learning and to help students align content clinically (Baeten, Dochy, & Struyven, 2012, p. 12).

The project genre of a policy recommendation was chosen simply as the practical way to communicate the information learned from the results of this study and the literature informed recommendations to the academic leadership at the institution. The Executive Summary attached as Appendix A, provides summary of the problem, summary of the study results including data analysis, and specific recommendations as above to remedy the identified problems. This Executive Summary also provides a format that works well with the institutional planning processes as these projects need to be built into the institution's planning and budgeting processes.

Review of the Literature

Theoretical Foundation

As described in the problem section, the institution admits students with other than standard admissions requirements under the AATP. The purpose of this study was to determine the differences in learning styles of students admitted per standard admission requirements and those admitted under the AATP program and develop supportive strategies for those admitted as AATP students. The tracking and support of AATP students is required by the CCE (CCE, 2015, p. 16). Support, in this context, may be considered as the efforts toward or supportive of student development.

Chickering and Reisser (1993) expanded on Chickering's early work defining seven vectors for student development and growth for college students (pp. 45-51). These include: 1. Developing competence; intellectual, physical, and interpersonal, 2. Managing emotions, 3. Moving through autonomy toward interdependence: not dependent on others, 4. Developing mature interpersonal relationships: Healthier relationships and appreciation of others, 5. Establishing identity, 6. Developing purpose: long term vocational and personal, and 7. Developing integrity: congruence of beliefs, values and actions (Chickering & Reisser, 1993, pp. 45-51; Arendale & Hane, 2014, p. 11).

Chickering's seven vectors are often categorized as Psychosocial in nature (Chickering & Reisser, 1993, p. 2). Cognitive theories may be described in terms of changes of student's thinking (Chickering & Reisser, 1993, p. 6). Therefore aspects of the vectors may also be considered cognitive in nature. This suggests that student development is both cognitive and social and is evidenced in the many successful student support projects at colleges and universities that are peer led or collaborative in nature. Problem based learning (PBL) as an example is considered a combination of cognitive (scientific) and social constructivist approaches (Malan, Ndlovu, & Engelbecht, 2014, p. 2). Peer mentoring programs have also been shown to be successful for both cognitive and social outcomes in first year college students (Chester, Burton, Xenos, & Elgar, 2013, p. 30; Hryclw, Tangalakis, Supple, & Best, 2013, p. 84; Zaniewski & Reinholz, 2016, p. 10). The vectors are not considered a continuum, but rather that an individual

may be at various stages of development on any of the seven vectors. The authors state that student development philosophy should be at the core of an institution (Chickering & Reisser, 1993, p. 44). Also, institutions must not only impart knowledge and skills, but confidence, creativity and social responsibility (Chickering & Reisser, 1993, p. 44).

As described in Section 1, constructivist learning theory is the idea that students construct knowledge through their interactions with the learning environment and in their own way, such that teachers cannot just transfer knowledge (Ocepek, Bosnic, Serbec, & Rugelj, 2013, p. 343). Arendale (2014) referencing Jean Piaget (Piaget & Inhelder, 1958) stated that long-lasting learning is not achieved without the student's active construction of the knowledge (p. 4). Learning cannot be passive. He also describes a specific application of constructivism developed by Lev Vygotsky (1962) known as the Zone of Proximal Development (ZPD) wherein Vygotsky argues that the presence of an advanced peer can serve to raise the whole group of students (Arendale 2014, p. 5). Arendale (2014) also states that ZPD can explain why a peer-lead group for one course can raise the performance of those students in other course work as the learning behaviors are subsequently transferred to other work (p. 5).

Chickering's seven vectors of student development demonstrate the need for both cognitive and social or psychosocial development. Constructivist theory identifies that students need to build on their experiences and must actively participate in their learning. Therefore, for this project, it is important to examine literature that consider the learning outcomes as well as the social impact of a project or research consideration. Given the

findings of the data analysis related to this study which include high levels of anxiety and fear of failure related to the program, it is evident that students in this study require not only academic support, but social support as well.

Review of Current Literature

In addition to reviewing topics related to theoretical foundation for student development, this literature review identified three areas within the current research that have been useful at various institutions with regard to student development and growth. These are peer-assisted learning strategies and programs, informed student advising, and interactive pedagogical approaches. Within the peer assisted learning programs, two specific types of programs appear in the literature, supplemental instruction and peer mentoring, which have been shown to improve learning outcomes, retention and persistence. Some of the terms associated with the search included: peer studies, supplemental instruction (SI), peer assisted learning (PAL), problem based learning (PBL), case based learning (CBL), academic advising, academic counseling, advising, peer mentoring, supportive structures, student support, academic support program/s, supportive materials, study skills, approaches and study skills inventory (ASSIST), and Learning and Study Strategies Inventory (LASSI). The literature search was conducted using Walden library resources and Google Scholar. Additionally, articles located via the initial search were also used as a source for finding articles that had either cited the initial article or were cited by the initial article. The latter was useful in discovering seminal work and theoretical foundations.

Peer-assisted learning. Most authors consider peer-assisted learning strategies to be best practices. Ticknor, Shaw and Howard (2014) provided an analysis of peer assisted learning programs, SI and tutoring programs and found all to be effective (pp. 53-54). The authors also found that peer-led programs were not only effective for struggling students, but many who achieve A and B grades participate and benefit (Ticknor et al., 2014, p. 62). Students that participate in peer assisted learning have higher levels of engagement, improved confidence, and better retention rates than those that do not participate (Arendale & Hane, 2014, p. 7; Hendrickson, 2014, p. 24; Higgins, Reeh, Cahill, & Duncan, 2015, p. 31; Hryclw et al., 2013, p. 84; Zaniewski & Reinholz, 2016, pp. 9-10). Peer assisted learning programs have been shown to improve academic performance of participants including GPA (Hendrickson, 2014, p. 24; Hryclw et al., 2013, p. 84; Zaniewski & Reinholz, 2016, p. 2). Students who participate in peer assisted learning programs associated with a specific course demonstrate that the strategies and skills learned are transferred to other courses and work (Arendale, 2014, p. 5; Hryclw et al., 2013, p. 84). In addition to academic outcomes, some authors found that interpersonal skills improved and that participants reported social benefits (Arendale & Hane, 2014, p. 13; Chester et al., 2013, p. 31; Zaniewski & Reinholz, 2016, p. 6).

Some of the recent research has considered results relative to learning styles (specifically learning approaches) and association with participation in peer assisted learning. Chester, Burton, Xenos, and Elgar (2013) studied 241 first year psychology students considering the effect of a peer mentoring program (p. 30). The authors saw a

significant increase in the use of deep and strategic approaches and a decrease with surface approaches as measured using ASSIST among the participants (Chester et al., 2013, pp. 33-34). Arendale and Hane (2013) found that students who participated in the peer assisted learning program at the University of Minnesota, demonstrated development in five of the seven vectors described by Chickering (p. 21). The authors concluded that participants demonstrated growth in four areas including engagement, confidence, interpersonal skills, and critical thinking skills (Arendale and Hane, 2013, pp. 25-26). Another important finding is that while authors agree that there are differences in the benefits of participation across genders, other underrepresented groups including low-income students and African American males benefit more than other groups (Arendale, 2014, p. 2; Ticknor et al., 2014, p. 60; Zaniewski & Reinholz, 2016, p. 10). Most of the studies cited include work done at the undergraduate level and much of that is with first year students. It is apparent that peer-assisted programs create positive effects for students challenged or not in regards to academic and social outcomes which can be measured in terms of learning approaches.

Supplemental instruction. The practice of supplemental instruction (SI) has been in place at institutions of higher education for over 40 years (Dawson, Van der Meer, Skalicky & Cowley, 2014, p. 633). Unlike other forms of peer assisted learning such as tutoring, SI does not target the academically weak or those experiencing challenges. Rather SI is associated with typically difficult (high-risk) courses, provides large or small group discussion led by a trained senior peer that has been successful in the course,

incorporates a variety of learning methods focusing on what to learn as well as how to learn, and is available to all students in the associated course (Clark & May, 2015, p. 502; Dawson et al., 2015, pp. 609-610; Hryclw et al, 2013, p. 80; Malm, Bryngfors, & Morner, 2015, p. 347).

Dawson, Van der Meer, Skalicky, and Cowley (2014) conducted an extensive systematic review of the literature between 2001 and 2010 on the effectiveness of SI (p. 610). Prior to this review, the USDE had, in 1995, completed a review and validated much of the literature to that ncepoint (Dawson et al., 2014, p. 609). Citing Martin and Arendale (1993), the authors state that the USDE supports SI claiming that students who participate in SI achieve higher final grades than those who do not participate, participating students are less likely to withdraw from the high-risk course, and participants persist (reenroll and graduate) at a higher rate than non-participants (Dawson et al., 2014, p. 611). The authors reviewed 103 articles of the 1415 that were found in the initial search, but ultimately only included 29 in the final review as these were the only articles to assess the effect of SI on the participant (Dawson et al., 2014, pp. 609-610). The authors conclude that the literature from 2001 to 2010 supports the claims of the USDE but that further research is still needed (Dawson et al., 2014, p. 634).

SI programs vary to some degree from program to program as design includes course content as well as introducing students to a variety of ways to learn. The latter is with the intent that study skills and approaches will develop and deep and strategic approaches can be supported. One of the important concepts is that while the content of a

high-risk course is being supported within the SI course, the study skills and approaches will be transferred to other course work (Arendale, 2014, p. 5; Hryclw et al., 2013, p. 84). When study skills and approaches are included in supportive course work, studies show that student's skills are enhanced. Hoops, Yu, Burridge, and Worlters (2015) studied 98 students enrolled in a student success course required for the bachelor's degrees in education at the participating university and compared GPA, retention and engagement (p. 124). It was discovered that participants had significant improvement in self-regulated learning and development across all 10 subscales of LASSI as measured posttest (Hoops et al., 2015, p. 136). Wernersbach, Crowley, Bates, and Rosenthal (2014) studied 300 students early in their undergraduate experience to compare self-efficacy between those who participated in study skills instruction and those who did not (p. 14). The authors noted a change in self-efficacy for those enrolled and concluded that students with less preparation required greater assistance and a course that includes study skills is advantageous (Wernersbach et al., 2014, p. 23). Miskioglu (2015) studied chemical engineering students at the Ohio State University comparing learning styles to self-efficacy (p. 5). Within this study, the author questioned the need for groups to be heterogeneous or homogeneous in nature and discovered that heterogeneous groups demonstrated better performance with a broader range of student skills and understanding, and that most groups that are randomly formed are heterogeneous (Miskioglu, 2015, p 15).

Malm, Bryngfors, and Morner (2015) studied 2463 former students and 769 current students from 12 engineering programs to consider the impact of an SI program (p. 351). The SI course was available to all but not mandatory. Records indicate that attendance versus non-attendance varied across cohorts and ranged from 49% to 64%. The results of the study indicated that participants completed about 30% more credits in the first year than non-participants (Malm et al., 2015, p. 362). Participants also had improved performance compared to non-participants and this performance was not limited to the SI-related courses (Malm et al., 2015, p. 363). Finally, participants scored higher on the LASSI's subscales of attitude, concentration, motivation and time planning and lower for anxiety than non-participants (Malm et al., 2015, p. 363).

While SI programs have traditionally been utilized to support first year undergraduate students, SI programs have recently been introduced in the health sciences, though none in the literature review were found for chiropractic education. Clark and May (2015) studied 55 third year nursing students to consider the effects of SI with transfer students in the nursing program (p. 505). The program known as Guided Study Sessions (GSS) was developed based on SI and includes group sessions that focus on knowledge and skills including academic and social challenges (Clark & May, 2015, p. 500). LASSI was utilized to provide focus on needed skills for the group sessions. The authors concluded that an SI model is appropriate to support upper-level courses especially gateway courses, that linking skills relevant for curricular needs can enhance the success rate and that LASSI or similar instrument may be useful for identifying skills

to focus on (Clark & May, 2015, pp. 511-512). Hryclw, Tangalakis, Supple and Best (2013), studied 483 mature students enrolled in a Bioscience for Paramedics course and co-enrolled in the peer-assisted study session (PASS) an SI program (p. 80). The study demonstrated that the PASS program was effective for improved academic performance, understanding of subject matter, student confidence, and providing better strategies which led to better learning outcomes (Hryclw et al., 2013, p. 84). While this study was conducted using mature student participants, the results are similar to other studies.

Another example in the health sciences is the SI program introduced at the Feik School of Pharmacy in San Antonio, Texas. This program is similar to others in that it does focus on at-risk courses, but differs in that it is taught by the course lead faculty rather than by student peers and is mandatory for at-risk students (Mosley, Maize, & LaGrange, 2013, 176). The study included 137 participants who were first or second year pharmacy students (Mosley et al., 2013, p. 176). The students that participated in the SI program felt that it enhanced their experience and that their grades improved (Mosley et al., 2013, p. 178). The mandatory nature of the program was not seen as negative by those who participated in the study (Mosley, et al., 2013, p. 178).

SI has been utilized for undergraduate support and has been shown effective in improving both academic and social outcomes for over 40 years. Only recently has SI been introduced to upper-level health science education, but the limited research available indicates that this practice is useful for these students as well. One institution modified the model significantly by not using peer instruction. While the specific model

may need to be created to meet the needs of the students and culture at the institution providing the support, SI clearly demonstrates promise for supporting students in the course associated with the supplemental instruction, for other course work and learning and provides psychosocial support as well.

Peer mentoring. Peer mentoring programs have been shown to be useful for first year undergraduate students and have improved academic success as well as social integration and therefore both retention and persistence (Chester et al. 2013, p. 30; Hryclw et al., 2013, p. 80; Zaniewski & Reinholz, 2016, p. 1). Peer mentoring programs are not as common in the literature as supplemental instruction programs. It is unclear whether there are fewer programs or the programs are not as frequently studied. The programs that are described and studied vary in specific design as do most programs at institutions. One author described a peer mentoring program that utilizes third-year students as peer mentors to a small group of first-year psychology students (Chester et al., 2013, p. 30). Small groups met for tutorials that included focus on five aspects of student success (capability, connectedness, resourcefulness, purpose, and culture) and learning approaches including deep, strategic, and superficial as measured with ASSIST (Chester et al., 2013,p. 30). The findings of the study indicated significant increases on three of the five indicators including: connectedness, culture and resources, and improvements in both deep and strategic learning with decreases in surface learning (Chester et al., 2013, pp. 33-34).

The PASS program, described above for paramedic students, also included a peer mentoring component. The authors describe the mentors' role as assisting in the understanding of content (Hryclw et al., 2013, p. 80). In concluding the study, the authors noted a positive contribution to both the academic and social integration with students reporting that participation had improved their "student networks" meaning their student to student connections (Hryclw et al. 2013, p. 84).

Zaniewski and Reinholz (2016) conducted a qualitative study of the "Near-Peer Mentoring Program" at Arizona State University (p. 1). The program consists of first year mentees and senior mentors all from STEM majors and all pairs have the same major. Mentors were students who had demonstrated good academic success and included sophomores through graduate students (Zaniewski & Reinholz, 2016, p. 1). The program focused on both psychosocial and academic issues and included a minimum number of required meetings and time during the meeting. Topics covered included coursework, time management, studies, social issues, stress, and finding work (Zaniewski & Reinholz, 2016, p. 6). Mentors and mentees reported socializing outside of the required meetings and meeting at other times than the required minimum (Zaniewski & Reinholz, 2016, p. 8). In conclusion the authors made five recommendations to institutions considering a peer mentoring program:

1. Give participants choice in pairing with a mentor.
2. Make the mentor and mentee accountable to each other.
3. Monitor relationships for concerns.

4. Take community into account in building a program.
5. Enable informal and food-centric meetings (Zaniewski & Reinholz, 2016, p. 10).

Peer mentoring provides opportunities for students who have successfully experienced the program and curriculum to provide some guidance to younger students. The limited data suggests that mentoring with a more senior peer will improve the newer students' outcomes both socially and academically.

Informed student advising. Young-Jones, Burt, Dixon, and Hawthorne (2013), conducted a study of 611 undergraduate students enrolled in a psychology course at a major university to understand the impact academic advising has on student success (p. 7). The study identified six factors that significantly related academic advising to student success; advisor accountability, advisor empowerment, student responsibility, student self-efficacy, student study skills, and perceived support (Young-Jones et al., 2013, p. 11). All of these were impacted by personal variables including gender and first-generation student status (Young-Jones et al., 2013, p. 15). The findings indicated that students with strong study skills, greater sense of responsibility, and higher self-efficacy are more likely to succeed (Young-Jones et al., 2013, p. 16). Therefore, academic advisors have an opportunity during the first year to both understand and influence the student.

On review of the literature, there were many programs that, like this institution's, are reactive in nature, but also demonstrate success and some that are data-informed.

There are fewer that are pro-active, but the few that were identified in the review were also informed programs. Some of the current reactive programs include study skills or other supportive course work for those who have struggled. Dill et al. (2014) studied 145 university students that had been academically suspended and subsequently participated in a Learning Skills Support Program (LSSP) class as part of their re-admission (p. 20). The course content is informed by LASSI and its 10 subscales (Dill et al., 2014, p. 21). Participants' awareness of the subscales is improved from pretest to posttest and 85.6% of participants were ultimately removed from academic suspension (Dill et al., 2014, p. 28). Hendrickson (2014) conducted a program review of a similar course "Insights on Success" offered to students on academic probation at the Rochester Institute of Technology (pp. 6-7). This course also uses LASSI to inform the content and the findings indicate improvement in GPA, removal from academic probation and improved completion in the cohort studied (Hendrickson, 2014, p. 24). Hoops, Yu, Burnidge, and Wolters (2015) studied 196 students half of whom had enrolled in a student success course at a large southwestern public research university (p. 128). This course also utilized LASSI and the findings indicated that participants demonstrated significant improvement in self-regulated learning across all 10 subscales of LASSI (Hoops et al., 2015, p. 136). The authors concluded that such courses cannot be "one-size fits all", but need to be designed based on the participants (Hoops et al., 2015, p. 142). These programs are all course based, but inform advisors of the need to individualize based on student's learning styles as measured based on a tool such as LASSI.

Another project looked at the success of an intervention program for academically dismissed and challenged students which was also reactive, but is not course-based. McNaught (2014) studied the success of a program known as a Solution Focused Brief Therapy (SFBT) model employed by academic counselors (p. 3). The plan, as described by the author, is not dictated by the counselor, but rather the counselor assists the student in the development of their own plan based on prior successes and the current experience (McNaught, 2014, pp. 3-4). Prior to implementation, 60 to 70% of students that had been re-admitted failed again and were dismissed (McNaught, 2014, p. 3). From 2011 and 2012 (the study period), 60% were in good standing 1 year later and only 30% had been dismissed (McNaught, 2014, p. 5).

Other programs that may inform academic advisors consider the pace or rate at which students take courses or move through a curriculum. Arvidson, Green, Allen, Mavis, Osuch, Lipscomb, O'Donnell and Brewer (2015) surveyed 215 medical school graduates from Michigan State University (p. 6). The findings of the study did not indicate that those who extended were any more or less successful at graduating or obtaining a residency than those who participated in the standard program (Arvidson et al., 2015, p. 6). The authors did conclude, however, that the program allows some students to complete medical school who, otherwise, may not have (Arvidson et al., 2015, p. 9). This plan also uses LASSI to inform students and academic advisors in planning for the students' success especially critical thinking and problem solving, test-taking, note taking and time management skills (Arvidson et al., 2015, p. 5).

Another program in health sciences is for the support of students who were not accepted to medical school on completing a bachelor's degree. Epps (2015) conducted a longitudinal study of the academic impact on post-graduate performance from 2001 to 2011 while at the Meharry Medical College (p. 8). Impacted students were supported in three phases. Students participated in the Princeton MCAT review, received additional instruction in upper-level courses, and participated in a program known as MAPS to support a successful repeat of the MCAT (Epps, 2015, p. 11). Participants succeeded in medical school and in acceptance to residencies at the same rate as other medical students (Epps, 2015, p. 20). The author concluded that early intervention approaches and proactive endeavors would be valuable (Epps, 2015, p. 20).

Two studies were identified in the health sciences where the researchers were working to proactively predict those that may struggle in medical school. Sadik and Rojas (2014) studied 36 students (nine from each of the first 4 years) and considered how learning style and learning strategy may identify at-risk medical students (p. 111). Findings indicated that a diverging learning style (associated in other studies as suitable for careers in the arts) were more likely to struggle in medical school (Sadik & Rojas, 2014, pp. 112-114). Also, lower performing students demonstrated weaknesses in testing taking and study methods on the LASSI (Sadik & Rojas, 2014, p. 114).

Winston, VanDerVleuten and Scherpbier (2014) studied the effectiveness of an early intervention (predictor) test for struggling students and the effectiveness of an intervention including large and small group workshops (p. 25). The test given in week 2

of medical school did prove valuable in predicting students who would have academic trouble when tested across three cohorts. Most of the students that failed the test also failed at least one course during the first three semesters (Winston et al., 2014, p. 27). Over the next three entering cohorts, those that failed the week 2 test were invited to first participate in large workshops that focused on study skills, self-regulation, metacognitive and dialogic techniques and these were followed up by small group workshops (Winston et al., 2014, p. 27). Findings indicate that the large workshops had no significant effect, but that the small follow up groups did add value (Winston et al., 2014, p. 29). The authors concluded that the failing student does not understand they are failing and does not reach out for help and efforts to prediction and prevention should prove effective and valuable (Winston, et al., 2014, p. 30).

Laird, Seifert, Pascarella, Mayhew and Blaich (2014) studied 3081 first year students at 19 institutions in the United States finding a relationship with deep learning approaches and the need for cognition and positive attitudes toward literacy as well as a relationship between reflective learning (a subscale of deep learning) and critical thinking skills (p. 407). Liew, Sidhu and Barua (2015) conducted a study of 217 second year and 202 third year premedical students in Malaysia comparing learning styles and approaches to outcomes with results in summative examinations (p. 1). While there was no correlation to learning preferences and outcomes, the findings indicated that 79.4% of high achievers in summative examinations were either strategic or deep learners (Liew et al., 2015, p. 5). Smith, Martinez-Alvarez, and McHanwell (2014) studied 244 students

across three disciplines (dental, medical and speech and language) comparing learning approach with learning in an anatomy course (p. 270). The speech and language students reported greater difficulty with the anatomy course and were also found to use more surface approaches while the medical and dental students adopted deep and strategic approaches (Smith et al., 2014, p. 274).

This literature review demonstrates that student advising and counseling should be informed. Many of the studies used the LASSI as an instrument to assist in providing data to better inform both the counseling of individual students and the development of courses for struggling students.

Pedagogical approaches. The current trend in higher education is a move from traditional lecture-based pedagogy to more interactive and multimodal teaching approaches. This portion of the literature review focuses some on the need for change and then specifically on changes that have been studied in health science professional education. Nothing was found in the chiropractic educational literature, but other health sciences have been studying specific practices in recent years. Downs and Wilson (2015) studied the effects of shifting to an active approach in a biology course offered in two locations in South Africa (p. 261). Like many others the authors recognized a reluctance to change despite research showing that student knowledge and learning are enhanced with interactive pedagogies compared to lecture (Downs & Wilson, 2015, p. 261). They also recognized that there is pressure to increase student access yet still maintain standards and retain students (Downs & Wilson, 2015, p. 261). The methods utilized

were simple and included shifting from mostly lecture (3 hours per week with 1 hour of lab) to utilizing some of the lecture hours in small groups each with a facilitator (Down & Wilson, 2015, p. 263). The results demonstrated that the small group interaction improved learning outcomes of participants (Down & Wilson, 2015, p. 269).

While learning style (specifically learning preferences) have not be shown to be good predictors of academic success, there are studies that indicate using a multimodal approach in teaching produces better outcomes. Good, Ramos, and D'Amore (2013) studied 137 preclinical students and compared VARK inventory findings to summative test results (p. 81). Consistent with other studies, the authors found the majority of these learners to be multimodal (Good et al., 2013, p. 85). They also discovered that students with more uni-modal preferences could struggle. For example, students with a strong kinesthetic preference struggled in content focused science courses (Good et al., 2013, p. 85). The authors also concluded that all learners are challenged by content focused courses given before developing an understanding of the context and therefore, context in the Health Sciences for preclinical courses provides for better learning as does multimodal delivery (Good et al., 2013, p. 85). Nicholson, Reed and Chan (2016) studied 66 undergraduate health science students participating in a multi-modal anatomy workshop measuring both self-perceived confidence and grades from mid-terms and finals (p. 5). Results demonstrated improved confidence and improved grades from the mid-term to the final in the study group compared to those that did not participate (Nicholson et al., 2016, p. 5). The authors concluded that using multi-modal pedagogies

such as this workshop, improve self-confidence, promotes engaged enquiry, and deep learning as well as integrates content with real-life clinical application (Nicholson et al, 2016, p. 9).

A multi-modal approach is often used as there are many learning preferences within a cohort and research has demonstrated deeper learning when utilizing more than one method of instruction (Good et al., 2013, p. 85; Nicholson et al., 2016, p. 9). Small groups of students have also been suggested as good for interactive methods (Boctor, 2013, p. 99; Ha & Lopez, 2014, p. 1). As previously noted, groups should be formed heterogeneously so that the strengths of each learning preference, approach and strategy can be utilized by the group. While random selection may work for some groups, if faculty have an understanding of the learning styles of students, informed decisions would be made regarding the make-up of working groups. Wu and Hou (2015) considered working groups based on Pask's Cognitive styles recommending that instructors organize and guide group discussion based on the participants needs (pp. 292-293). The authors also recognized that prior studies and best practices indicate that a heterogeneous make-up of the group is preferred (Wu & Hou, 2015, p. 279).

One method that appears in the literature for achieving multi-modal pedagogy is learning games. Boctor (2013) studied 39 nursing students to evaluate the effectiveness of a Jeopardy style game to achieve learning outcomes (p. 96). The game is used as an alternative to lecture and addressed the four learning preferences of the VARK instrument. Results from participant surveys indicated that the students felt the method

was both engaging and beneficial to learning (Boctor, 2013, p. 99). Gwo-Jen, Han-Yu, Chun-Ming, and Iwen (2013) conducted a study of 288 students using learning games to consider the necessity of aligning learning systems with learning styles (pp. 188-190). The authors found that students tend to choose a learning element (in this case a game) based on intuition and not learning style and that this did not produce desired results (Gwo-Jen et al., 2013, p. 195). They also discovered that when the learning games were aligned with learning style, the results were significantly better (Gwo-Jen et al., 2013, p. 195). This research supports the notion that supplemental learning instruction align with learning style.

Another method that appears in the literature is problem-based learning (PBL). Malan, Ndlovu and Englebecht (2014) state, "PBL prescribes a student-centered learning environment in which students are not viewed as empty vessels, but as bringing their own perceptual frameworks and different learning styles to an active dynamic learning process" (p. 2). PBL introduces real life problems into courses and are often used for small group work integrating course content and critical thinking skills. In conducting a qualitative study examining the effects of introducing PBL into a foundational program these authors concluded that PBL can affect self-regulated processes and activities promoting the use of deep learning strategies (Malan et al., 2014, p. 12).

In the health sciences, nursing seems to have the recent work demonstrating PBL into the curriculum. Spiers et al. (2014) conducted a qualitative study including 45 former graduate nursing students all of whom had completed a PBL curriculum (p. 1462).

This was an ethnographic study that utilized semi-structured interviews (Spiers et al., 2014, p. 1464). The authors report varied levels of satisfaction with the program and equate high satisfaction with deep learning approaches, low satisfaction with surface learning approaches and others with strategic learning approaches acknowledging that more work needs to be done (Spiers et al., 2014, p. 1470). Recently, Yardimci, Baktas, Ozkutuk, Mulsu, Gerceker, and Basbakkal (2017) considered the relationship between study process (learning approaches) and motivation in nursing education studying 330 nursing students (p. 13). The authors compared students from three institutions with differing approaches (PBL, integrated and traditional) finding a significant correlation to PBL approaches and deep learning (Yardimci et al., 2017, pp. 16-17). The authors found factors such as internal motivation, critical thinking, problem-based learning, active learning, written and oral presentations, and participation in teamwork all played an important role in helping students adopt a deep approach (Yardimci et al., 2017, p. 17). The authors recommend that educators should provide daily life-related information in both the clinical and classroom environments (Yardimci et al., 2017, p. 16).

One type of PBL that is often employed in the health sciences is case-based learning (CBL). CBL specifically uses cases which is useful in the health sciences. Often these are presented as mock patient situations that reinforce learning outcomes. A recent large study included 1098 first-year student teachers comparing the effect of CBL with traditional lecture on the approaches to learning (Baeten, Dochy, & Struyven, 2012, p. 1). The students were in four different groups, one that had only traditional lecture

(LLLL), one that was only CBL (CCC), one that alternated CBL with traditional lecture (LCLC) and one that started with traditional lecture and gradually introduced CBL (LLCC) (Baeten et al., 2012, pp. 6-7). The LCLC and LLCC groups developed more strategic approaches and demonstrated diminished surface approaches with these being greater in the LLCC group (Baeten et al., 2012, p. 10). The authors concluded that gradually introducing CBL has a greater effect on strategic learning approaches, but none affected deep learning approaches (Baeten et al., 2012, p. 18). This finding while promising, seems to conflict with that of Spiers et al. and Yardimci et al. both of whom found a correlation with PBL and deep learning in nursing students. Maybe as suggested in earlier chapters, the educational background has something to do with it as the participants of the Baeten et al. study were participating in a teaching program.

Also studying nursing students, Kantar and Massouh (2015) conducted a qualitative study considering the effects of CBL after completing 2 years of study (p. 8). In this study, participants reported that exposure to clinical experiences in the classroom via CBL deepened their learning (Kantar & Massouh, 2015, p. 13). Analysis of the findings revealed three learning practices and four themes related to attributes of practice. The learning practices included: recognizing the particulars of a clinical situation, making sense of patient data and informing decisions, and reflection (Kantar & Massouh, 2015, p. 11). The four attributes included: salience of clinical knowledge, multiple ways of thinking, professional self-concept, and professional attribute of caring (Kantar & Massouh, 2015, p. 13). The authors conclude that CBL can help to develop professional

skills and that shift from traditional lecture especially in health professional education is paramount (Katar & Massouh, 2015, p. 14).

Another study in nursing compares CBL with traditional lecture and the effect on problem solving. Yoo and Park (2014) studied 190 nursing students using the Problem Solving Inventory (PSI) as a pre and posttest (p. 48). While there were no significant differences in the cohorts at the pretest, posttest results indicate that the CBL group scores were significantly higher for problem solving 10 weeks after the program was concluded (Yoo & Park, 2014, pp. 49-50). The authors concluded that incorporating CBL in health education should improve problem solving skills (Yoo & Park, 2014, p. 50). Recognizing that CBL is a valid pedagogy and can improve critical thinking skills, Hong and Yu (2017) recently compared two methods of introducing CBL into a lecture course (p. 16). The authors considered 122 participants that were randomly assigned to one of four classes two of which were assigned as control and two as experimental. The difference in the two classes was based only the method of introduction of the CBL cases. The control group received the cases in a single event at one time and the experimental group had the cases presented over time as if the patient were progressing (unfolding cases) through an illness (Hong & Yu, 2017, p. 18). While both groups improved in both knowledge and critical thinking skills, there was a significantly greater improvement in the experimental group (Hong & Yu, 2017, p. 22).

CBL not only improves problem solving and critical thinking skills, but may improve specific course content or learning outcomes as well. Gade and Chari (2013)

conducted a study that included 150 participants from the NKP Salve Institute of Medical Sciences and Research Center in Nagpur India considering the effect of CBL on the outcomes of an Endocrine Physiology course for first year medical students (p. 357). The course included traditional didactic lectures on thyroid physiology and then introduced a paper-based patient case including multi-nodular goiter to reinforce the concepts. The case was provided and students worked with a facilitator in groups of 20 (Gade & Chari, 2013, p. 357). Pre and posttest scores demonstrated significant improvement in the students understanding ($p = 0.018$) (Gade & Chari, 2013, p. 356). Based on survey results, the authors concluded that CBL improves self-directed learning and problem-solving skills as well as helping students see the connection of the basic and clinical sciences (Gade & Chari, 2013, p. 356).

Considering the learning outcome of information literacy of pharmacy students, Ha and Lopez (2014) conducted a study that included 97 participants in a third year applied pharmacy care course (p. 1). The lab associated with the course included 12 patient cases one of which was a patient that was not information literate and required a care plan (Ha & Lopez, 2014, p. 2). The study included a 10 question information literacy test that was used as a pretest and posttest. The results of the pretest were not distributed. Pretest mean average was 6.9 ± 1.5 while the posttest mean average was 9.4 ± 0.8 with a statistically significant mean difference ($p < .001$) (Ha & Lopez, 2014, p. 3). The authors conclude that CBL is effective in teaching health literacy concepts and clinical application (p. 4).

Based on this review of the literature, it is clear that the institution needs to employ multiple strategies to address the needs of students including AATP students. These include peer assisted learning, both supplemental instruction and peer mentoring, informed academic advising, and pedagogical changes including training for faculty. The literature suggests that these approaches will help AATP students develop deep learning approaches, critical and clinical thinking skills, and improve and employ individual strategies based on the outcomes of the instruments employed, especially ASSIST and LASSI.

Success of this program must be considered both in cognitive terms as students succeed academically, but also in psychosocial terms as student confidence and competence are improved. Improvement in both retention and persistence of AATP students must be measured and if improved may be indicative of both cognitive and psychosocial progress.

Implementation

The project which is written as an executive summary and recommendations to the institutioin includes recommendations for implementation. Specifically, the development of supplemental instruction courses and the oversight of the program will fall under the direction of the Center for Excellence in Learning, Teaching and Technology (CELTT). The courses need to be designed using pedagogies that are different than those employed in the main course with which they are aligned. These courses also need to include important study strategies identified as either weaknesses

that need support or strengths that should be enhanced and include, selecting main ideas, self-testing, and use of study aids. Developing a peer mentoring program that is sustainable and fits in with some of the other current initiatives will be overseen by the CELTT and the Dean of Clinics. Both have a current interest in creating such a program such as to provide mentoring by proven senior students and an opportunity to engage in the clinical aspect of training sooner in the educational process. Implementation of the informed advising policy will be simpler. There are only three individuals conducting advising with AATP students. These three can be trained in the use of the LASSI instrument such as to better understand the individual strengths and weaknesses of the student and provide appropriate advice and support. These individuals are trained in advising students and have multiple tools available, but need the more detailed and individualized information that this tool will provide. The institution has already developed case-based learning for senior students. This program has been established for about 2 years and was developed under the direction of the Dean of Clinical Education including evidence based rubric development. The Dean of Clinical Education and the Chairs of each of the four academic departments will work together to develop a plan for case-based learning in the class room that will not only support student learning at the class level, but will better prepare them for the clinical experience.

With the exception of the CBL project, there are budgetary issues that need to be addressed in planning, designing and implementing these projects. Training of senior students identified to participate as supplemental instruction facilitators or peer mentors,

providing for the of both the SI and peer mentor project, and the purchase of licenses for LASSI use for incoming students are a few of the budgetary implications.

Potential Resources and Existing Supports

For SI, the CELTT is in place with appropriately trained leadership to work with faculty to develop the SI courses. Tutoring services already attracts the highest performing students. From these are the likely candidates for SI facilitators.

For peer mentoring, again the CELTT has the needed expertise and administrative structure to support this endeavor. The Dean of Clinics has an initiative that dovetails well with peer mentoring. These two individuals can work in the development of this program specifically for the institution. The CELTT has administrative support and technology needed for the tracking of participants.

For informed advising, the institution has a well-trained AATP advisor and an academic counselor who meet regularly with AATP students now. The addition of using LASSI will only require minimal training which can be done in house.

For CBL, the institution has an existing program that is completely developed that needs to be applied to earlier course work. Department chairs are well suited to make decisions and recruit faculty to support initial efforts and then grow the program to incorporate CBL more broadly over time. This initiative has little if any budgetary implications.

Potential Barriers

For SI and peer mentoring, the greatest potential barrier will be budget. The only peer assisted learning at the institution now is a peer tutoring program. Recently, the budget was reduced as much of this program is funded by the federal work-study program. Institutional funds have been limited. Fortunately, the new president has a student-centric perspective and is promoting the use of college funds to better support students in any way that can demonstrate the need per regulation and per effectiveness. Specific budgets will need to be worked with the CELTT, the college clinic and academic departments, but it is likely that one or both of these initiatives could be funded. As peer-assisted learning is relatively inexpensive and what is being proposed is done in groups, effectiveness both from an academic perspective and a cost perspective can be demonstrated.

The other barrier could be resistant faculty. While the plan only looks to one course in a given academic term, it also looks to the most highly failed course as the course that needs support. It is a delicate matter to be sure that the faculty member sees this initiative as supportive and not punitive or a reflection of their current teaching. Some courses are just more difficult than others and students need content support.

For informed advising, the only barrier is also the budget. Licenses to obtain permission to use the LASSI instrument are only $4.50 per person. Approximately 60 AATP students per year enter the college, so this is not an expensive proposition.

For CBL, the greatest barrier is time. While the institution has developed a program and has a rubric in place, case development is a timely process. It includes identifying a case that supports a specific learning need and then writing up the case (completely de-identified) so that it can be used. The institution needs to provide sufficient time for faculty to be trained in using the current process and applying it to their course needs and then to develop multiple cases for this use. While this is a time-consuming process, it is worth doing as the literature has demonstrated the benefit.

Proposal for Implementation and Timetable

Design for the first four SI courses to begin in the Summer 2018 with implementation in either the Fall of 2018 or the Winter or 2019. These first four courses will be required for AATP students but could be made available to others.

The Dean of Clinics will work with the CELTT to begin development of the peer mentoring program in the Summer of 2018 with a target to implement in the Winter or 2019. The role out should be one quarter at a time with mentors and new entrance mentees working in small groups. Start with just AATP students at first and assess results to determine over time if the program would be useful and if resources are available to other students.

Informed advising can begin with the new budget year which is Summer 2018. Training on the LASSI instrument can occur for the advisors during the Spring of 2018 in preparation for the summer provided budget is approved for the needed licenses.

For CBL, the Dean of Clinical Education should work with one department chair and identify one key thread of courses that will benefit from CBL. The two can work with these key faculty members from Summer through Fall of 2018 to incorporate a few cases into these key classes. This work will serve as a foundation to reproduce the process across other departments. Also, immediately, the department chairs will need to identify key courses or curricular threads for CBL. This should be based on recent information from the IR department which identifies areas of weakness per NBCE exam performance and institutional internal benchmark outcomes. Based on this information, priorities can be established and the first working group of faculty identified.

Implementation of CBL will likely be ongoing for some time due to the time required to develop appropriate cases. However, once the department chairs have identified the priorities, they and the Dean of Clinical Education can move from one thread to another.

Roles and Responsibilities of Student and Others

As described above, the CELTT will play the main role with faculty in the development of the SI courses. CELTT will also assume oversight of the SI program moving forward. The CELTT will also have oversight of the peer mentoring program. Initial development will require collaboration with the Dean of Clinics. High performing senior students play the most important role in both of these programs. AATP students will be required to participate in both SI and peer mentoring.

The current academic counselor and AATP advisor are responsible to implement the informed advising program. Training on use of the LASSI tool is available online once licenses are obtained. The tool is easy to use in either its computer or paper-based format.

As described above, the Dean of Clinical Education, the academic department chairs and certain faculty will be responsible for development of CBL in the didactic curriculum. Department chairs will be responsible to ensure that CBL is included as a sustainable teaching modality as faculty members change over time.

Project Evaluation

The evaluation of this plan includes levels at the institutional and program level. Institutionally, as described in section one, NBCE scores were used as evidence that there is a problem to address. NBCE scores are tracked by the IR department and reported broadly to all campus stakeholders. Students including AATP students admitted with the proposed solutions in place, will need to be tracked over time and the institution will need to compare the results of NBCE testing. With implementation of these initiatives, do AATP students perform at least as well as standard admission students? This data will only be fully available approximately 3 years following initiation of this project, but preliminary data will be available with 1 to 2 years.

As programs, each of the initiatives should produce results. This study utilized three tools, ASSIST, LASSI and VARK. The SI initiative and the peer mentoring initiative should both have some implications with regard to ASSIST and LASSI

outcomes within a year of implementation. Follow up can be done using repeat ASSIST and LASSI results periodically to understand how students are employing deep learning approaches and strategies that are included in the SI program. Also, as these tools demonstrated some level of fear of failure and anxiety on entrance, how do these same tools measure these aspects of the psychosocial issues 1 and 2 years into the program?

As for the CBL, as noted above, the institution utilizes a case of the week program in its clinical training program to measure students' competency. Tracking of students exposed to CBL in the class can be measured against those who were not exposed to CBL in the class during this part of the curriculum.

In summary, the recommended evaluation is both outcomes-based and formative in nature. Shalock (2001) states that some of the reasons for using outcomes-based evaluation includes: understanding the specific contributions of programs, clearer understanding of effectiveness, improving education and improving program and service accountability (p. 3). Formative evaluation informs the process early on and while the program is being implemented. The institution should compare the results of NBCE pre and post administering this program by continuing to track all students' performance. The institution should conduct additional surveys utilizing ASSIST and LASSI tools annually following the initial implementation of this program. This data, collected annually over a 3 to 4-year timeframe, will provide formative assessment especially to understand how elements of the program intended to assist students with the psychosocial issues identified in this study, adapt. For example, Using the LASSI instrument,

students' anxiety, attitudes, and motivation can be tracked as they progress through the program, such that the institution will understand if and perhaps how the program is helping these students. The institution should also track performance in the clinical case of the week program during and post the administration of this program. Data collected during initial implementation can provide formative evaluation to assist with continual improvement and data collected once fully implemented can provide summative data as to the overall effectiveness of the program. Collectively, this data should provide evidence of the effectiveness of the individual initiatives, help improve the program during implementation, and the collective effect the project has over time.

Implications Including Social Change

Local Community

The most important impact locally includes the student community at the institution under study. As demonstrated in section one, the institution admits a student population with a greater diversity in educational backgrounds than prior to 2013. Faculty members have noticed the difference in their classroom, but have not been able to identify what specifically. The results of this study indicate that students entering are more likely to adopt deep learning approaches across all three cohorts than the literature would have suggested, but also identifies that entering students in this study have greater fear of failure and anxiety than other college students. It is important to the institution to address both the cognitive needs of our students and the psychosocial needs of our

students. This project addresses both and therefore has implications that are important to both faculty and students.

Also, as reported in Section two, chiropractic is underrepresented ethnically with only 1% of chiropractors being African American and only 3% being Hispanic (Johnson et al 2012, pp. 3 & 9; Lacy et al, 2012, p. 523; Komaromy et al, 1996, p. 1308). The 2013 CCE admissions regulations give the institution the opportunity to recruit in community colleges where IPEDS data shows that a majority of first year college students of color enroll (U.S. Department of Education, National Center for Education Statistics, 2012). With greater inclusion of underrepresented populations in Chiropractic College, eventually underserved communities will have greater access to chiropractic services. This study allows the institution to better support the students now being recruited.

Far-Reaching

This work should not only support the work at this institution, but for all United States chiropractic colleges admitting students under the 2013 CCE standards. There are 17 other chiropractic colleges in the US. This work may also have some relevance to other health science education as admission standards have similarly changed in nursing, optometry, and dentistry. These health science industries are also starting to admit a greater diversity of students.

Finally, this work may be of import to the (CCE) the accrediting body for chiropractic programs in the US. While standards of admissions may not change,

research such as this may help inform the accrediting bodies on expectations of institutions relative to the types or levels of support needed for students entering as AATP.

Conclusion

This section included a discussion on the project related to the study of learning approaches, strategies, and preferences of students admitted as standard admissions, AATP-science, and AATP-GPA to a chiropractic college in the United States from the Fall of 2016 through the Summer of 2017. This study was designed to provide information to better understand the differences so that appropriate support could be designed for those admitted as AATP. While this study accomplished that goal, of equal importance was the discovery of the unexpected weaknesses of students admitted to the institution across all three cohorts. The institution has a regulatory obligation to provide appropriate support to AATP students. It also has an educational obligation to all students regardless of admission's status. This section provided description of a project intended to support AATP students appropriately based on research findings and also support student generally. The peer-assisted learning approaches proposed have been shown to help students develop not only cognitively, but also psychosocially. Considering the individual is important in this context as one does not exist without the other. The institution will have some decisions to make regarding the implementation of the recommendations described herein and as Appendix A. As a learning institution, the institution will need to continue to support not only certain students, but must be prepared

to better understand all students and provide an appropriate environment and support structure that provides both cognitive and psychosocial support.

Section 4: Reflections and Conclusions

Introduction

This section is a reflection by the author and considers the strengths and limitations of this research project. It also considers some alternatives to approaches to the work presented. It includes a reflective analysis by the author on the project and what was learned as a scholar, project developer, and leader. Social Impact and future research are also considered.

Project Strengths

The project's strengths in addressing the problem include that it is informed by both data from the research associated with the study and the current literature. Research did reveal some differences in the cohorts being studied but also provided valuable information regarding all students entering the institution. The data shifted the perspective from looking for specific learning or cognitive issues to include psychosocial issues of entering students. Current literature provided a wealth of information that addresses both cognitive learning and the psychosocial issues of entering students. The support systems at the institution will be improved for AATP students as is mandated by regulation, but will are also improved for students in general as well.

While the institution will have to decide how the proposed project will be implemented, especially as there are budgetary considerations, it may be considered a strength that the current administration is looking for ways to better support student success and so this project aligns well with the current climate.

Recommendations for Remediation of Limitations

One of the limitations of the project is the sample size. While the sample exceeded the minimum needed to achieve statistical significance, the AATP populations were small compared to the standard population. Additionally, as the CCE has altered admissions standards there is an assumption on the part of most chiropractic college enrollment professionals and faculty that the difference since 2013 is the addition of the AATP students and that the standard admission students remain the same as pre-2013 standards. In reality, pre-2013, the standards were very prescriptive of which science courses had to be completed preadmission. Under the current standards, standard admission students can enter with any health or human science degree. As an example, a student that has a kinesiology degree can enter and should be well prepared, but most kinesiology degrees do not require chemistry or physics. There may be a limitation to this study that assumes greater difference in the academic preparation between standard admissions and the AATP-science than actually exists.

To address these limitations, additional study may be done to increase the size of the pool at the institution over time or a similar study could be conducted partnering with other chiropractic colleges to expand the number of participants in a follow up study. Additional study could also be conducted to consider the actual differences in the entering cohorts based on admissions status.

Alternative approaches to addressing this problem could be to consider the legitimacy of admissions standards and could compare the readiness of currently

admitted students to students admitted pre-2013, perhaps based on NBCE results and/or internal benchmarking during that period. Institutions may reconsider how they apply AATP admissions standards and require students who lack certain science based undergraduate courses to either complete as part of entry or to offer some of these courses during the first few academic terms. This latter solution would extend the tenure of the student, but may be a viable solution.

Scholarship

Prior to engaging in this process, I had done some research and prepared presentations for professional conferences and also done some program evaluations. What I had not engaged in sufficiently was the depth of literature review and statistical analysis required for such a project. I have done literature review before, but probably only what was needed to justify a project or seek an answer. Truly working toward a thorough and in-depth review of the literature was not something that I had undertaken. Doing so provided me an opportunity to see what so many others had already done and how much there is yet to be done. It also provided me the opportunity to find foundational works and to consider discovery into theory. This level of review proved to be useful to my learning and helped to tie different research papers together and to make better sense of what I was reading.

As for statistical analysis, I struggled in choosing a research topic only because there were two projects that I wanted to pursue. One was this project and another would have been a qualitative study. Both are important topics. The decision was made based

on what was more immediately pressing for my institution and the other chiropractic and health science colleges. I made the pragmatic choice. What I did not realize is how unprepared I was for analyzing data. This actually delayed my process some. At first, I felt fortunate to have a statistician that works with the research department to provide some help, but found that she had little experience analyzing categorical data. Ultimately, I did some additional training on the use of SPSS and to understand how categorical data is used and this allowed me to run the analyses completely on my own. I found this very necessary to my understanding of the data. This experience, while time consuming, has proven very valuable to me and I find myself even more passionate about the topic having this experience.

Project Development and Evaluation

Once the data was analyzed and I had discovered the answers to the specific questions, I was also excited to see data that provided answers that I did not expect. Ultimately, the data provided the direction for the literature review and the development of the final project. Once this was complete, the recommendations to the program were clear. As the original research questions were based in outcomes and the data driving the recommendations were also based in outcomes from the research tools, the evaluation of the project of course would also be based in outcomes over time.

I learned some years ago to use data and benchmarking in program and project development. I have been used to using data or research from other institutions. This

project has taught me how to produce and utilize research data along with literature to develop projects.

Leadership and Change

I have been fortunate to be involved in higher education leadership for some years now. I entered this program to learn how to better do my job and to improve my skills. As a leader, I appreciate collaboration. As a researcher, at least in relation to this project, I can see how collaboration can provide a broader perspective, larger participant pools and potentially a greater opportunity to generalize results. That said, this project is specific to the institution where the study was conducted. The institution needs to be able to assess itself and its functions to improve. Some leaders believe they have the answers. This project has helped me to see that leaders should seek answers to complex problems in an organized and structured way. It is likely that someone else has already asked the question or something similar to it. Too often leaders try something without understanding what the consequences may be without looking to the literature. We are fortunate in higher education that there are others looking at the same questions and that within our institutions, there are those with expertise that can help search for solutions.

Change is always hard and there will be resistance. When a question has been answered based on research data and existing literature to provide context, then it is easier to get others on board. Rather than just producing an initiative that is based in opinion or one's own experience (which is valuable), data and the experience of others

brings the capacity to make decisions and recommend and move toward change with some sense of a positive outcomes.

Analysis of Self as Scholar

I moved toward the project proposal quickly and worked well with my chair and committee. I think my years participating in accreditation on my campus and as a reviewer have prepared me to quickly gather information and succinctly report it. When it came to data collection and analysis, as stated above, I was underprepared. Data collection took 10 months. I don't know that there was much I could do about that, but I found it frustrating. When it came to analysis, I was not prepared and I found I had to do some additional training and preparation on my own. Even though I would have preferred for all of this to move more quickly, I have benefitted from this project greatly. I have planned already at least one follow up project based on this work, to write this project for publication as well as the follow up project and to submit both for professional conference presentation. I look forward to additional works through the remainder of my career. Each of these will provide me the opportunity to improve as a scholar.

Analysis of Self as Practitioner

I learned that I am not as patient as I thought I was. As the VPAA at the institution where this study was performed, there were needed protections that had to be in place. Participants did not and still do not know that I was the researcher on this project. The director of IR and his team were responsible for the actual data collection (based on the study design). This time was frustrating as I could not do anything to

improve participation and had to allow the process as it was designed to unfold. As stated, I see myself as a collaborator. In this part of the process, I had to act as one more than ever as I relied on others to conduct the work I had designed. They did the job as described and were very proficient in their efforts. It was much appreciated. I have learned that I do have the capacity to work with others who may differ from my opinion, work ethic, or even priorities. For example, I wanted the IR department to have a high level of priority in completing their part of this project which included the actual data collection, but then they needed to ensure that all survey forms contained no identifying information before they could turn them over to me. They had to place this work within the other projects they have ongoing and give it priority as they saw fit. It did test my willingness as an administrator to work with other administrators and understand overall priorities. I appreciate more than ever the need to work together for the good of an institution.

Analysis of Self as Project Developer

As stated above, in project development, I have utilized research data and benchmarked based on literature review, but had not personally been involved in designing a research project that produces data to answer a question and then create a solution. This project has allowed me to look at project development more deeply. I have found also, that with significant outcomes and data that reveals unknowns, my passion for a project increases. Rather than seeing this project as just a requirement for

the degree toward which I am working, I believe it will make a difference and it has better prepared me as a project developer moving forward.

The Project's Potential Impact on Social Change

As stated above, this project has an impact at the local level, most importantly, at the institution where the study was conducted. This project has not only defined some differences based on admissions status but has provided important information regarding new entering students across all three cohorts studied. The project will provide not only cognitive support, but psychosocial support for new chiropractic students. This has implications at the institution and all chiropractic colleges in the United States with the potential for positive impact at other health science institutions. Also, as previously stated, the 2013 CCE standards allow chiropractic colleges to recruit in community colleges. This is where most students of color who attend college start. If chiropractic is to make a difference in the provision of health care to underserved populations, then this is vital. Having recruited these students, there is now both the regulatory and educational responsibility of the institution to support these students. This project will provide the needed supportive structure such that these students can succeed and then return to their communities and serve.

It is important to recognize that the results of data analysis revealed that the majority of students entering the institution have a fear of failure and are experiencing anxiety about the program. The psychosocial needs of these students are just as important as the cognitive needs.

Implications, Applications, and Directions for Future Research

What was learned from this research was greater than what was expected. It was expected that there would be some greater understanding of the differences of entering students based on admissions status. This understanding was accomplished and the findings were somewhat different than expected. Also learned were the important ways that these students do not differ. While the ways students do not differ did not come up as statistically significant, it is important to recognize that the majority of entering students are experiencing fear of failure and some anxiety. This fear and anxiety also has to be addressed.

It is important to know whether this is an institutional phenomenon or if it is common among new chiropractic students. Is it common among other health science students at the graduate level? The answer to this question has important implications to at least health science research as the fields of nursing, optometry, and dentistry have also broadened their admissions standards to some extent.

Other considerations for future research include the investigation as above; do other chiropractic or health science graduate students also experience fear and/or anxiety on entrance? For chiropractic, it is evident that there may not be as much of a difference in newly admitted students based on admissions status as is assumed in the 2013 CCE standards. It would be valuable to investigate how much difference actually exists across a population of students. It is likely that even among the standard admission students; the

level of academic preparation is broader than assumed as their minimal requirements have changed as well.

Conclusion

This project demonstrated strengths in that it did measure the differences in students learning approaches, strategies, and preferences based on admissions status. It also provided valuable information on all three student cohorts providing much needed information to develop a project to improve student support. While minimum numbers to achieve statistical significance were achieved, it may be useful to have more participants or to expand such a study across other similar institutions.

As the researcher on this project, I learned much about myself in terms of scholarship, project development, leadership, and change. Collaboration is even more important to me that it had already been. Use of research data in addition to published research in solving problems and designing projects is invaluable. Consideration of a project as it relates not just to the problem at hand, but its impact on society and the larger context is also very valuable in research but also in project development.

As always, this research project has resulted in implications for additional research, in this case, projects that could be important to chiropractic education, chiropractic programmatic accreditors, and possible to other health science graduate programs.

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Appendix A, Project/Executive Summary

A Comparison of Chiropractic Students' Learning Styles Based on Admission Status and Recommendations Made to the Chiropractic Program

An Executive Summary Presented to the College Administration and Academic Leadership

By

Scott F. Donaldson

Submitted as a Summary Report Based on Doctoral Study and Research Completed from Fall 2016 to Summer 2017

Introduction

Per recent regulation, the institution is now admitting students with less than the standard required science courses and less than the standard GPA, these students require additional support toward their success, but how these students learn compared to those that meet standard admissions requirements is not understood. In 2013, the Council on Chiropractic Education introduced admissions standards for chiropractic colleges allowing students admission with less than standard requirements, Alternative Admissions Track Plan (AATP) placing responsibility of tracking and support for these students on the admitting college. Literature demonstrates that students learning styles including approaches, strategies and preferences vary based on educational background and culture and that learning style, outcome performance and clinical reasoning are related. The purpose of this study was to better understand entering chiropractic students learning styles based on admissions status informing academic supportive efforts at a chiropractic college. The theoretical framework for this study was based on Curry's work where he described elements of learning in layers similar to an onion with the inner layers being stable characteristics and the outer layers being more flexible and susceptible to change. The four layers include from stable to flexible; cognitive personality, information processing, social interaction, and instructional preference. The study was based on determining how students admitted per standard requirements, those admitted as AATP for lack of science, and those admitted AATP with a lower than standard GPA all differ with regard to learning styles. The study was a quantitative study using cross-sectional survey methodology that incorporated three validated tools each measuring a distinct aspect of learning style. The instruments include ASSIST, LASSI, and VARK. The sample included all new incoming students over four consecutive terms. A minimum of 152 participants was required. The total number of new entrants during the study period was 195 and 165 participated. The data from the ASSIST and LASSI tools are nominal so analysis includes: histograms and frequency tables and Pearson's chi-square test for independence being calculated to consider significance between cohorts followed by post-hoc testing. The values from the VARK tool represent total scores per participant across the four scales and as such can be analyzed using independent *t* test. Data from this study will provide information needed to make informed recommendations to better support students including AATP students.

Evidence from both within the institution and the literature indicate the necessity of this study. Since the introduction of the 2013 admissions standards, [redacted] faculty members have reported changes to the classroom environment and challenges helping students ([redacted] Department Chairs, personal communications, Spring and Summer 2015). Researchers have shown that health science students and students with other educational backgrounds differ in their learning styles including preferences, approaches and strategies (Breckler, Joun, and Ngo, 2009, p. 30; Gurpinar, Bati, and Tetik, 2011, p. 310; Mitchell, James, and D'Amore, 2015, pp 163-165; Tarabashkina and Lietz, 2011, p. 228). In addition to the educational background, cultural background has also been

shown to be important to the learning styles of incoming students (Urval, et al., 2014, p. 217).

Studies also demonstrate that understanding learning styles have an impact on pedagogy (Meehan-Andrews, 2009, p. 31; Wagner, 2014, pp 350-351) and improved advising and mentoring (Marek, 2013, p. 48).

[redacted] has a regulatory mandate to support the AATP students that it accepts, but also has an educational obligation to support all students including AATP. To better understand how to support these students, the study described above was conducted. As the educationalenvironment has been demonstrated to have an effect on learning styles, participants in this study included new incoming students within the first few weeks of the first term. This was to limit the effect that the [redacted] educational experience has on results and measure the students as they arrive from their undergraduate experience. Of the 195 students admitted from Fall 2016 through Summer 2017, 165 participated in the study that included three tools; the Approaches and Study Skills Inventory for Students (ASSIST), the Learning and Study Strategies Inventory (LASSI) and the VARK (Visual, Aural, Read/Write and Kinesthetic) questionnaire. Each of these tools has been previously studied for validity and reliability.

The ASSIST instrument considers three scales, deep learning approaches, strategic learning approaches and surface learning approaches. Deep learning approaches are those that the student can make relevant to themselves, their experience or their educational endeavors and are considered the desirable approaches. Strategic approaches are those used to achieve the highest marks possible. Surface approaches are considered short term learning such as memorization of facts, do not usually lead to long term learning and are least desirable.

The LASSI instrument considers three scales including skill, will and self-regulation. To some extent the titles are evident. Skill refers to the skills strategies required for student success including subscales of information processing, selecting main ideas, and test strategies. Will refers to the strategies often considered personal traits with subscales including; anxiety, attitude, and motivation. Self-regulation includes subscales concentration, self-testing, use of study aids, and time management. Each is measured with a cumulative score that is compared to other United States students ultimately reflective of relative strength, needing improvement or weakness across each scale and subscale.

The VARK instrument is intended to consider how the student prefers to take in information and includes a visual learning preference, aural learning preference, read/write learning preference and a kinesthetic learning preference.

Data was collected from all three tools for the 165 student participants was analyzed using SPSS software and Chi-square test for independence for both the ASSIST and LASSI data and independent *t* test for the VARK data.

Data Analysis

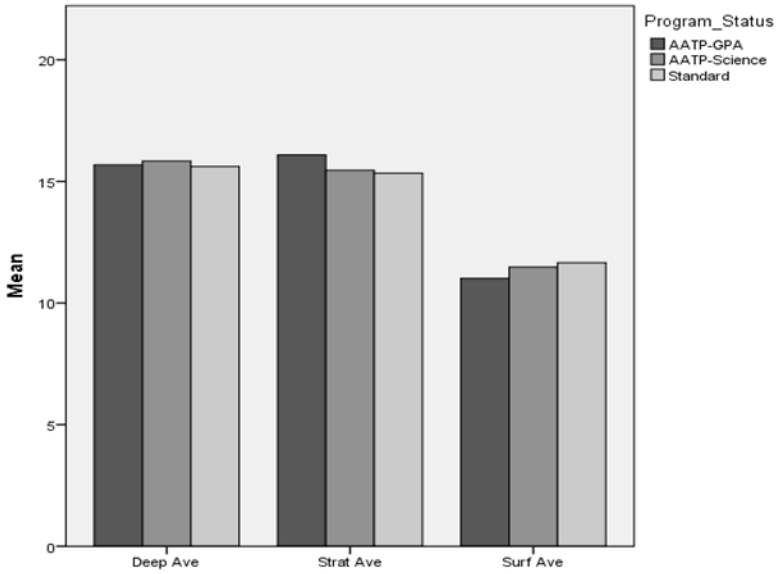

Figure 1. Mean scores for study cohorts and ASSIST scales

Note. Deep Ave = Mean scores for deep learning approaches, Strat Ave = Mean scores for strategic learning approaches, Surf Ave = Mean scores for surface learning approaches.

While a visual analysis of figure 1 does not demonstrate that there may be any significant differences within the scales of the ASSIST instrument across the cohorts, it does demonstrate that all three cohorts more closely agree with deep learning approaches and equally disagree with surface learning approaches. It is also interesting to note that the AATP-GPA students have a slightly higher agreement with strategic approaches. Chi-square test of independence demonstrated no significant differences for either standard admission students and AATP-
science or AATP-GPA across the three scales. However, when comparing the subscales there was a significant difference for the subscale unrelated memorizing comparing standard to AATP-science students with a *p*-value of 0.023 and results approaching significance for syllabus boundness with a *p*-value of 0.058.

Table 1

Frequency of Responses per Cohort on the Subscales Associated with the ASSIST Scale for Surface Learning Approaches

	Surface											
	LP			UM			FF			SB		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Agree	5.2	8.3		23.5	45.8	15.8	42.6	41.7	47.4	63.5	37.5	47.4
Neutral	19.1	20.8	5.3	38.3	12.5	47.4	22.6	12.5	26.3	22.6	41.7	26.3
Disagree	75.7	70.8	94.7	38.3	41.7	36.8	34.8	45.8	26.3	13.9	20.8	26.3
	Standard, n = 115			AATP-Science, n = 24			AATP-GPA, n = 19					

Note. LP = lacking purpose, UM = unrelated memorizing, FF = fear of failure, SB = syllabus boundness. Stand = Standard, AATP-S = AATP-Science, AATP-G = AATP-GPA

Table 1 shows that the AATP-science students more completely agree with the concepts related to unrelated memorizing and the standard students more completely with the concepts related to syllabus boundness.

There was no significant difference when comparing the standard students and the AATP-GPA students across the thirteen subscales of ASSIST. Note it is preferable that there is a high level of disagreement with the listed subscales for surface approaches. It is important to note that for subscale fear of failure (FF) there is a high degree of agreement for all three cohorts. This explains a lack of difference, but also needs to be address as students in all three incoming cohorts exhibit a fear of failure to an equally high degree.

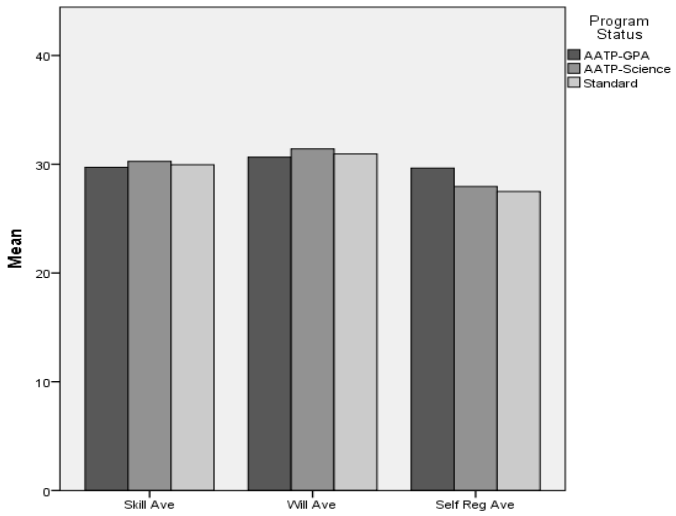

Figure 2. Mean scores for study cohorts and LASSI scales

Note. Skill Ave = Mean scores for skill strategies, Will Ave = Mean scores for will strategies, Self Reg Ave = Mean scores for self-regulation strategies.

A visual analysis of figure 2 demonstrates fairly equal distribution across the three scales of the LASSI instrument. The mean score for self-regulation for AATP-GPA appear greater than for both of the other cohorts.

Table 2

Frequency of Responses Related to Strength per Cohort on the LASSI Scales

	Standard, n = 112			AATP-Science, n = 25			AATP-GPA, n = 18		
	Skill	Will	Self-Reg	Skill	Will	Self-Reg	Skill	Will	Self-Reg
Relative Strength	33	21.4	29.5	36	28	40	38.9	11.1	55.6
Needs Improvement	27.7	33.9	29.5	32	40	32	33.3	50	16.7
Weakness	39.3	44.6	41.1	32	32	28	27.8	38.9	27.8

Note. Skill = skill strategies, Will = will strategies, Self-Reg = self-regulation strategies
Table 2 shows general agreement across most of the scales. Also important to note is that most students' scores fall in the needs improvement or weakness categories across all three scales. The one exception is that AATP-GPA scores for self-regulation fall mostly in the area of relative strength. Using Chi-square test of independence comparing the standard and AATP-GPA students and including the needs improvement and weakness categories as one categorydemonstrated a significant difference in the scale Self-Regulation between the two groups with a *p*-value of 0.023.
Tables 3, 4, and 5 shows the percentage of participants from each cohort whose responses aligned with relative strength, needs improvement, and weakness within the subscales associated with LASSI.

Table 3

Frequencies of Responses per Cohort of the LASSI Subscale Skill

	Skill								
	INP			SMI			TST		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Relative Strength	59.8	64	50	23.2	16	38.9	37.5	44	38.9
Needs Improvement	20.5	4	38.9	32.1	48	27.8	20.5	32	16.7
Weakness	19.6	32	11.1	44.6	36	33.3	42	24	44.4
	Standard, n = 112			AATP-Science, n = 25			AATP-GPA, n = 18		

Note. INP = information processing, SMI = selecting main ideas, TST = test strategies, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA

Table 4

Frequencies of responses per cohort of the LASSI subscale will

	Will								
	ANX			ATT			MOT		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Relative Strength	36.6	44	22.2	22.3	32	16.7	35.7	40	33.3
Needs Improvement	19.6	24	27.8	34.8	28	55.6	33	36	33.3
Weakness	43.8	32	50	42.9	40	27.8	31.3	24	33.3
	Standard, n = 112			AATP-Science, n = 25			AATP-GPA, n = 18		

Note. ANX = anxiety, ATT = attitude, MOT = motivation, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA

Table 5

Frequencies of responses per cohort of the LASSI subscale self-regulation

	Self-Regulation											
	CON			SFT			STA			TMT		
	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G	Stand	AATP-S	AATP-G
Relative Strength	24.1	32	50	52.7	44	72.2	46.4	68	55.6	25.9	44	50
Needs Improvement	28.6	24	16.7	19.6	32	11.1	24.1	12	27.8	25	16	16.7
Weakness	47.3	44	33.3	27.7	24	16.7	29.5	20	16.7	49.1	40	33.3
	Standard, n = 112			AATP-Science, n = 25			AATP-GPA, n = 18					

Note. CON = concentration, SFT = self-testing, STA = study aids, TMT = time management, Stand = standard, AATP-S = AATP-science, AATP-G = AATP-GPA

When comparing the responses for the subscale study aids for the cohorts standard and AATP-science and considering needs improvement and weakness as one category, Chi-square results demonstrated a result approaching significance with a *p*-value of 0.051. As demonstrated in the frequency tables (table 5), a higher percentage of AATP-science students demonstrated a relative strength in use of study aids.

When comparing the responses for the subscale concentration for cohorts standard and AATP-GPA, Chi-square results demonstrated a significant difference with a *p*-value of 0.023. As demonstrated in the frequency tables, (table 5) a higher percentage of AATP-GPA students demonstrated a relative strength for concentration.

It is important to note that while there was no significant difference in the subscales anxiety, attention, and motivation (Table 4), all related to the scale will, and the subscale seeking main ideas (Table 3), a majority of all three cohorts fell into the needs improvement or weakness categories. An assumption that the standard students would more likely align within these subscales as strengths while AATP students may demonstrate weakness is not true. Frequency graph analysis demonstrates that the reason there is no significant difference may be because all cohorts demonstrate weaknesses equally. [redacted] will need to be prepared to support all students as it appears that entering [redacted] students generally scored themselves low compared to other college students in the United States across several LASSI subscales.

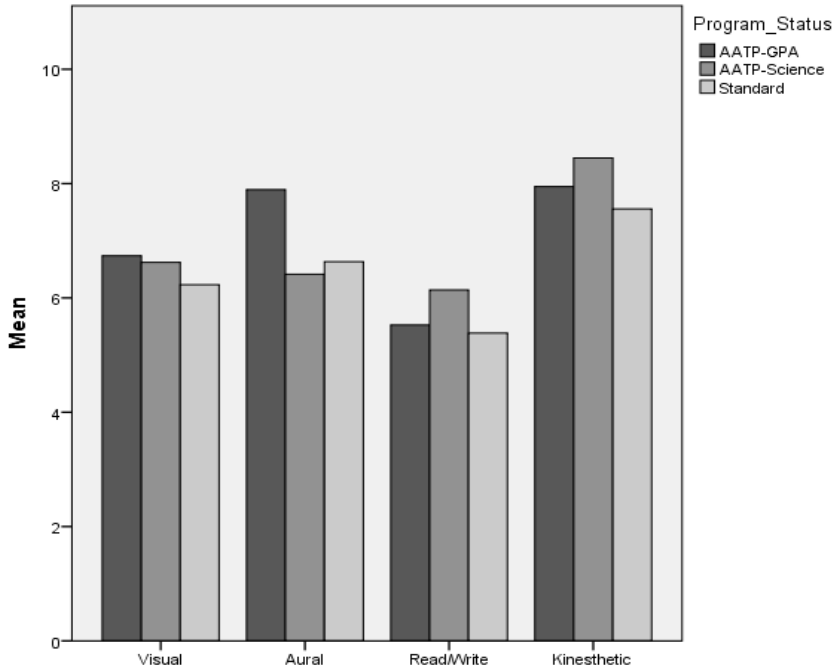

Figure 3. Mean scores for study cohorts and VARK scales

Visual analysis demonstrates a prevalence of the kinesthetic preference across all three cohorts. Also there is a high preference for aural learning with the AATP-GPA cohort. Based on the total scores per scale and using the highest score for each participant, the dominant preference is determined. In cases where the highest score is equal for two or more of the preferences, the participant is determined to be multi-modal. Table 6, shows the percentage of dominant preferences across all three cohorts and considers the four scales of VARK and the additional scale multi-modal.
Table 6,

Frequencies of prevalence per scale and per cohort from the VARK instrument

	Standard n = 117	AATP-Science n = 29	AATP-GPA n = 19
Visual	13.6	20	20
Aural	18.6	6.7	20
Read/Write	10.2	10	0
Kinesthetic	35.6	40	30
Multi-Modal	21.2	20	25

Independent *t* test comparing standard students to AATP-science students demonstrated no significant results for the four scales of VARK. Independent *t* test comparing standard

students to AATP-GPA students demonstrated no significant results for the four scales of VARK.

Summary of Data Analysis Findings

Data analysis includes findings for how standard admission students differ from AATP-science and AATP-GPA students as well as information that will be beneficial in supporting all students admitted to [redacted]. Of significance for the standard versus AATP-science students: There was a significant difference in the unrelated memorizing subscale of the ASSIST instrument with the AATP-science students demonstrating a higher level of agreement with these concepts. There was a result approaching significance in syllabus boundness subscale of the ASSIST instrument with the standard students demonstrating a higher level of agreement with these concepts. There was a significant difference in the use of study aids subscale of the LASSI instrument with the AATP-science students demonstrating a higher level of relative strength. Of significance for the standard versus AATP-GPA students: There were no significant differences across the ASSIST scales, but it is an interesting note, that the AATP-GPA students had a slightly higher preference toward strategic approaches. There was a significant difference in the self-regulation scale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength. There was a significant difference in the concentration subscale of the LASSI instrument with AATP-GPA students demonstrating a higher level of relative strength.

Also important from the data analysis, all three study groups reported equally agreement with the subscale fear of failure of the ASSIST instrument. As a surface learning subscale, it is preferable that there be greater disagreement with this concept. All three study groups also demonstrated equal levels of needs improvement or weakness in the subscales anxiety, attitude and motivation of the will scale of the LASSI instrument. While not demonstrating a difference among [redacted] students by admissions status, it does demonstrate an important concept for [redacted] to address as its incoming students are demonstrating high levels of fear and anxiety on entering their graduate education. All three study groups were equally weak in the subscale selecting main ideas of the scale skill of the LASSI instrument. These findings were unexpected by must be considered in planning for [redacted] student success and support.

Literature Based Foundation for Recommendations

Chickering and Reisser (1993) defined seven vectors for student development and growth (pp.45-51). These include: 1. Developing competence; intellectual, physical, and interpersonal, 2. Managing emotions, 3. Moving through autonomy toward interdependence: not dependent on others, 4. Developing mature interpersonal relationships: Healthier relationships and appreciation of others, 5. Establishing identity, 6. Developing purpose: long term vocational and personal, and 7. Developing integrity: congruence of beliefs, values and actions (Chickering & Reisser, 1993, pp. 45-51; Arendale & Hane, 2014, p. 11). These seven vectors are independent and have ben categorized as both cognitive and psychosocial in nature (Chickering & Reisser, 1993, pp. 2-6). Based on the data analysis, [redacted] students differ somewhat in their learning

styles based on admissions status. They also share a common theme in terms of weakness across four related subscales, fear of failure, anxiety, attitude and motivation. It is apparent that [redacted] needs to employ solutions that are both cognitive and psychosocial in nature to achieve the desired results.

Current literature on this subject identifies three areas that have been useful at other institutions demonstrating results. These include: peer-assisted learning strategies, informed student advising and counseling, and interactive pedagogical approaches. Specifically recommended is supplemental instruction (SI), peer mentoring, LASSI informed counseling and case-based learning (CBL).

Supplemental instruction (SI) differs from other peer led programs such as tutoring in that it is designed around a typically difficult course and provides organized small or large group sessions led by a trained peer facilitator (Clark & May, 2015, p. 502; Dawson, Van der Meer, Skalickky & Cowley, 2015, pp. 609-610; Hryclw, Tangalakis, Supple, & Best, 2013, p. 80; Malm, Bryngfors, & Morner, 2015, p. 347). This is a proactive approach. The sessions are designed to use pedagogies that differ from that which takes place in the associated class and includes specific strategies. In the case of [redacted], since selecting main ideas shows up as a weakness, this concept should be built in as an example. SI has been shown to be very effective in not only supporting the course it is designed around but the skills and approaches learned will be transferred to other course work supporting the overall concepts of deep and strategic learning (Arendale, 2014, p. 5; Dawson et al., 2014, p. 634; Hryclw et al., 2013, p. 84).

Peer Mentoring has also been shown to be useful to support students both in academic success and social integration as well (Chester, Burton, Xenos, & Elgar, 2013, p. 30; Hryclw et al., 2013, p. 80; Zaniewski & Reinholz, 2016, p. 1). Programs vary by institution but all describe a senior student who has succeeded at the program working with a small group of first year students. In one program, the groups focus on five aspects of student success (capability,connectedness, resourcefulness, purpose, and culture) and learning approaches and strategies (Chester et al., 2013,p. 30). Another defined a minimum number of meetings and the time of the meetings, but found that the students would get together more frequently than required affecting both academic and social integration (Zaniewski & Reinholz, 2016, p. 8).

Advising and counseling often happen at institutions reactively. This is common and needed, but informed proactive advising has proven to be more effective in assisting students (Sadik and Rojas, 2014, p. 111; Winston, VanDerVleuten and Scherpbier, 2014, pp. 25-27). Utilizing the LASSI to identify strengths and weaknesses in individuals under advising has proven useful to determine what kinds of specific support or additional learning may be needed in both individual advising and for course support (Dill et al., 2014, p. 21; Hendrickson, 2014, p. 24; Hoops, Burridge, & Wolters, 2015, p. 142).

Case based learning (CBL) is a type of problem based learning (PBL) that is particularly useful in the health sciences (Baeten, Dochy, & Struyven, 2012, p. 1). PBL and CBL provide an opportunity for interactive learning and to make material relevant to

learners (deep learning). These can be used in class for small group activities providing an opportunity to interact (Boctor, 2013, p. 99; Ha & Lopez, 2014, p. 1). , "PBL prescribes a student-centered learning environment in which students are not viewed as empty vessels, but as bringing their own perceptual frameworks and different learning styles, to an active dynamic learning process" (p. 2). PBL introduces real life problems into courses and are often used for small group work integrating course content and critical thinking skills. In conducting a qualitative study examining the effects of introducing PBL into a foundational program these authors concluded that PBL can affect self-regulated processes and activities promoting the use of deep learning strategies (Malan, Ndlovu, & Engelbrecht, 2014, p. 12). CBL is a great way to introduce PBL to [redacted].

Recommendation

Peer-Assisted Learning

[redacted] should design and implement two programs, a supplemental instruction program and a peer mentoring program.

Supplemental instruction. [redacted] has already identified the most highly failed course in each of the first eight terms (two calendar years). These should be organized through the Center for Excellence in Teaching, Learning and Technology (CETLL). The programs should be designed based on the current pedagogy used in the primary course (designed with different and interactive approaches). Ensure group participation. The courses should be sure to address the identified needs both strengths and weaknesses of AATP students, namely, unrelated memorizing as a weakness, must make the material relevant; syllabus bound, again make material relevant to learners; use of study aids as a strength, identify appropriate study aids for the supplemental course as part of the design and teach study skill as part of the course. [redacted] will need to plan based on budget needs and capacity to implement. If possible, design the first four courses and implement and then add one per term until all eight are in place. The literature identifies that these are more successful if peer led than instructor led. As LCCW has a requirement to support AATP students, these SI courses should be mandatory for all AATP students but open to all students who desire or need the additional support.

Benefits of SI relative to the AATP based learning styles study include: supports the AATP-science students with higher unrelated memorizing results by providing course content relevance to self and professional pursuit, supports AATP-science students with lower syllabus bound results (desired) by helping them to focus on what is important in the course, supports the strength of AATP-science students use of study aids, but providing additional aids during thissupplemental course, supports need for multiple pedagogies per VARK results of multi-modal learners, supports AATP-GPA students that demonstrated a strength in self-regulation, specifically in concentration as SI has proved useful in support of the concentration subscale of LASSI (Malm et al., 2105, p. 363), supports the overall need for students with weakness in anxiety, attitude, and motivation (Hoops et al, 2015, p. 136; Malm et al., 2015, p 363)

Peer mentoring. There are many models. Aligning a successful senior student with a small group of students has proven successful and could work for [redacted]. [redacted] has in place an intern program as its capstone experience. [redacted] has plans to add to its curriculum, clinical observations to the learning of new students. This program could be aligned with a mentor program. Rather than random assignments of senior and more junior students for observation only, [redacted] should consider matching senior student mentors to small groups of incoming students. Provide these with opportunities to meet and talk about specific issues. The senior mentor can also work with the junior students to ensure that observations are arranged. Having studied successful programs, Zaniewski and Reinholz (2016) suggested the following: give participants choice in pairing with a mentor, make the mentor and mentee accountable to each other, monitor relationships for concerns take community into account in building the program and enable informal and food-centric meetings (p. 10). Again, this program may be mandatory for AATP students and available to others, but given the outcomes of the research demonstrating a need across all entering cohorts toward psychosocial support, such a program may be beneficial to all. This effort will take considerable coordination and resources. To begin, perhaps start with the incoming AATP students (usually no more than 20 students and often less). Then test the results over time and consider whether expansion is indicated. Benefits of peer mentoring relative to the AATP based learning styles study include: supports the AATP-science students with a high association to unrelated memorizing as it can support successful strategies, supports the strengths of the AATP-science students in syllabus bound and use of study aids as mentors have succeeded in the program and can help in these areas, same for the support of AATP-GPA students with a strength in concentration, supports all students needs to academically and socially integrate (Chester et al. 2013, p. 30; Hryclw et al., 2013, p. 80), and supports learners challenged by content focused courses giving a contextual understanding (Good, Ramos, & D'Amore, 2013, p. 85).

Informed Advising/Counseling

Currently, [redacted] AATP students have mandatory meetings with the AATP advisor and the academic counselor at least during the first term of admissions. Train both of these parties on the correct use of the LASSI and ASSIST instruments. Consider purchasing licenses for one or both tools as an online offering (the assessment is done immediately). If budget constraints limit to one of the tools, the LASSI instrument demonstrated more results on this study that were significant to advising. While there were only limited data that proved significantly different for the cohorts studied, individuals within this study had very different results and therefore is demonstrated the need to consider each student individually when it comes to advising. Using the computer based LASSI, results would be immediate and so advising incoming AATP students would be easier for the advisors and counselors. Additionally, follow-up could be done using the same tools as the student progresses through the program.

Benefits of informed mentoring relative to the AATP based learning styles study include: supports the individual student around his or her own needs. This study has demonstrated some identified differences in the standard and AATP students, but has also identified some serious needs that are common to all and that each is an individual. This initiative supports the needs of the individual.

Case Based Learning (CBL)

This is also a considerable undertaking that includes the need for planning resources and training. First [redacted] should consider which courses in the first two years (preclinical) training would be benefit from the addition of CBL. The faculty for the impacted courses will need to have some buy in to this concept. Therefore, training and faculty support will be needed. The CELTT should lead this initiative along with the department chairs. Cases may be identified from the current holdings of the college clinic. Specifically, the type of case needed in a course has to be identified, and then case/s must be located. The [redacted] clinic has in place a program known as clinical case of the week that utilizes case based learning for interns in their final year. This program and its rubrics can be adapted to earlier course work. Aligning these two programs will accomplish not only getting CBL in the classroom, but will also better prepare students for their clinical work.

Benefits of case based learning relative to the AATP based learning styles study includes: support for multiple pedagogies needed to reach all learners, CBL improves and develops strategic and deep approaches in learners (Baeten et al., 2012, pp. 6-7; Kantar & Massouh, 2015, p. 13).

Planning, Budgeting and Implementation

Recommendations made herein are based on the data analysis and current research literature review. Four initiatives are proposed for consideration. Careful planning and budgeting is required for any one of these to be successful. It is recommended that [redacted] academic leaders consider this information and prioritize its actions to support students including AATP students. Supplemental instruction is a large undertaking, but once designed can be built into the curriculum as any other course. As it is peer led, finding qualified peer facilitators and

providing training and oversight will be an ongoing project. Peer mentoring also is a considerable undertaking and requires considerable supervision once in place. Starting small and testing an initiative or program is wise. Advising and counseling for AATP students is occurring now. Consider using at least the LASSI instrument in its electronic format to enhance these efforts. [redacted] already has plans to include some CBL. Faculty will need training, but with the clinical case of the week program, this will be easier to initiate then some other recommendations.

Supplemental Instruction

[redacted] has already identified the highest failed courses for each of the first eight academic terms (two calendar years). Supplemental instruction (SI) as a peer assisted learning initiative should be assigned to the Center for Excellence in Learning, Teaching and Technology (CELTT) at [redacted]. If each course was two hours in length for the first

ten weeks of the eleven week quarter and the introduction included an SI course in each of the first four quarters (first year), the budget impact would be 80 hours of instruction per quarter or 320 hours for the year. Additionally, SI peer instructors should receive specific training at the beginning of each quarter. Course design needs to include study strategies to include: selecting main ideas, self-testing, and use of study-aids, to support the demonstrated strengths and weaknesses. Pedagogy for each course should include small group work and should also be designed using strategies differing from those utilized in the main course.

Budget and plans can be included in the fiscal year 2018-2019 which begins July 1, 2018. As courses need to be designed, it is likely that the earliest implementation could be Fall of 2018. Course design will be completed by the director of the CELTT in conjunction with the course instructors. AATP students will be required to participate and others may opt to participate.

Peer Mentoring

The [redacted] Director of Assessment and Educational Effectiveness (DAEE) who oversees the CELTT, has expressed interest in a mentoring program for [redacted]. Based on this research, peer mentoring will help students in their transition. Students from all three cohorts scored low compared to other college students in the areas of fear of failure, anxiety, attitude and motivation. In addition to cognitive support, psychosocial support is also important. Peer mentoring has been shown to be valuable in both areas. [redacted] already provides each new student an assigned intern within the [redacted] clinics. These are currently assigned randomly. For a short period, the [redacted] student council had an initiative to run a volunteer based student mentor program that had some success but was unsustainable. If the DAEE oversees an organized program, tracks participation, and can provide some funds to support mentors in the same way that tutors and SI instructors will be supported, a sustainable program can be designed. Senior students at [redacted] are working in the on campus health center. These senior students are in the best position to be mentors to small groups of new [redacted] students.

If peer mentors are assigned to a small group, no one on one, with minimum mandatory meetings, and designed topics for discussion, then the number of hours needed in a quarter and thus a year can be determined and a budget created for this program. Based on the work of Zaniewski and Reinholz (2016) having at least some food based events should enhance participation and outcomes (p. 16). This should also be considered in planning and budgeting.

It is recommended that the CELTT and the Dean of the Clinic work together to create a [redacted] peer mentoring program to meet the needs of entering students. This program can be blended with some of the other [redacted] specific initiatives currently underway such as the effort to have students participate in observational rounds early in the curriculum. A complete plan and budget will need to be proposed for implementation in the next fiscal year.

Informed Advising

It is recommended that [redacted] purchases licensed use of the LASSI assessment instrument for all incoming AATP students and maybe for all students. Minimally, AATP students should be assessed using the LASSI instrument. Outcomes will inform the current AATP advisor, the current academic counselor and the new academic advisor in the specific needs of each student. This study has identified needs across cohorts and all students as aggregate. To provide appropriate advising, understanding the individual needs and being proactive are important (Arvidson, Green, Allen, Reznich, Mavis, & Osuch, 2015, p. 5; Epps, 2015, p. 20). All AATP students have required advising meetings. During these meetings, the advisor gets to know the students and tries to assess needs. The addition of LASSI outcomes will greatly enhance this experience. LASSI licenses are $4.50 per assessment. [redacted] needs to decide if this use will be for AATP students only (approximately 60 students per year) or if it will be utilized for all incoming students and budget appropriately.

Case-Based Learning

Case based learning is occurring at [redacted], but only in the last year as part of the clinical experience. The clinical case of the week program is well developed and provides a good foundation on which cases may be introduced in earlier course work. As all students will need to be successful in their efforts during the clinical experience including the clinical case of the week and as this program is well developed including an evidence informed rubric, it makes sense to utilize this format to inform the development of case-based learning throughout the curriculum to support all [redacted] student learning. The academic planning group (APG) should take on the project of working with individual departments to determine where to introduce cases as a part and in support of the existing curriculum. There are not any budgetary restraints on this initiative, but development will take time. It is recommended that each department identify appropriate courses and faculty to work with and coordinate with the Dean of Clinical Education who oversees the current case of the week project to ensure consistency.

Conclusions

[redacted] is under regulatory requirements and academic obligation to provide support to AATP students and to other students in general. This study not only identified the few areas where these students differ, but also some important areas that need support across all cohorts. [redacted] will need to decide how to best use this information. Consideration should be given to the AATP students, but also to other students as it is apparent that there is a general issue with fear and anxiety in starting this new program.

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Appendix B: Permission to use ASSIST

From: ENTWISTLE Noel [Noel.Entwistle@ed.ac.uk]
Sent: Sunday, February 21, 2016 1:18 AM
To: Scott Donaldson
Subject: Re: Use of ASSIST

Dear Scott Donaldson,

You are welcome to use ASSIST.

Best wishes,

Noel Entwistle

Professor Emeritus
University of Edinburgh

Appendix C: Copy of ASSIST

ASSIST

Approaches and Study Skills Inventory for Students

This questionnaire has been designed to allow you to describe, in a systematic way, how you go about learning and studying. The technique involves asking you a substantial number of questions that overlap to some extent to provide good overall coverage of different ways of studying. Most of the items are based on comments made by other students. Please respond truthfully, so that your answers accurately describe your **actual** ways of studying, and work your way through the questionnaire quite **quickly**, making sure that you give a response to **every item.**

Background information

Name or Identifier ..... **Age** ..... **years** **Sex** M / F

University or College ..... **Faculty or School** .....

Course ..... **Year of study** .....

A. What is learning?

When you think about the term 'LEARNING', what does it mean to you?

Consider each of these statements carefully, and rate them in terms of how close they are to your own way of thinking about it.

		Very close	*Quite close*	*Not so close*	*Rather different*	*Very different*
a.	Making sure you remember things well.	5	4	3	2	1
b.	Developing as a person.	5	4	3	2	1
c.	Building up knowledge by acquiring facts and information.	5	4	3	2	1
d.	Being able to use the information you've acquired.	5	4	3	2	1
e.	Understanding new material for yourself.	5	4	3	2	1
f.	Seeing things in a different and more meaningful way.	5	4	3	2	1

PLEASE TURN OVER

B. Approaches to studying [also called the *Revised Approaches to Studying Inventory* (RASI)]

The next part of this questionnaire asks you to indicate your relative agreement or disagreement with comments about studying made by other students. Work through the comments, giving your **immediate** response. In deciding your answers, think in terms of **this specific course unit or module**, unless told to do otherwise. Again, it is very important that you answer **all** the questions: when you've finished, please check you have done that.

5 means agree (√) 4 = agree somewhat (√?) 2 = disagree somewhat (x?) 1 = disagree (x).

Try not to use 3 = unsure (??), unless you really have to, or if it cannot apply to you or your course.

		√	√?	??	x?	x	
1.	I manage to find conditions for studying which allow me to get on with my work easily.	5	4	3	2	1	
2.	When working on an assignment, I'm keeping in mind how best to impress the marker.	5	4	3	2	1	
3.	Often I find myself wondering whether the work I am doing here is really worthwhile.	5	4	3	2	1	
4.	I usually set out to understand for myself the meaning of what we have to learn.	5	4	3	2	1	
5.	I organise my study time carefully to make the best use of it.	5	4	3	2	1	
6.	I find I have to concentrate on just memorising a good deal of what I have to learn.	5	4	3	2	1	
7.	I go over the work I've done carefully to check the reasoning and that it makes sense.	5	4	3	2	1	
8.	Often I feel I'm drowning in the sheer amount of material we're having to cope with.	5	4	3	2	1	
9.	I look at the evidence carefully and try to reach my own conclusion about what I'm studying.	5	4	3	2	1	
10.	It's important for me to feel that I'm doing as well as I really can on the courses here.	5	4	3	2	1	
11.	I try to relate ideas I come across to those in other topics or other courses whenever possible.	5	4	3	2	1	
12.	I tend to read very little beyond what is actually required to pass.	5	4	3	2	1	
13.	Regularly I find myself thinking about ideas from lectures when I'm doing other things.	5	4	3	2	1	
14.	I think I'm quite systematic and organised when it comes to revising for exams.	5	4	3	2	1	
15.	I look carefully at tutors' comments on course work to see how to get higher marks next time.	5	4	3	2	1	
16.	There's not much of the work here that I find interesting or relevant.	5	4	3	2	1	
17.	When I read an article or book, I try to find out for myself exactly what the author means.	5	4	3	2	1	
18.	I'm pretty good at getting down to work whenever I need to.	5	4	3	2	1	
19.	Much of what I'm studying makes little sense: it's like unrelated bits and pieces.	5	4	3	2	1	
20.	I think about what I want to get out of this course to keep my studying well focused.	5	4	3	2	1	
21.	When I'm working on a new topic, I try to see in my own mind how all the ideas fit together.	5	4	3	2	1	
22.	I often worry about whether I'll ever be able to cope with the work properly.	5	4	3	2	1	
23.	Often I find myself questioning things I hear in lectures or read in books.	5	4	3	2	1	
24.	I feel that I'm getting on well, and this helps me put more effort into the work.	5	4	3	2	1	
25.	I concentrate on learning just those bits of information I have to know to pass.	5	4	3	2	1	
26.	I find that studying academic topics can be quite exciting at times.	5	4	3	2	1	
27.	I'm good at following up some of the reading suggested by lecturers or tutors.	5	4	3	2	1	
28.	I keep in mind who is going to mark an assignment and what they're likely to be looking for.	5	4	3	2	1	
29.	When I look back, I sometimes wonder why I ever decided to come here.	5	4	3	2	1	
30.	When I am reading, I stop from time to time to reflect on what I am trying to learn from it.	5	4	3	2	1	

	√	√?	??	x?	x
31. I work steadily through the term or semester, rather than leave it all until the last minute.	5	4	3	2	1
32. I'm not really sure what's important in lectures so I try to get down all I can.	5	4	3	2	1
33. Ideas in course books or articles often set me off on long chains of thought of my own.	5	4	3	2	1
34. Before starting work on an assignment or exam question, I think first how best to tackle it.	5	4	3	2	1
35. I often seem to panic if I get behind with my work.	5	4	3	2	1
36. When I read, I examine the details carefully to see how they fit in with what's being said.	5	4	3	2	1
37. I put a lot of effort into studying because I'm determined to do well.	5	4	3	2	1
38. I gear my studying closely to just what seems to be required for assignments and exams.	5	4	3	2	1
39. Some of the ideas I come across on the course I find really gripping.	5	4	3	2	1
40. I usually plan out my week's work in advance, either on paper or in my head.	5	4	3	2	1
41. I keep an eye open for what lecturers seem to think is important and concentrate on that.	5	4	3	2	1
42. I'm not really interested in this course, but I have to take it for other reasons.	5	4	3	2	1
43. Before tackling a problem or assignment, I first try to work out what lies behind it.	5	4	3	2	1
44. I generally make good use of my time during the day.	5	4	3	2	1
45. I often have trouble in making sense of the things I have to remember.	5	4	3	2	1
46. I like to play around with ideas of my own even if they don't get me very far.	5	4	3	2	1
47. When I finish a piece of work, I check it through to see if it really meets the requirements.	5	4	3	2	1
48 Often I lie awake worrying about work I think I won't be able to do.	5	4	3	2	1
49 It's important for me to be able to follow the argument, or to see the reason behind things.	5	4	3	2	1
50. I don't find it at all difficult to motivate myself.	5	4	3	2	1
51. I like to be told precisely what to do in essays or other assignments.	5	4	3	2	1
52. I sometimes get 'hooked' on academic topics and feel I would like to keep on studying them.	5	4	3	2	1

C. Preferences for different types of course and teaching

5 means definitely like (√) 4 = like to some extent (√?) 2 = dislike to some extent (x?) 1 = definitely dislike (x).
Try not to use 3 = unsure (??), unless you really have to, or if it cannot apply to you or your course.

	√	√?	??	x?	x
a. lecturers who tell us exactly what to put down in our notes.	5	4	3	2	1
b. lecturers who encourage us to think for ourselves and show us how they themselves think.	5	4	3	2	1
c. exams which allow me to show that I've thought about the course material for myself.	5	4	3	2	1
d. exams or tests which need only the material provided in our lecture notes.	5	4	3	2	1
e. courses in which it's made very clear just which books we have to read.	5	4	3	2	1
f. courses where we're encouraged to read around the subject a lot for ourselves.	5	4	3	2	1
g. books which challenge you and provide explanations which go beyond the lectures.	5	4	3	2	1
h. books which give you definite facts and information which can easily be learned.	5	4	3	2	1

Finally, how well do you think you have been doing in your assessed work overall, so far?
Please rate yourself **objectively** on this nine-point scale, based on the grades you have actually been obtaining

Very well *Quite Well* *About average* *Not so well* *Rather badly*

Appendix D, Permission to use LASSI

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February 23, 2016

To Whom It May Concern:

This is to certify that H&H Publishing Co., Inc. is the sole source of the LASSI, Learning and Study Strategies Inventory, by Claire Ellen Weinstein, Ph.D., all editions.

We have granted permission for Scott Donladson to use LASSI in his doctoral research at Life Chiropractic College West in Hayward, California.

Please contact our office should you have any questions regarding this matter.

Kind regards,

Kristi Hackworth

Kristi Hackworth

INNOVATIONS IN LEARNING SINCE 1978

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Appendix E Copy of LASSI

Learning and Study Strategies Inventory

Second Edition

Claire E. Weinstein, Ph.D.
Department of Educational Psychology, University of Texas at Austin
David R. Palmer, Ph.D.
Texas Health and Human Services Commission
Ann C. Shulte, Ph.D.
University of North Carolina

Many students are not as aware as they need to be about how they study and learn. The **Learning and Study Strategies Inventory (LASSI)** is designed to help you develop or expand that awareness so you can be more successful in college.

The **LASSI** helps you to assess your strengths and weaknesses in ten different areas related to being a strategic and successful learner in college. Research has shown that each of these areas is important for succeeding in higher education.

The greatest benefit from completing the **LASSI** is that it will help you to identify areas of your knowledge, skills, motivation and attitudes you may need to improve. Using this information can help you to target your efforts to become a more strategic and successful student.

Instructions for completing

The **Learning and Study Strategies Inventory (LASSI)** contains 80 statements related to how you learn and study. You need to read each statement and then mark a response according to the following key:

Very much typical of me
Fairly typical of me
Somewhat typical of me
Not very typical of me
Not at all typical of me

Sample Question:
99. I like to learn more about myself by taking inventories like this. a b c (d) e

a. **Not at all typical of me**—does not necessarily mean that the statement would never describe you, but it would be true of you only in rare instances. Circle **a** for this response.

b. **Not very typical of me**—means that the statement generally would not be true of you. Circle **b** for this response.

c. **Somewhat typical of me**—means that the statement would be true of you about half the time. Circle **c** for this response.

d. **Fairly typical of me**—means that the statement would generally be true of you. Circle **d** for this response.

e. **Very much typical of me**—does not necessarily mean that the statement would always describe you, but that it would be true of you almost all the time. Circle **e** for this response.

In the above example, we have circled **d**, indicating that this person usually likes to take inventories like the **LASSI**. Try to rate yourself according to *how well the statement describes you,* not in terms of what you think you should do or what others do. There are no right or wrong answers to these statements. Please work as quickly as you can without being careless and *please complete all the items.*

Learning and Study Strategies Inventory
Second Edition

Claire E. Weinstein, Ph.D.
David R. Palmer, Ph.D.
Ann C. Shulte, Ph.D.

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Web www.hhpublishing.com

Very much typical of me
Fairly typical of me
Somewhat typical of me
Not very typical of me
Not at all typical of me

1.	I concentrate fully when studying.	a	b	c	d	e
2.	I am unable to summarize what I have just heard in a lecture or read in a textbook.	a	b	c	d	e
3.	I try to find relationships between what I am learning and what I already know.	a	b	c	d	e
4.	I find it hard to stick to a study schedule.	a	b	c	d	e
5.	In taking tests, writing papers, etc., I find I have misunderstood what was wanted and lose points because of it.	a	b	c	d	e
6.	I am able to study subjects I do not find interesting.	a	b	c	d	e
7.	When I decide to study, I set aside a specific length of time and stick to it.	a	b	c	d	e
8.	Because I don't listen carefully, I don't understand some course material.	a	b	c	d	e
9.	I try to identify potential test questions when reviewing my class material.	a	b	c	d	e
10.	During class discussions, I have trouble figuring out what is important enough to put in my notes.	a	b	c	d	e
11.	To help me remember new principles we are learning in class, I practice applying them.	a	b	c	d	e
12.	My underlining is helpful when I review text material.	a	b	c	d	e
13.	When it comes to studying, procrastination is a problem for me.	a	b	c	d	e
14.	I set high standards for myself in school.	a	b	c	d	e
15.	When I am studying a topic, I try to make everything fit together logically.	a	b	c	d	e
16.	I find it difficult to maintain my concentration while doing my coursework.	a	b	c	d	e
17.	I only study the subjects I like.	a	b	c	d	e
18.	When preparing for an exam, I create questions that I think might be included.	a	b	c	d	e
19.	When I take a test, I realize I have studied the wrong material.	a	b	c	d	e
20.	If there is a web site for my textbook, I use the information provided there to help me learn the material.	a	b	c	d	e
21.	I have difficulty identifying the important points in my reading.	a	b	c	d	e
22.	When work is difficult, I either give up or study only the easy parts.	a	b	c	d	e
23.	To help me learn the material presented in my classes, I relate it to my own general knowledge.	a	b	c	d	e
24.	There are so many details in my textbooks that it is difficult for me to find the main ideas.	a	b	c	d	e
25.	I review my notes before the next class.	a	b	c	d	e
26.	I have difficulty adapting my studying to different types of courses.	a	b	c	d	e
27.	I translate what I am studying into my own words.	a	b	c	d	e

Very much typical of me
Fairly typical of me
Somewhat typical of me
Not very typical of me
Not at all typical of me

28.	I put off studying more than I should.	a b c d e
29.	I get discouraged because of low grades.	a b c d e
30.	Even if I am having difficulty in a course, I can motivate myself to complete the work.	a b c d e
31.	I spread out my study times so I do not have to "cram" for a test.	a b c d e
32.	My mind wanders a lot when I study.	a b c d e
33.	I stop periodically while reading and mentally go over or review what was said.	a b c d e
34.	I go to the college learning center for help when I am having difficulty learning the material in a course.	a b c d e
35.	I feel very panicky when I take an important test.	a b c d e
36.	I have a positive attitude about attending my classes.	a b c d e
37.	I test myself to see if I understand what I am studying.	a b c d e
38.	When I study for a test, I have trouble figuring out just what to do to learn the material.	a b c d e
39.	Even if I do not like an assignment, I am able to get myself to work on it.	a b c d e
40.	When they are available, I attend review sessions for my classes.	a b c d e
41.	I would rather not be in school.	a b c d e
42.	I set goals for the grades I want to get in my classes.	a b c d e
43.	When I am taking a test, worrying about doing poorly interferes with my concentration.	a b c d e
44.	I try to see how what I am studying would apply to my everyday life.	a b c d e
45.	I have trouble understanding exactly what a test question is asking.	a b c d e
46.	I worry that I will flunk out of school.	a b c d e
47.	To help make sure I understand the material, I review my notes before the next class.	a b c d e
48.	I do not care about getting a general education, I just want to get a good job.	a b c d e
49.	I find it hard to pay attention during lectures.	a b c d e
50.	I try to relate what I am studying to my own experiences.	a b c d e
51.	I dislike most of the work in my classes.	a b c d e
52.	I review my answers during essay tests to make sure I have made and supported my main points.	a b c d e
53.	When studying, I seem to get lost in the details and miss the important information.	a b c d e
54.	I use special study helps, such as italics and headings, that are in my textbook.	a b c d e

Very much typical of me
Fairly typical of me
Somewhat typical of me
Not very typical of me
Not at all typical of me

55.	I am very easily distracted from my studies.	a	b	c	d	e
56.	Even when I don't like a course, I work hard to get a good grade.	a	b	c	d	e
57.	It is hard for me to decide what is important to underline in a text.	a	b	c	d	e
58.	To help me learn the material, I complete at least some of the practice problems in my textbooks.	a	b	c	d	e
59.	I do not have enough time to study because I spend too much time with my friends.	a	b	c	d	e
60.	To check my understanding of the material in a course, I make up possible test questions and try to answer them.	a	b	c	d	e
61.	Even when I am well prepared for a test, I feel very anxious.	a	b	c	d	e
62.	I set aside more time to study the subjects that are difficult for me.	a	b	c	d	e
63.	I do poorly on tests because I find it hard to plan my work within a short period of time.	a	b	c	d	e
64.	During a demonstration in class, I can identify the important information I need to remember.	a	b	c	d	e
65.	I am up-to-date in my class assignments.	a	b	c	d	e
66.	When I am having trouble with my coursework, I do not go to the instructor for help.	a	b	c	d	e
67.	I end up "cramming" for every test.	a	b	c	d	e
68.	When I listen to class lectures, I am able to pick out the important information.	a	b	c	d	e
69.	When I am studying, worrying about doing poorly in a course interferes with my concentration.	a	b	c	d	e
70.	I do not care if I finish college as long as I have a good time.	a	b	c	d	e
71.	I try to find a study partner or study group for each of my classes.	a	b	c	d	e
72.	Courses in certain subjects, such as math, science, or a foreign language, make me anxious.	a	b	c	d	e
73.	When completing a problem-solving task, it is difficult for me to pick out the important information.	a	b	c	d	e
74.	After a class, I review my notes to help me understand the information that was presented.	a	b	c	d	e
75.	If I get distracted during class, I am able to refocus my attention.	a	b	c	d	e
76.	In my opinion, what is taught in my courses is not worth learning.	a	b	c	d	e
77.	If I am having trouble studying, I ask another student or the instructor for help.	a	b	c	d	e
78.	I get so nervous and confused when taking an examination that I fail to answer questions to the best of my ability.	a	b	c	d	e
79.	I find that during lectures I think of other things and don't really listen to what is being said.	a	b	c	d	e
80.	Even when study materials are dull and uninteresting, I manage to keep working until I finish.	a	b	c	d	e

You have now completed **LASSI**. Turn the page to begin the scoring process.

Scoring Directions—Participant's Chart for **LASSI**

Name:
Date:
ID Number:

The chart below is used to interpret the scores you calculated on page 9 of this booklet. Each column is labeled with a three-letter code representing one of the ten **LASSI** scales. Find your score on the scale directly above each scale code and circle this number. Do this for each scale.

For example, if your ATT score was 32, find the number 32 just above the ATT scale and circle the 32, as shown in the example below.

If you cannot find your exact score, circle the **next lowest number**. When you have finished all ten scale scores, connect the circles to see your **LASSI** profile. The columns on the far left and far right of the chart show percentiles. You can use these percentiles to look at your scores in relation to other college students answering the same items.

Example:

40	33
35	
30	(32)
25	
	ATT

Each of the three-letter codes indicates a category of learning and study strategies or methods. The meanings of the codes are:

- ANX • anxiety and worry about school performance
- ATT • attitude and interest
- CON • concentration and attention to academic tasks
- INP • information processing, acquiring knowledge, and reasoning
- MOT • motivation, diligence, self-discipline, and willingness to work hard
- SFT • self-testing, reviewing, and preparing for classes
- SMI • selecting main ideas and recognizing important information
- STA • use of support techniques and materials
- TMT • use of time management principles for academic tasks
- TST • test strategies and preparing for tests

Percentiles	ANX	ATT	CON	INP	MOT	SFT	SMI	STA	TMT	TST	Percentiles
99	40	40	40	40	40	40	40	38	40	40	99
95	37	39	37	38	39	36	38	35	37	38	95
90	35	—	35	35	38	33	37	33	35	36	90
85	33	38	34	34	37	31	35	32	33	35	85
80	32	37	33	33	36	30	34	30	32	34	80
75	31	—	32	31	—	29	33	29	31	33	75
70	30	36	31	30	35	28	32	—	30	32	70
65	29	—	30	—	34	27	31	28	29	—	65
60	28	35	29	29	33	26	30	27	28	31	60
55	27	—	—	28	—	—	29	26	27	30	55
50	26	34	28	27	32	25	—	—	—	—	50
45	25	—	27	—	31	24	28	25	26	29	45
40	24	33	26	26	—	23	27	24	25	28	40
35	23	—	25	25	30	22	26	—	24	—	35
30	22	32	24	24	29	—	25	23	23	27	30
25	21	—	23	—	28	21	24	22	22	26	25
20	20	31	22	23	27	20	23	21	21	25	20
15	18	30	21	22	26	19	22	20	20	24	15
10	17	28	19	21	24	17	21	19	18	23	10
5	14	26	17	19	22	15	18	17	16	21	5
1	10	21	13	15	18	12	13	13	12	18	1
	ANX	ATT	CON	INP	MOT	SFT	SMI	STA	TMT	TST	

Scoring Interpretation

Notice that the columns on each side of the chart are labeled "Percentiles." A percentile indicates the portion of a national sample of students who scored at or below a particular score. For example, the score of 32 on ATT is beside the 30th percentile; that means 30% of the students in a national sample scored 32 or lower while 70% of the students scored higher than 32.

What do these scores mean to you? Any score at or above the 75th percentile level indicates an area of relative strength. Improving your strategies and skills in these areas should not be your highest priority. However, improving in any area of learning and studying can still be helpful to you for succeeding in college.

Any score between the 50th and 75th percentile levels indicates an area where you may need to improve your strategies and skills. Without improving your knowledge and skills in these areas, you may encounter difficulties succeeding in college.

Any score at or below the 50th percentile level indicates an area of relative weakness. Improving your strategies and skills in these areas should be your highest priority. It is very likely that your strategies and skills in these areas are not sufficient to help you succeed in college. There are many college courses, books, computer-based instruction, and other learning resources at your college, the college learning center, or the bookstore that can help you to improve your learning and study strategies.

Duplicate Chart for Those Administering **LASSI**

Name:
Date:
ID Number:

The chart below is used to interpret the scores you calculated on page 9 of this booklet. Each column is labeled with a three-letter code representing one of the ten **LASSI** scales. Find your score on the scale directly above each scale code and circle this number. Do this for each scale.

For example, if your ATT score was 32, find the number 32 just above the ATT scale and circle the 32, as shown in the example below.

If you cannot find your exact score, circle the **next lowest number**. When you have finished all ten scale scores, connect the circles to see your **LASSI** profile. The columns on the far left and far right of the chart show percentiles. You can use these percentiles to look at your scores in relation to other college students answering the same items.

Example:

Each of the three-letter codes indicates a category of learning and study strategies or methods. The meanings of the codes are:

- ANX • anxiety and worry about school performance
- ATT • attitude and interest
- CON • concentration and attention to academic tasks
- INP • information processing, acquiring knowledge, and reasoning
- MOT • motivation, diligence, self-discipline, and willingness to work hard
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- TMT • use of time management principles for academic tasks
- TST • test strategies and preparing for tests

Percentiles	ANX	ATT	CON	INP	MOT	SFT	SMI	STA	TMT	TST	Percentiles
99	40	40	40	40	40	40	40	38	40	40	99
95	37	39	37	38	39	36	38	35	37	38	95
90	35	—	35	35	38	33	37	33	35	36	90
85	33	38	34	34	37	31	35	32	33	35	85
80	32	37	33	33	36	30	34	30	32	34	80
75	31	—	32	31	—	29	33	29	31	33	75
70	30	36	31	30	35	28	32	—	30	32	70
65	29	—	30	—	34	27	31	28	29	—	65
60	28	35	29	29	33	26	30	27	28	31	60
55	27	—	—	28	—	—	29	26	27	30	55
50	26	34	28	27	32	25	—	—	—	—	50
45	25	—	27	—	31	24	28	25	26	29	45
40	24	33	26	26	—	23	27	24	25	28	40
35	23	—	25	25	30	22	26	—	24	—	35
30	22	32	24	24	29	—	25	23	23	27	30
25	21	—	23	—	28	21	24	22	22	26	25
20	20	31	22	23	27	20	23	21	21	25	20
15	18	30	21	22	26	19	22	20	20	24	15
10	17	28	19	21	24	17	21	19	18	23	10
5	14	26	17	19	22	15	18	17	16	21	5
1	10	21	13	15	18	12	13	13	12	18	1
	ANX	ATT	CON	INP	MOT	SFT	SMI	STA	TMT	TST	

Scoring Interpretation

Notice that the columns on each side of the chart are labeled "Percentiles." A percentile indicates the portion of a national sample of students who scored at or below a particular score. For example, the score of 32 on ATT is beside the 30th percentile; that means 30% of the students in a national sample scored 32 or lower while 70% of the students scored higher than 32.

What do these scores mean to you? Any score at or above the 75th percentile level indicates an area of relative strength. Improving your strategies and skills in these areas should not be your highest priority. However, improving in any area of learning and studying can still be helpful to you for succeeding in college.

Any score between the 50th and 75th percentile levels indicates an area where you may need to improve your strategies and skills. Without improving your knowledge and skills in these areas, you may encounter difficulties succeeding in college.

Any score at or below the 50th percentile level indicates an area of relative weakness. Improving your strategies and skills in these areas should be your highest priority. It is very likely that your strategies and skills in these areas are not sufficient to help you succeed in college. There are many college courses, books, computer-based instruction, and other learning resources at your college, the college learning center, or the bookstore that can help you to improve your learning and study strategies.

A User's Manual for **LASSI** is available to those administering the inventory. This User's Manual includes a history of the instrument's development, descriptions of the ten scales included in the LASSI, a section on administration and scoring, results of pilot and field testing, and the process used in scale construction. In addition, it contains information to help create individual prescriptions for enhancing students' skills.

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Other Related Assessments/Publications from H&H Publishing Company

Instructional Materials

Becoming a Strategic Learner by Claire E. Weinstein – Online instructional modules to help students improve in the ten areas of the **LASSI**

Essential Study Strategies by Walter Pauk – Study Skills text which includes two **LASSIs**

Assessments

LASSI-HS – Learning and Study Strategies Inventory, High School Version

PEEK – Perceptions, Expectations, Emotions, and Knowledge about College

INCLASS – Inventory of Classroom Style and Skills

TIA – Technology and Internet Assessment

Pages four, six, eight, ten and twelve were blank as the back sides of pages three, five, seven, nine and eleven.

Appendix F Permission to use VARK

From: Neil Fleming [neil.fleming@vark-learn.com]
Sent: Saturday, February 20, 2016 10:37 AM
To: Scott Donaldson
Subject: Your Copyright Permission Request

Dear Scott

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As I am away from the office this week Information about using VARK for research can be requested and sent later.

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There are two inexpensive video presentations that help explain many of the finer points of VARK. The first is An Introduction to VARK and the second is VARK FOR TEACHERS who want to assess their own teaching methods and use VARK to modify their strategies. There is more detail on our website at this page:

http://vark-learn.com/products/webinars

Book Downloads: You may find the VARK books helpful. They are all available as immediate and inexpensive downloads. They are sent immediately after payment, so don't shut down your computer until the book arrives as a PDF on your browser.

Business users should visit our VARK business site at: http://business.vark-learn.com. VARK is not free for for-profit and not-for profit businesses and government agencies. Best wishes for your research.

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Appendix G Copy of VARK

The VARK Questionnaire (Version 7.8)

How Do I Learn Best?

Choose the answer which best explains your preference and circle the letter(s) next to it.
Please circle more than one if a single answer does not match your perception.
Leave blank any question that does not apply.

1. You are helping someone who wants to go to your airport, the center of town or railway station. You would:
   a. go with her.
   b. tell her the directions.
   c. write down the directions.
   d. draw, or show her a map, or give her a map.
2. A website has a video showing how to make a special graph. There is a person speaking, some lists and words describing what to do and some diagrams. You would learn most from:
   a. seeing the diagrams.
   b. listening.
   c. reading the words.
   d. watching the actions.
3. You are planning a vacation for a group. You want some feedback from them about the plan. You would:
   a. describe some of the highlights they will experience.
   b. use a map to show them the places.
   c. give them a copy of the printed itinerary.
   d. phone, text or email them.
4. You are going to cook something as a special treat. You would:
   a. cook something you know without the need for instructions.
   b. ask friends for suggestions.
   c. look on the Internet or in some cookbooks for ideas from the pictures.
   d. use a good recipe.
5. A group of tourists want to learn about the parks or wildlife reserves in your area. You would:
   a. talk about, or arrange a talk for them about parks or wildlife reserves.
   b. show them maps and Internet pictures.
   c. take them to a park or wildlife reserve and walk with them.
   d. give them a book or pamphlets about the parks or wildlife reserves.
6. You are about to purchase a digital camera or mobile phone. Other than price, what would most influence your decision?
   a. Trying or testing it.
   b. Reading the details or checking its features online.
   c. It is a modern design and looks good.
   d. The salesperson telling me about its features.
7. Remember a time when you learned how to do something new. Avoid choosing a physical skill, eg. riding a bike. You learned best by:
   a. watching a demonstration.
   b. listening to somebody explaining it and asking questions.
   c. diagrams, maps, and charts - visual clues.

d. written instructions – e.g. a manual or book.

8. You have a problem with your heart. You would prefer that the doctor:
   a. gave you a something to read to explain what was wrong.
   b. used a plastic model to show what was wrong.
   c. described what was wrong.
   d. showed you a diagram of what was wrong.

9. You want to learn a new program, skill or game on a computer. You would:
   a. read the written instructions that came with the program.
   b. talk with people who know about the program.
   c. use the controls or keyboard.
   d. follow the diagrams in the book that came with it.

10. I like websites that have:
   a. things I can click on, shift or try.
   b. interesting design and visual features.
   c. interesting written descriptions, lists and explanations.
   d. audio channels where I can hear music, radio programs or interviews.

11. Other than price, what would most influence your decision to buy a new non-fiction book?
   a. The way it looks is appealing.
   b. Quickly reading parts of it.
   c. A friend talks about it and recommends it.
   d. It has real-life stories, experiences and examples.

12. You are using a book, CD or website to learn how to take photos with your new digital camera. You would like to have:
   a. a chance to ask questions and talk about the camera and its features.
   b. clear written instructions with lists and bullet points about what to do.
   c. diagrams showing the camera and what each part does.
   d. many examples of good and poor photos and how to improve them.

13. Do you prefer a teacher or a presenter who uses:
   a. demonstrations, models or practical sessions.
   b. question and answer, talk, group discussion, or guest speakers.
   c. handouts, books, or readings.
   d. diagrams, charts or graphs.

14. You have finished a competition or test and would like some feedback. You would like to have feedback:
   a. using examples from what you have done.
   b. using a written description of your results.
   c. from somebody who talks it through with you.
   d. using graphs showing what you had achieved.

15. You are going to choose food at a restaurant or cafe. You would:
   a. choose something that you have had there before.
   b. listen to the waiter or ask friends to recommend choices.
   c. choose from the descriptions in the menu.
   d. look at what others are eating or look at pictures of each dish.

16. You have to make an important speech at a conference or special occasion. You would:
   a. make diagrams or get graphs to help explain things.
   b. write a few key words and practice saying your speech over and over.
   c. write out your speech and learn from reading it over several times.
   d. gather many examples and stories to make the talk real and practical.