LEARNING STYLE DIFFERENCES OF UNDERGRADUATE ALLIED HEALTH STUDENTS IN THE CLINICAL AND CLASSROOM SETTING

THESIS

Presented in Partial Fulfillment of the Requirements for the Degree Master of Science in the Graduate School of The Ohio State University

By
Lisa Nicole Cox, BS, ATC
Graduate Program in Allied Medicine
The Ohio State University
2009

Thesis Committee:
Professor Jill Clutter, Advisor
Professor Georgianna Sergakis
Professor Laura Harris
Abstract

Student learning is an important consideration in the development of course designs. By recognizing and holding a better understanding of student learning styles, educators are able to build a better framework for more efficient and desirable teaching methods. This study aimed to find a relationship between allied health students’ classroom and clinical learning styles. Two Kolb Learning Style Inventories were administered to a total of 82 seniors in The School of Allied Health at The Ohio State University. This sample included students in the Athletic Training, Medical Dietetics, Radiological Sciences, and Respiratory Therapy programs. The students were asked to fill out the first questionnaire in regards to their didactic classroom learning. The second survey was administered at least one week after the first and the students were asked to fill out this questionnaire in regards to their current clinical experience. The data collected from the questionnaires was then entered into the Statistical Package of the Social Sciences for analyses. Overall, in the didactic classroom setting, 24.2% (n=16) of the students were Divergers, 28.8% (n=19) were Accommodators, 19.7% (n=13) were Convergers and 27.3% (n=18) were Assimilators. In the clinical settings 27.8% (n=20) of the students were Divergers, 36.1% (n=26) were Accommodators, 23.6% (n=9) were Convergers and only 12.5% (n=9) were Assimilators. Learning style did not change for 66.7% (n=10) of Athletic Training Majors. Over half of the Medical Dietetics (53.8%,
n=7), Radiological Sciences (72.7%, n=8) and Respiratory Therapy (52.9%, n=9) students’ Learning Style did change with the switch of the setting from classroom to clinical. It was found in Cross tabulation that the Accommodating learner was least likely to change style with setting (75%, n=12) with the Diverger style next at 69.2%. The change of style that was least likely to occur was between the Converger and Diverger (n=2) and the Assimilator and Accommodator (n=4). These findings support the idea that learning styles are an effective and interesting way to learn about the dynamic of a specific program or class. Future research should be done to fully assess and grasp an understanding of the styles of those active in the field of Allied Health education.
Acknowledgements

I would like to thank the HayGroup® for their cooperation in my use of the Kolb Learning Style Inventory. I would also like to acknowledge the cooperation of those students and professors who took part in my data collection, for without them, I would have no study. Finally, I would like to recognize my advisor for all her hard work and patience. Her guidance and support was substantial in the completion of my graduate study.
Vita

June 2002……………………………..Carroll HS

May 2006………………………………B.S. Athletic Training, Wilmington College

2006-2007…………………………….Athletic Trainer, Cincinnati SportsMedicine

2007-present……………………….Athletic Trainer, SportsMedicine GRANT

Fields of Study

Major Field:  Allied Medicine

Minor Field:  Research Methods
# Table of Contents

Abstract ................................................................. ii

Acknowledgments .................................................... iv

Vita ................................................................. v

List of Figures ..................................................... vii

Chapter 1: Introduction ................................................. 1

Chapter 2: Review of Literature ...................................... 4

Chapter 3: Methodology .............................................. 18

Chapter 4: Description of Study ..................................... 22

Chapter 5: Summary and Conclusions ............................. 33

References ........................................................... 37

Appendix A: Cover Letter to Questionnaire ...................... 40

Appendix B: Demographics Page .................................. 42

Appendix C: Email Confirmation for Use of Learning Style Inventory ................................. 44
List of Figures

Table 2.1  Kolb Learning Style Model .......................................................10
Table 2.2  Learning Styles in relation to sought profession identified by study ………13
Table 3.1  Learning Style Type Grid ..........................................................20
Table 4.1  Kolb Learning Style Model .......................................................25
Table 4.2  Percentages of Learning Styles in classroom and clinical setting ........29
Table 4.3  Crosstabs of Learning Styles in classroom and clinic .....................30
Table 4.4  Directional Changes across the X-Axis ........................................30
Table 4.5  Directional Changes across the Y-Axis ........................................31
Table 4.3  Change of Learning Style by Major ............................................32
Chapter 1: Introduction

Various amounts of time and research have been spent on understanding learning over the past few years. This research has encompassed a variety of areas including how one learns, what influences learning, and the societal impacts of learning.\(^1\) Highly respected learning societies have endorsed the concept of students understanding their own personal learning styles.\(^2\) Research has supported this fact showing that learning style and teaching preference have an effect on student education.\(^2\) Some researchers believe that learning trait is not held by the student, but comes from the relationship between the student and the material being studied.\(^3\) By recognizing the concepts of student learning and learning styles, educators are able to build a framework for more efficient and desirable teaching methods. This holds very true for those health professions where clinical education is a factor. Some frustrations may occur between the student and the educator if a student’s learning style does not remain the same when making the switch from classroom to clinical education. Kolb suggests a good educator will guide their students through all four learning styles in order to produce a more balanced learner.\(^4\) This balanced learner will more readily and successfully adapt to the various instruction methods provided by either the classroom or clinical educator because of his/her deep understanding and previous use of all learning styles.\(^5\)

The purpose of this research is to study the difference held between the clinical and classroom learning styles of allied health students at one university.
The research questions to be addressed in this study include:

1. What are the most prevalent classroom learning styles of the students in the allied health professions?

2. What are the most prevalent clinical learning style of the students in the allied health professions?

3. Are there significant differences between the learning styles of the students in the classroom setting and the students in the clinical setting?

4. Are there relationships between those who change learning styles across settings and academic program?
Definition of Terms

Learning Style= the way in which one learns

Learning Style Inventory= A self-report which measures the way in which one learns

Millennial= those born between the years 1980 and 2000. They are usually technologically savvy and are used to having their time heavily scheduled by their “soccer moms”

Allied Health Professions= Radiological Sciences, Athletic Training, Respiratory Therapy, Medical Dietetics

ATC=Athletic Trainer-health care professional encompassing the prevention, diagnosis, and intervention of emergency, acute, and chronic medical conditions involving impairment, functional limitations, and disabilities

PT=Physical Therapist-health care professional whom provides services to individuals and populations to develop, maintain and restore maximum movement and functional ability throughout life

OT=Occupational Therapist-works with a client to help them achieve a fulfilled and satisfied state in life through the use of purposeful activity or interventions designed to achieve functional outcomes which promote health, prevent injury or disability and which develop, improve, sustain or restore the highest possible level of independence

Classroom Setting= the traditional didactic environment of teacher relaying information to students

Clinical Setting= the more non-traditional setting in which the teacher is a working professional who helps the student practice and learn basic skill required for his/her field
Chapter 2: Review of Literature

Educators in the allied health field have embraced scientific research and content knowledge and have used these tools as a foundation in the education of their students. It is also important, however, to understand that most of these educators have not studied pedagogy or learning theory which supports this foundation. Today’s educational reform in the allied health field has focused solely on curricular content and formal test preparation. There is cause to believe that theoretical framework and learning theory can hold a strong place in the advancement of the education of students studying in the field of allied health. Much of this drive was prompted by ‘Making a Difference’ which placed more emphasis on practice-oriented based teaching. This shift has been used to raise the learning needs awareness of a new, more diverse population of allied health students. Because of this, focus should be placed on learning styles and the impact they have on the process of education. A learning style is an attribute of an individual who is active in an instructional circumstance in a way that produces learning outcomes. A learning style preference refers to the likes and dislikes an individual has for conditions of learning and preferred learning strategies. Incorporating learning styles into the education of allied health students will not only have a positive impact on the learning process, but also on the students’ ability to build relations with patients and co-workers. In the report of the 1997 meeting of the National Committee of Higher Education statements were made in support of a student knowing his
or her personal learning style. The report stated that ‘an effective strategy is to guide and enable learners to be effective learners, to understand their own learning styles and to manage their own learning.’ These reforms and projections made about learning and education lie within the confines of learning theory in relation to learning style.

Learning can be viewed as ‘a change in human disposition or as a capacity which can be retained and is not simply ascribable to growth.’ Learning is believed to occur when a learner understands new concepts, knows new facts, or displays the use of a new skill. This process is lifelong and is achieved easiest through real life experiences. Adult learners are considered to be more motivated, self-directed, active, and desire to have direct input into their learning process. Researcher Jane Vella has developed 12 principles for effective adult learning. These principles follow the idea that adult learners need to be a part of the decision making process, to feel they are in a safe, respectful, environment where roles and teamwork are used and hold strong relationships in this environment. They also learn better in environments where they are engaged in what they are learning and can be held accountable. The needs, age, education level, and learning style of the student should be held in consideration when the educator is formatting and building courses. The strategies students use to gain the needed knowledge is believed to be content specific and are brought about during the teaching/learning process. For example, a collegiate freshman studying for a foundations class in allied health may still rely on simple learning techniques from high school such as flashcards and memorization techniques. By the time this student reaches clinical rotations his senior year, he needs to apply the foundational knowledge learned in
real-life situations. The task of simply reiterating information learned in class and having no ability to adjust to these situations will not suffice.

Because of the diverse population of students in the field of allied health, not all learning environments can relate to every student’s learning style. This is why students must learn to adapt to those environments that are opposed to their dominant ways of learning. However a student dominant in one learning style, is not necessarily weak in the other areas. By recognizing the concepts of the student learning style, educators can gain a better framework for incorporating various delivery methods into their teaching. A study conducted by Montgomery and Groat suggests reasons why various styles should be considered in the teaching process.

1) An understanding of the various learning styles can open doors for better communication between the teacher and the student.

2) The teacher having knowledge of the students various learning styles can allow the educator to respond correctly to the diverse group of students and their questions and comments.

3) Educators can relay their learning objectives in the most productive way possible.

4) Considering learning styles can increase teacher satisfaction.

When an educator considers the use of learning styles in their teaching methods, they must remember that while learners may prefer one or two specific styles, they will still use a variety of techniques to some extent. Because of the diverse population of students seen in
today’s allied health programs, it is the responsibility of the teacher to address this diversity of styles and develop an appropriate teaching technique. It is believed that the student partaking in certain learning activities can have a direct outcome on the quality of learning. Students only retain 10-20% of what they hear in a lecture, but by adding visual aids to the presentation (i.e., pictures, posters, presentations) student’s recall doubles to about 50%. By adding speaking parts and active roles, a teacher can increase their students’ retention to 90+%.

All of these various tools (i.e., lecture, visual aid, speaking, active roles) activate various learning styles that each student may hold. These tools can also add a fun aspect to what may have become a dull process over the course of the semester.

Learning styles have been processed and studied for many years in hopes of benefiting both the student and the educator. In the ever-growing field of allied health instructors should be studying the learning styles of their students to allow them to reach the largest number of students in the most effective way. This would allow educators to be more efficient in their teaching practices. Studies have shown there to be a significant correlation between learning style preference and various factors including educational outcomes, gender, learning preferences, subject area, and learning environment. While having a student grasp his/her personal learning style, it is also imperative that he/she understand one must be able to adapt to an environment different from the preferred style. By creating environments diverse in teaching methodologies, teachers can support all types of learning styles. This creates a more welcoming and rewarding experience for all students and educators involved.
Experiential Learning and Kolb’s Learning Style Inventory

The Experiential Learning Model\textsuperscript{15} looks at the learning process in a way that allows for identifiable differences in learning styles and learning environments. This model consists of a four stage cycle which consists of: 1) concrete experiences (feeling), 2) observation and reflection (watching), 3) abstract conceptualizations (thinking), and 4) active experimentation (doing). Kolb states that people develop learning styles through heredity, life experiences, and demands of the present environment. Each person will develop a learning style that has some weak and strong points. The Learning Style Inventory (LSI) was developed as a self-inventory to measure one’s learning strengths and weaknesses. There are four significant styles that Kolb has developed: (1) the converger, (2) the diverger, (3) the assimilator, and (4) the accommodator.

The Converger is dominant in Abstract Conceptualization (AC) and Active Experimentation (AE). He does well with questions or problems where there is only a single best answer. Research has shown that he is typically unemotional and tends to deal with things rather than people. Most engineers have been found to be of the converger style.\textsuperscript{15,16}

The Diverger sits at the opposite end of the spectrum in comparison to the Converger. The Diverger is best at Concrete Experiences (CE) and Reflective Observation (RO). He tends to excel in situations where a concrete problem needs to be examined from all angles. He is good at “brainstorming” and generating new
ideas. He tends to be creative and imaginative and research has found that this style has been characteristic of those interested in the arts and humanities.\textsuperscript{15,16}

The Assimilator stands dominant in Abstract Conceptualization (AC) and Reflective Observation (RO). He masters inductive reasoning and the formation of theories. He is not as interested in the practical use of the theories as the Converger, but rather is more concerned that the theory is logically precise. This style is found more in the basics of math and science rather than the applied sciences.\textsuperscript{15,16}

The Accommodator sits at the opposite of the Assimilator. He is best at Concrete Experiences (CE) and Active Experimentation (AE). He tends to be more of “risk-taker” and his strengths lie in getting things done and carrying out plans. He adapts well in new situations and may solve problems in a trial and error manner. He may sometimes be seen as pushy and impatient. Accommodators usually excel in technical and practical fields, such as business.\textsuperscript{15,16}

Kolb designed the Learning Style Inventory (LSI) to measure individual learning style which was derived from the Experiential Learning Theory.\textsuperscript{15} The final form of the inventory came from three main objectives. The first, states that the test should be brief and concise so it could be used not only as a measuring device, but also as a tool used to discuss
learning styles with individuals. The second, posts that an individual should respond to it in a way they would respond to a learning situation. Finally, the third objective states that the test should be valid in measuring the learning styles of those taking the Inventory.\textsuperscript{15,16} Since the initial form, the Kolb LSI has been used in hundreds of studies, some concerning the field of allied health.

![Kolb Learning Style Model](image)

Figure 2.1 Kolb learning style model. Adapted from Kolb.\textsuperscript{16}
Allied Health and Learning Styles

Various researchers have spent time and resources studying the learning styles of students in various allied health fields along with nursing and medicine. Not only have learning styles been the focus of these studies, but also the relationship between learning styles and age, gender, profession, and attitudes towards various methods of learning. However, very minimal research has looked into the relationship between learning styles and clinical education. A significant portion of studies have found that those people working or studying in the field of health and medicine present as Kolb’s definition of convergers. In a study done by Aletta Z. Linares, the converger style was prominent in 60% of nursing and allied health faculty and students. These people were also considered to be more self-directed in their learning. The second most prominent style was the assimilator. However, this study was based on volunteer subject sampling which leaves area open for self-selection. This study also looked at students in their junior year and was administered only in the traditional classroom setting. A study of 227 third-year medical students presented with 102 (45%) convergers. This group was also followed by assimilators (26%). These students were surveyed before their third year of surgical clerkship. The convergers in this research were found to perform better on objective tests. Because these were surgical students being surveyed, there is question as to whether the dominance to the converger style was just, or whether it was related to the idea that convergers naturally gravitate towards objective professions such as surgery. In an assessment of nursing students in the traditional classroom setting, while not one style was more predominant than any of the others, Cavanagh found the diverger style to occur most frequently. Finally, in a 2003 study of
allied health students, Hauer, Straub, and Wolf\textsuperscript{8} found PA and OT students both
predominantly presented with converger and assimilator styles, while the majority of nurses
were accommodators and divergers. However, PTs were primarily accommodators and
convergers.\textsuperscript{8} Again, this was another study that focused solely on the traditional classroom
setting and this study’s results were based on very small sample sizes.

The concept of the “dual” learning style has also been accounted for in some studies. This occurs when the subject presents with two predominant styles on the inventory. In Rassool and Rawaf’s\textsuperscript{2} study of nursing students using the Honey & Mumford learning styles, they found not only the reflector group to be a predominant style, but also part of the “reflector-theorist” dual learning style. About 30\% of the total sample was classified in this group.\textsuperscript{2} These findings keep with the theory that nurses are not only scientific, but also people oriented. When a learning style is calculated, it can be not only looked at singly, but also in relation to other factors. Many studies do so.

Cavanagh\textsuperscript{18} looked at the learning styles of nursing students. Analyses were run to judge any possible relationship between learning style and gender, age, or previous employment. No statistically significant associations were found. Linares\textsuperscript{7} researched the relationship between learning styles and GPA and academic success. The findings showed no significant relationship established between learning style and graduation GPA. There was also no significant relationship established between academic success (defined in this study as completion of the student’s program of study) and learning style.\textsuperscript{7} A study complete by Stradley\textsuperscript{4} focused on the learning styles of athletic training students. In this study, the geographic region each student lived in was considered a possible mediating variable. The
analyses revealed no significant difference in classroom learning style for these students regardless of geographic region.\textsuperscript{4} Finally, Sandmire and Boyce\textsuperscript{19} took a different approach and studied collaboration between paired learning styles. In their research, they paired people of opposite learning styles (particularly the AC-CE pairs) and compared their scores on a collaborative case study to those pairs with the same learning style. (particularly CE-CE). They found the AC-CE pairings to score significantly higher, suggesting the possibility of pairing students and clinicians with opposite learning styles could be productive in the students’ education.\textsuperscript{19}

<table>
<thead>
<tr>
<th>Profession</th>
<th>Diverger</th>
<th>Accommodator</th>
<th>Assimilator</th>
<th>Converger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing</td>
<td>Cavanaugh\textsuperscript{18}</td>
<td>Hauer, Straub, Wolf\textsuperscript{8}</td>
<td></td>
<td>Linares\textsuperscript{7}</td>
</tr>
<tr>
<td>Medicine</td>
<td></td>
<td></td>
<td></td>
<td>Lynch\textsuperscript{37}</td>
</tr>
<tr>
<td>Physician Assistant</td>
<td></td>
<td></td>
<td>Hauer, Straub, Wolf\textsuperscript{8}</td>
<td></td>
</tr>
<tr>
<td>Occupational Therapy</td>
<td></td>
<td></td>
<td>Hauer, Straub, Wolf\textsuperscript{8}</td>
<td></td>
</tr>
<tr>
<td>Physical Therapy</td>
<td></td>
<td>Hauer, Straub, Wolf\textsuperscript{8}</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2.2. Learning Style in relation to sought profession identified by study.

\textit{Education of Millennial Students}

Those now known as the Millennial generation were born between the years of 1980 and 2000 and make up the majority of the student population at most colleges and universities. Scientists are still researching the aspects of this population, but trends in education are already starting to surface. Having been raised by a generation of “soccer moms”, Millennials are accustomed to having their time structured for them and they
naturally aim for success. These students who have been sheltered by their parents will need to learn to advocate for themselves and how to properly deal with authorities in order to become successful college students. All their lives these student have been shuttled from sporting practice to skill lessons with not much free time. This trend will continue through college as students will join many organizations and clubs. In college the ideal amount time recommended to study is doubled in comparison to high school, while Millennials still only spend about half of the recommended time doing class work and studying. This generation expects fun and interactive learning. They have grown up in a time where the internet is readily available, and they prefer current technology to be integrated into their education, and at times exceed in ability over faculty. They have learned by trial and error (ie, video games) where they learn to be persistent in an environment where following the manual rarely helps. They prefer multiple modes of information presentation. Simulations and clinical work fit the likings of this generation. They enjoy being mentored by older generations which provides a customized learning environment for the student. Millennials desire a personal touch from their educators and flourish in a supportive and encouraging environment.

The strengths and weaknesses of this generation should be incorporated in new educational techniques. A study completed by Gould and Caswell tested the preferred teaching and testing methods of athletic training students and the athletic training program directors. They found that students and program directors preferences were very different. Students were less likely to prefer teaching methods that required active participation. Students were also significantly less likely to prefer testing methods such as essay, short
answer, oral/practical, and oral presentation testing, in comparison to program directors. These findings show that today’s generation of students desire a more comprehensive and cooperative learning approach as opposed to the traditional format. The traditional teacher’s lecture format assumes that all students are auditory learners. In this format, students retain 70% of what is covered in the first 10 minutes, but only 20% of what is covered in the last 10 minutes. New and more innovative learning techniques have been developed and tested to keep up with the needs of this new generation. One such curriculum was tested on a group of medical students in Sri Lanka. In this program classes were built around student generated learning. Small group discussions are held and they are introduced to clinical thinking through cases in which teachers are merely facilitators. This curriculum reported higher scores in deep processing, critical processing, and concrete processing as opposed to the traditional students. These students also reported greater use of memorizing and rehearsing strategies. Today’s universities are using more ‘flexible’ teaching models to optimize educational opportunities. (i.e., peer teaching, peer learning).

Peer assisted learning (PAL) is recognized as one of many clinical education tools. In a study of athletic training students in a clinical setting, 19% of students agreed that they learned a large amount of their clinical skills from other students, and 66% stated they practiced moderate to large amounts of their skills with other students. Accurate and appropriate feedback is vital in the mastering of new clinical skills. While some students may feel that the information they gain from peers is not as helpful as the information they may have learned from Clinical Instructors (CI), because CIs may be monitoring many students at a time, the peer feedback may provide vital immediate information that the busy
CI was unable to give. All forms of clinical education aim to aid in the development of clinical proficiencies a student may need while working in the field. Experiential learning can be applicable to allied health education through case studies, clinical experience, and clinical postconference discussions. Clinical postconference discussions can facilitate problem solving, collaboration, and evaluation and discussion of real-life scenarios. “Because adult learning is grounded on real-world experiences, clinical experience provides an environment conducive to the learned process and the development of clinical reasoning.” Learning styles, in relation to clinical education, have not been a common ground for research. Coker examined the learning styles of athletic training students in the clinical and classroom setting. In her study, she found that 58% of respondents switched learning styles according to the setting (clinical or classroom). Forty-two percent of the students were categorized as convergers in the clinical setting, while 30.8% were categorized as accommodators. This study, however had a small sample of 26 undergraduate athletic training students and failed to control test-retest reliability when the LSIs were given back to back in the classroom setting. Lynch found in his study of third year surgical clerkship medical students that none of their learning orientations measured by the LSI correlated with clinical performance. These findings show that educators need a way to peer into the learning styles of their students in the clinical setting. This would allow these educators to find the best way to facilitate learning in such a diverse educational setting.

All of the allied health fields in this study require success in the classroom, but also in clinical rotations. These students are tested daily on their hands-on and patient relationship skills. For these students to become a success in their chosen fields, they need to prove to be
competent in their clinical and classroom settings. This success can be jump-started by the proper alignment of learning styles and education. With a look at the way allied health students prefer to learn, in both clinical and classroom settings, educators can easily facilitate the material needed in a rewarding and resourceful manner.
Chapter 3: Methodology

This study is a descriptive study using a survey questionnaire. After receiving exempted approval from the IRB, all senior status students enrolled in both clinical and classroom work in The School of Allied Health Professions at The Ohio State University were invited to participate. This group included students from following programs: Athletic Training (n=15), Medical Dietetics (n=24), Respiratory Therapy (n=17), and Radiological Sciences (n=26). The Learning Style Inventory was developed by David Kolb to measure one’s learning strengths and weaknesses. After completion of the LSI, the student learns he is predominantly one of four learning styles (Converger, Assimilator, Accommodator, and Diverger). These Inventories were administered to the students by the study's co-researchers and program directors. A directional letter was read aloud and the students were asked to complete the first survey. Those who did not wish to participate were told they would not be penalized by their professor. Each student was asked to answer the inventory in relation to a specific course which had been previously identified as primarily didactic. This required the student to rank from one to four, their feelings regarding a certain learning situation that was listed. This was done for twelve situations that were listed. They were also asked demographic information (sex, age, program of study) and to list the last four digits of their phone number for tracking purposes only.
After the students completed this first Learning Style Inventory, the researcher collected them and identified them as Inventories in relation to the classroom setting by marking them with an identifying color. The second survey was administered at least one week after the first. The students were instructed to fill out this inventory in relation their current clinical work. Again, those who did not wish participate were informed that they would no be penalized by their professor in the current class. This again required a ranking of feelings on a scale from one to four in regards to twelve different educational scenarios. They were asked to fill out the same demographic information and the identifying last four digits of their phone number. After completion, this group of Learning Style Inventories were collected and marked with a separate identifying color. The Inventories were then collected by the primary researcher, paired by identification number and were entered into the Statistical Package of the Social Sciences (SPSS Corporation, version 17.0, Chicago IL) data system.

After final entry of the completed inventories in to the statistical package, each student’s learning style from the clinical setting and the classroom setting was computed. This was done by totaling each student’s score for each learning mode (Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation) using equations provided by the Haygroup®, the distributor of the Kolb Learning Style Inventory. Combination scores were then calculated. This was done by subtracting the CE score from the AC score (AC-CE) and the RO score from the AE score (AE-RO). These two numbers were then graphed on the learning style grid using the AERO score as the “X” and the ACCE
score as the “Y”. The placement of the student’s point in one of the four quadrants identifies learning style. (Figure 3.1)

![Learning Style Type Grid](image)

After each student’s classroom and clinical learning style was computed, analyses were completed to look at the following relationships:

1) Overall learning style of allied health students in the classroom and clinical setting

2) Overall learning style of each allied health program

3) Overall clinical learning style versus classroom learning style
4) Difference in those who changed learning styles across settings and those who did not in each allied health program

The data was entered into the SPSS statistical package and was summarized using frequencies and percentages. Research questions 3 and 4 were answered using chi square analyses.
Chapter 4: Description of Study

LEARNING STYLES IN UNDERGRADUATE ALLIED HEALTH STUDENTS;
CLINICAL VERSUS CLASSROOM

Abstract

Learning Outcome & Conclusion: To determine the differences in undergraduate Allied Health students learning styles in the clinical and the classroom settings.

Background: Student learning is an important consideration in the development of course and clinical design. By recognizing and holding a better understanding of student learning styles, educators are able to build a better framework for more efficient and desirable teaching methods.

Methods: Two Kolb Learning Style Inventories were administered to a total of 82 seniors in The School of Allied Health at The Ohio State University. This sample included students in the Athletic Training, Medical Dietetics, Radiological Sciences, and Respiratory Therapy programs. The students were asked to fill out the first questionnaire in regards to their didactic classroom learning. The second survey was administered at least one week after the first and the students were asked to fill out this questionnaire in regards to their current
clinical experience. The data collected from the questionnaires was then entered into the Statistical Package of the Social Sciences for analyses.

**Results:** Overall, in the didactic classroom setting, 24.2% (n=16) of the students were Divergers, 28.8% (n=19) were Accommodators, 19.4% (n=13) were Convergers and 27.3% (n=18) were Assimilators. In the clinical settings 27.8% (n=20) of the students were Divergers, 36.1% (n=26) were Accommodators, 23.6% (n=17) were Convergers and only 12.5% (n=9) were Assimilators. Learning style did not change for 66.7% (n=10) of Athletic Training Majors. Over half of the Medical Dietetics (53.8%, n=7), Radiological Sciences (72.7%, n=8) and Respiratory Therapy (52.9%, n=9) students’ Learning Style did change with the switch of the setting from classroom to clinical. It was found in Cross tabulation that the Accommodating learner was least likely to change style with setting (75%, n=12) with the Diverger style next at 69.2%. The change of style that was least likely to occur was between the Converger and Diverger (n=2) and the Assimilator and Accommodator (n=4).

**Conclusion:** Learning styles are an effective and interesting way to learn about the dynamic of a specific program or class. Future research should be done to fully assess and grasp an understanding of the styles of those active in the field of Allied Health education.
Introduction

Highly respected learning societies have, for years, endorsed the concept of students understanding their personal learning styles. Research has supported this fact time and again showing that learning style and teaching preference have a positive effect on student education. Understanding and recognizing the concepts of student learning and learning styles allows educators to build more desirable and efficient teaching methods. David Kolb, the developer of the Learning Style Inventory, suggests students be guided through all four learning styles in order to be a more balanced learner. This learner can then more easily adapt to the various instruction methods that may be used by a classroom educator or a clinical instructor. The 1997 meeting of the National Committee of Higher Education reported the positive impact learning styles can have on student education. The report emphasized the effectiveness of managing one’s learning by understanding his learning style.

The field of Allied Health is seeing a growth in the diversity of its students. This fact makes it hard for all learning environments to try and relate to each individual learning style. Reason shows why students must adapt to the environments that are opposed to their ways of learning. By understanding the concepts of these student learning styles, educators can better incorporate various delivery methods in their teaching. In this ever-growing field, instructors should be studying the learning styles of their students to allow educators to reach the largest number of students in the best possible way.

Learning styles have not only been the primary focus of recent research, but also the relationship these styles have with age, sex, profession, and attitudes towards various
methods of learning. The Kolb Learning Style Inventory has been the tool used in many of these studies to grade the participant’s learning style. This tool is derived from the Experiential Learning Model. This Model looks at the learning process in a way that allows for identifiable differences in learning styles and learning environments. Through completion of the questionnaire, the participant ranks their feelings toward the use of Concrete Experiences, Reflective Observation, Abstract Conceptualization, and Active Experimentation in their learning. (Figure 4.1)

<table>
<thead>
<tr>
<th>CE</th>
<th>Concrete Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>Active Experimentation</td>
</tr>
<tr>
<td>AC</td>
<td>Abstract Conceptualization</td>
</tr>
<tr>
<td>RO</td>
<td>Reflective Observation</td>
</tr>
</tbody>
</table>

Figure 4.1 Kolb Learning Style Model. Adapted from Kolb.
Four statistically significant learning styles have been derived from this tool. This first is the Converger. This person is dominant in Abstract Conceptualization (AC) and Active Experimentation (AE). This person is typically unemotional and deals better with things rather than people.\textsuperscript{15,16} The second style is the Diverger which sits opposite of the Converger. This person is best with Concrete Experiences (CE) and Reflective Observation (RO). He tends to be creative and imaginative and good at “brainstorming” and creating new ideas.\textsuperscript{15,16} The third style, the Assimilator, stands dominant in Abstract Conceptualization (AC) and Reflective Observation (RO). The Assimilator masters inductive reasoning and the formation of theories.\textsuperscript{15,16} Finally, the Accommodator sits opposite of the Assimilator. He excels in Concrete Experiences (CE) and Active Experimentation (AE). His strengths lie in getting things done and carrying out plans.\textsuperscript{15,16} A majority of the studies using Kolb’s Learning Style Inventory (LSI) found those people working in the field of health and medicine present with the Converger learning style. However, none of these studies looked at the relationship the student’s classroom learning style holds with his clinical learning style.

Health profession education programs require success not only in the classroom, but also in clinical rotations. For these students to become a success in their chosen field, they need to prove to be competent in their clinical and classroom settings. This success can be facilitated by the alignment of learning styles and education. With a look at the way allied health students prefer to learn, in both settings, educators can easily facilitate the material needed in an efficient and resourceful manner. Thus, the purpose of this study was to classify students’ learning styles and identify differences held between the clinical and classroom learning styles of allied health seniors at one university.
**Methods**

**Subjects**

Eighty-two seniors from The School of Allied Health at The Ohio State University were surveyed for this research. The programs which participated included Athletic Training (n=15), Medical Dietetics (n=24), Radiological Sciences (n=26) and Respiratory Therapy (n=17). This group had a mean age of 23.01 (±3.253) and was predominantly female with only 23 male participants. In the cover letter of the survey, it was stated that the students would not be penalized from their professor if they did not wish to participate. However, it was also noted that completion and return of the survey would imply the participants’ consent to participate.

**Questionnaire**

The Kolb Learning Style Inventory (LSI) was used to assess each student’s learning style. Permission to use this survey was granted after application by HayGroup® (Boston, MA). This LSI questionnaire consists of 12 sentences with a choice of 4 optional endings. The participants were asked to rank (from 1-4) the endings. This ranking was done in accordance with how well the participant felt each ending coincided with how they would go about learning new material. A ranking of 4 indicates the ending is most like the participant, and a ranking of 1 indicates the ending is least like the participant. Each number was only to be used once per sentence. The scores were then totaled and reduced to two numbers, which were then plotted on a graph which indicated the participant’s learning style. Demographic information was also included on the questionnaires which included sex, age, major, and the last four digits of a telephone number to be used as an identification tool.
**Data Collection**

The Kolb Learning Style Inventory was distributed twice to each class of seniors. The students were instructed to fill out the first survey in relation to their classroom work, and one week later were asked to fill out the second in relation to their current clinical work. They were asked to list the last four digits of their telephone number on both so the first and second questionnaires could be linked together for analyses. The classroom and clinical surveys were each marked with a separate identifying color by the researchers. Once they were all collected by the primary researcher, the information was entered into the Statistical Package of the Social Science (SPSS Corporation, version 17.0, Chicago, IL) for analysis.

**Data Analysis**

Both questionnaires were matched together for each individual to allow for assessment of changes in learning style. Responses were then entered into SPSS including coding for sex and academic major. Each individual’s clinical and classroom learning styles was then figured and coded. Frequencies and percentages were used to analyze the data and a chi square was used to determine the (1) changes in overall learning style and (2) program of study versus change or no change in learning style.

**Results**

All together, 66 (80.4%) participants completed the didactic classroom survey and 72 (97.8%) completed the clinical survey. Fifty-six participants (68.29%) successfully completed both surveys. Overall, in the didactic classroom setting, 24.2% (n=16) of the students were Diversers, 28.8% (n=19) were Accommodators, 19.7% (n=13) were Convergers and 27.3% (n=18) were Assimilators. In the clinical settings 27.8% (n=20) of

28
the students were Divergers, 36.1% (n=26) were Accommodators, 23.6% (n=17) were Convergers and only 12.5% (n=9) were Assimilators as shown in Figure 4.2

![Table showing percentages of learning styles in classroom and clinic](image)

Interestingly, when those 56 completed sets of surveys were analyzed using a crosstabs matrix of classroom versus clinical style preference, the highest frequency occurred within the Accommodator title. Twelve participants reported this style in both the classroom and the clinical setting. The second highest occurrence appeared in the dual Diverger category. Nine participants presented with this style in both the classroom and clinical settings. However, there were no recordings of any participant having the Diverging classroom style and Converging clinical style. (Figure 4.3)

![Crosstabs of related learning styles](image)
The directional changes of classroom to clinical style were also noted. Eighty percent (n=12) of those who crossed the X-axis (separating the learning modes of abstract conceptualization and concrete experiences) of the Learning-Style Type grid did so towards concrete experiences in the clinical setting. (Figure 4.4)

Also, 61.1% (n=11) of those who crossed the Y-axis (separating the modes of active experimentation and reflective observation) did so towards active experimentation in the clinical setting. (Figure 4.5) Thus, the learning mode holds significance with the way a student may change his or her learning style.
Looking at the academic majors of the participants in comparison to whether their learning style did or did not change also presented some interesting findings. The field of Athletic Training showed a 66.7% (n=10) rate of students who did change learning styles. The other programs, Medical Dietetics (53.8%, n=7), Radiological Sciences (72.7%, n=8) and Respiratory Therapy (52.9%, n=9) presented with the majority of their students keeping the same learning style across the different settings. (Figure 4.6) Thus, showing that of all the professions, the Athletic Training student is more likely to change his predominant learning style across settings.
Athletic Training | Medical Dietetics | Radiological Sciences | Respiratory Therapy
---|---|---|---
Did not change | 5 | 7 | 8 | 9
Changed | 10 | 6 | 3 | 8

Figure 4.6 Change of Learning Style by Major

It is also interesting to note, however, the breakdown of learning styles individually in each academic program of study, and most notably, clinical learning style. Eleven of 17 Respiratory Therapy students presented with an Accommodating clinical learning style and zero Athletic Training students demonstrated an Assimilating clinical learning style. A notable jump was also made in the Assimilating category. Seventeen of a possible 66 students (27.3%) reported an Assimilating style in the classroom setting, and only 9 of a possible 72 (12.5%) reported the same in the clinical setting.

**Discussion**

The learning styles of various allied health students are spread across the axis. While this study did not find a specific significant learning style for each program, or a significant jump from classroom to clinical style for allied health programs, some very interesting observations and implications can be made. Studies previously mentioned which looked at students in allied health, nursing, and medicine found that the majority of students presented with the Converger learning style followed by the Assimilator.\textsuperscript{7,8,16,25} Our study shows the Converger style to be the most uncommon style in both settings. This holds true for all areas of study with the exceptions of Medical Dietetic clinical setting and Athletic Training classroom setting. Coker et al was the only examination that looked at clinical and classroom settings.
learning styles in relation to one another. Her study found that 58% of respondents switched learning style according to setting opposed to the 48.2% found in this study. These all raise the question of; is really possible to brand one learning style to one profession, area or setting of study?

Many studies have tried to describe a relationship with learning style and another factor. Cavanaugh studied nursing students’ learning styles relationship to age, sex, and previous employment and found no statistically significant relationships. A relational study between learning styles and GPA was complete by Linares who also found no statistically significant relationship. Stradley went as far as to study Athletic Training students’ learning style relation to geographical region and found no significant difference in learning style regardless of region. These studies along with the present study help cast a light on the complex idea of learning style theory. While this research has presented no statistically significant findings, it shows that the idea of the learning style is complex; it is something that needs to be continually researched. The pinpointing of a profession or setting to a specific style may not be possible, but some relationships between these styles may serve as a guide to educators. There were only 6 total relationships between opposite styles. Two of these were between the Converger and Diverger and 4 were between the Assimilator and Accommodator. This lends to the idea that while a student may be predominantly stronger in two styles, that these styles are more likely to be next to each other on the axis, rather than across. If an educator can teach to two opposite styles, then it is more likely they will touch on the majority of their students’ preferred modes. Because of the diverse population of
students seen in today’s allied health programs, it is the responsibility of the teacher to address this diversity of styles and develop an appropriate teaching technique.¹²

Limitations

A convenience sample was used, so the information gained can only be generalized back to the sample. Relatively small sample sizes hampered the proposed analyses (Chi squares were invalid due to insufficient cell numbers) The lack of full completion of both surveys proves detrimental to this research. A possible 26 more completed sets of surveys could have proven useful for analyses.

Conclusion and Implications

Continued research is needed in the field of clinical and classroom learning styles. Previous research has shown the usefulness of students understanding their personal learning styles. In the growing field of health care education, there has been a shift towards bettering clinical education. Educators are beginning to realize the importance of their students’ clinical education, and are working towards improving the experience for all those involved. The movement towards a deeper look into clinical education can be jump started by long term studies involving students learning styles in both educational settings. This research should focus on looking into the changes across these settings of larger and more diverse population. The continued research will only better the educators and clinical instructors knowledge and ability to facilitate comprehensive learning.
Conclusion

The ability to incorporate learning styles into teaching gives educators another tool to positively impact their students’ learning process, and in turn, the students’ ability to build relations with patients and co-workers in the future. It is thought that the techniques students use to gain knowledge is brought about during the teaching/learning process. This study focused on the idea that clinical education is different than classroom education, and this may be cause for a change in learning styles amongst students. Our study, however, like many others, did not find a specific learning style for each academic program in either the classroom, or clinical setting. However, it is interesting to note that 27 (48.2%) of students changed their learning style across settings. It is also interesting to note that 75% (n=12) of the Accommodators did not change style with setting and neither did 69.2% (n=9) of Divergers. Both of these styles prefer less of the abstract conceptualization mode and more of the concrete experience mode. Clinical learning is usually a hands-on experience, so this supports the idea that someone who already prefers this style in the classroom is still going to prefer the same in the clinical setting. This is also supported by the fact that 80% (n=12) of those who crossed the X-axis (dividing the learning modes of concrete experiences and abstract conceptualization) did so from abstract conceptualization for didactic learning to concrete experiences for clinical learning. On the other hand, 61.1% (n=11) of those who
crossed the Y-axis (dividing the learning modes of reflective observation and active experimentation) did so from reflective observation in the classroom to active experimentation in the clinical setting. This opens up to the idea that those who are going to change their learning style from classroom to clinic, are going to do so towards more learning by doing and experiencing. These two modes are what one can usually expect to experience in clinical learning experiences. Thus, an understanding of not only learning styles, but also learning modes is of high importance.

When specifically looking at learning mode, 53.6% (n=30) of participants preferred active experimentation in the classroom and 64.3% (n=36) preferred the same in the clinical setting. A total of 44.6% (n=25) preferred active experimentation in both settings. The second highest mode seen was reflective observation mode which sits opposite of active experimentation on the axis. Only 23.2% (n=13) preferred this mode in the classroom while only 19.3% (n=11) preferred the same mode in their clinical learning. Seven students (12.5%) primarily used Reflective Observation in both settings. The study of learning styles and modes can be used as a tool to easily connect with the dissimilar population of the Millennial generation.

The field of allied health has seen a growth in diversity with the entrance of Millennials. This diversity seen in students gives educators the task of addressing the diversity of learning styles and developing appropriate teaching techniques for both settings. By recognizing learning styles and modes and their changes, teachers can open communication lines between educator and student. Having an understanding of these styles can also allow the educator to respond correctly to the students and their questions and
comments, and relay learning objectives in the best possible way. While no specific relationship between styles and settings was noted, there was a pattern in the direction of change. Twenty-one (77.8%) of the 27 participants whose style changed with the setting, changed to an adjacent style. Only 6 students crossed to opposite styles. This supports the idea of teaching to opposite styles to reach multiple students. By teaching to opposite learning styles, the educator will touch on every learning mode and in turn, partially work in every learning style. Understanding this idea will give educators the opportunity to reach the largest number of students in the best possible way and be more efficient in their teaching practices. New and more innovative techniques need to be developed to keep this new generation interested and informed. With a better look into the learning styles and modes of allied health students, the material needed to facilitate proper learning can be done so in a more fun and resourceful manner.

Limitations

The sample proves to be the largest limitation in this research. The size was small in relation to the thousands who are currently studying in these programs. A larger sample may have provided more statistically significant relationships and findings. Also, the combined response rate, 68.3% (n=56) with 72 completions of the clinical survey and 66 completions of didactic survey hinders the reliability of the statistics. The demographics of the sample also may not be representative of the target population as the research was administered at one large Division I University.
Recommendations

The findings of this study are quite useful when making recommendations for real life settings. The majority of the participants who preferred separate learning styles preferred ones which were adjacent to each other on the Learning Style Type grid. While dominance in one learning style was not a trait, dominance in one learning mode over another could be seen through this. By this fact, it can be deduced that teaching to opposite learning styles or learning modes will prove to be most efficient when teaching the dissimilar population of the millennial generation.

Future Research

While this research is not statistically representative of the target population, it still opens the door for further research. Studies of allied health students learning styles and modes should be completed in each classroom. While one style or mode may not surface as the favorite, it allows the educator to peer into the way their students are thinking and processing information in both the clinic and classroom. This better understanding of students’ learning will allow professors, teachers and clinical educators to better perform their responsibilities of shaping better students and clinicians.
References


Appendix A: Cover Letter to Questionnaire
Dear Survey Participant,

I am currently working on my Masters of Science in Allied Health through The Ohio State University. During my time at The Ohio State University I have grown a deep interest in clinical and classroom education. My research has been designed to study the learning styles as identified by the Learning Style Inventory and the differences in the clinical and classroom setting. The title of my study is Learning Style Differences of Undergraduate Allied Health Students in the Clinical and Classroom Settings.

The following is a Learning Style Inventory. I ask you to fill out this survey to the best of your ability. Completion of this survey will be voluntary and confidential. As a voluntary participant you are free to terminate your participation at any time without prejudice. While this survey is meant to be confidential, I ask that you write in the last four digits of your phone number in the appropriate space. This will only be used as an identifier at a later date to compare information to your second survey. Completion and return will imply your consent to participate. This Inventory and demographic section should take about five minutes to complete.

Thank you for your time and participation. If you have any question regarding the research or are interested in obtaining the results, feel free to contact my advisor, Jill Clutter, PhD, at clutter.1@osu.ed.

Sincerely,

Lisa Cox, ATC
Graduate Student
The School of Allied Health
The Ohio State University

Jill Clutter, PhD, CHES
306 Atwell Hall
453 W. 10th Ave.
Columbus, OH 43210-123
Appendix B: Demographic Page
Demographics

Please write in answer:

Last Four Digits of Phone Number: ______

Age: _____ years

Please Circle One:

Sex:
  A. Male
  B. Female

Educational Major:
  A. Athletic Training
  B. Medical Dietetics
  C. Radiological Science
  D. Respiratory Therapy
Congratulations! Your research request regarding use of the Learning Style Inventory (LSI) has been approved. Attached you will find one document containing three pages (.pdf file--Adobe Acrobat 4.05):

* MCB200C - This is a copy of the LSI test. You may print or copy this document as needed for your research.

* MCB200D - The profile sheet contains the answer key for the test as well as the profiling graphs for plotting scores. This document may also be reproduced as necessary for your research. The AC-CE score on the Learning Style Type Grid is obtained by subtracting the CE score from the AC score. Similarly, the AE-RO score = AE minus RO.

These files are for data collection only. This permission does not extend to including a copy of these files in your research paper. It should be sufficient to source it.

We wish you luck with your project and look forward to hearing about your results. Please email a copy of your completed research paper to Jessica_Menendez@Haygroup.com or mail it to the following address:

LSI Research Contracts
c/o Jessica Menendez
HayGroup
116 Huntington Avenue, 4th floor
Boston, MA 02116

If you have any further questions, please let me know.

Regards,

Jessica L. Menendez
Hay Group Transforming Learning
116 Huntington Avenue
Boston, MA 02116
(617) 927-5026 (DD)
(617) 927-5008 (F)
www.haygroup.com/TL