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A Nationwide Learning-Style Assessment of Undergraduate Athletic Training Students in CAAHEP-Accredited Athletic Training Programs

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Objective: To identify the learning styles and preferred environmental characteristics of undergraduate athletic training students in Commission on Accreditation of Allied Health Education Programs (CAAHEP)-accredited athletic training education programs and to determine if learning-style differences existed among geographic regions of the country.

Design and Setting: Fifty CAAHEP-accredited athletic training programs were randomly selected in proportion to the number of programs in each geographic region. Ten students from each school were selected to complete the Kolb Learning Style Inventory (LSI) and the Productivity Environmental Preference Survey (PEPS).

Subjects: A total of 193 undergraduate athletic training students (84 men, 109 women) with a mean age of 22.3 ± 2.8 years completed the PEPS, while 188 students completed the LSI.

Measurements: We used chi-square analyses to determine if differences existed in learning-style type and if these differences were based on geographic location. We calculated analysis of variance to determine if there were any geographic differences in the mean overall combination scores of the LSI. Descriptive statistics were used to evaluate the PEPS.

Results: The overall return rate was 38%. The chi-square analyses revealed no significant difference in learning-style type for athletic training students, regardless of the geographic region. The LSI yielded a relatively even distribution of learning styles: 29.3% of the students were accommodators, 19.7% were divergers, 21.8% were convergers, and 29.3% were assimilators. The overall mean combination scores were 4.9 (abstract-concrete) and 4.9 (active-reflective), and analysis of variance indicated no significant difference in the mean combination scores among the geographic regions. The PEPS revealed that undergraduate athletic training students demonstrated a strong preference for learning in the afternoon.

Conclusions: Undergraduate athletic training students demonstrated great diversity in learning style. Educators must strongly consider this diversity and incorporate teaching methods that will benefit all types of learners.

Key Words: Productivity Environmental Preference Survey, Learning Styles Inventory, clinical education

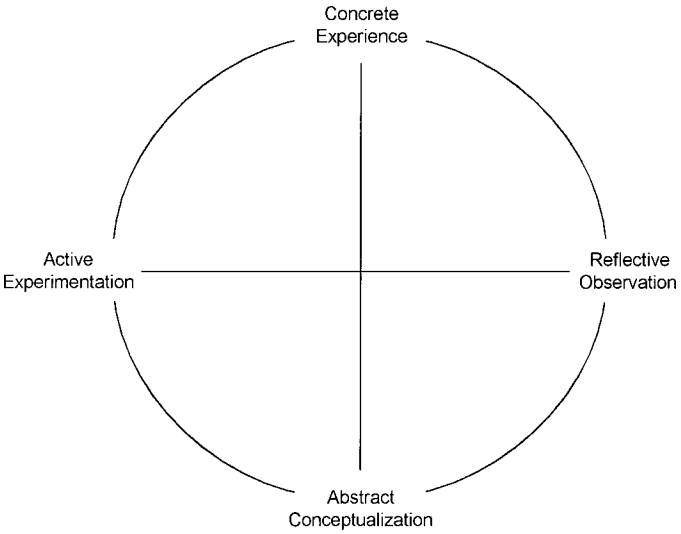
As the concern for the state of athletic training education continues to grow and change, so must our strategies for teaching the students who intend to carry on the profession. With the expansion of curriculum programs, we are faced with the task of teaching the greatest number of students in the best possible way. In order to be effective instructors, we must understand and define the learning styles of our athletic training students.

Learning style, defined as the composite of characteristic cognitive, affective, and physiologic factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment,[1] is often assessed through learning-style inventories. The Kolb Learning Style Inventory ([LSI] McBer Publishing, Boston, MA) has been used to identify an individual's learning style.[2–6] Extensive research[7–11] to classify learning styles has been conducted on students in the allied health professions, such as nursing, dentistry, and occupational and physical therapy. To date, only a few investigators[5,6,12,13] have looked specifically at athletic training students.

Identifying and subsequently teaching to students' learning styles has been shown to be beneficial.[14–19] Therefore, classifying the learning styles of athletic training students enables educators to provide an environment that facilitates learning.

The need to continue this exploration as the athletic training profession shifts to curriculum-based programs and competency-based clinical learning is great.

In addition to identifying the learning styles of athletic training students, it is equally important to assess and evaluate the environmental conditions that enhance the learning process. The Productivity Environmental Preference Survey ([PEPS] Price Systems, Inc, Lawrence, KS)[20] identifies the most important environmental variables influencing an individual's ability to learn and perform. By evaluating students on 2 levels of learning styles, we can begin to develop a profile of the typical athletic training student, including how he or she processes information and the environment that is most conducive to learning. The purpose of our study was to identify the learning styles and preferred environmental characteristics of undergraduate athletic training students in Commission on Accreditation of Allied Health Education Programs (CAAHEP)-accredited athletic training education programs. The secondary purpose was to determine if learning-style differences existed among geographic regions of the country.



Representation of the cyclic nature of the experiential learning theory.

METHODS

Subjects

All subjects of this investigation were undergraduate students enrolled in CAAHEP-accredited athletic training education programs across the United States. Students in 22 of the 50 schools contacted completed the surveys. Students were asked to complete both surveys. A total of 193 students (84 men, 109 woman with a mean age of 22.3 $\pm$ 2.8 years) completed the PEPS, and 188 completed the LSI. Before completing the surveys, all subjects signed informed consent forms approved by the university's institutional review board, which also approved the study.

Instrumentation

The instruments used in this study were the Kolb LSI, revised in 1985, and the PEPS, developed in 1979. For the purposes of this study, we chose the Kolb LSI to assess and determine the learning styles of the athletic training students and the PEPS as an instrument to assess the preferred conditions and environment of athletic training students. Both were chosen for several important reasons, including their prior use by many well-regarded educational researchers[2–6,14–16] and their demonstrated high reliability and construct validity.[21–24]

The Kolb LSI provides insight into a student's information-processing capabilities. Information processing is the intellectual approach the student takes to assimilate information.[23] The Kolb LSI is an instrument designed to assess the strengths and weaknesses of a student's learning style. It is based on Kolb's experiential learning theory, which describes a cycle of learning that all learners incorporate at some point.[25,26] Kolb's cycle is described as follows[27]: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) (Figure).

The LSI is useful in providing a measure of the extent to which a learner emphasizes abstractness over concreteness (abstract-concrete [AC-CE]) and action over reflection (active-reflective [AE-RO]). The 2 combination scores are plotted onto a grid and fall into 1 of 4 quadrants: accommodator, diverger, converger, or assimilator.[28] The quadrant in which the student's score falls indicates his or her preferred learning style. More balanced learning styles fall closer to the center of the grid. Table 1 displays some of the strengths and weaknesses that characterize each of the learning-style types.

Table 1. Strengths and Weaknesses of Learning-Style Types[29]

Learning-Style Type	Strengths	Weaknesses
Accommodator	Involvement in new situations with trial and error; risk taking	Trivial improvements; being involved in seemingly meaningless activities
Diverger	Imaginative ability; understands people	Inability to make decisions
Converger	Uses deductive reasoning; prefers application of ideas	Makes decisions too quickly; solves the wrong problem
Assimilator	Builds theoretic models; uses inductive reasoning	Lack of practical applications generated from theory

A distinction of the learning cycle is that no one mode describes a person entirely. Rather, everyone's learning style is an individual combination of these learning modes. Kolb and Wolfe[2] advocated a balance of all 4 abilities in order to be an effective learner. Combining the scores on the LSI and plotting them accordingly allows a student's preferred learning style (ie, accommodator, diverger, converger, or assimilator) to be revealed.

The LSI is a 9-question instrument in which the student is asked to rank 4 statements for each question that best describes his or her preferred manner of learning.[28] The 4 words or statements in each question represent 1 of the 4 steps in the experiential learning cycle. Responses in each column are added, yielding 4 scores, indicating the person's relative preference for each learning mode. From the 4 totals, composite scores are obtained by subtracting the concrete experience score from the abstract conceptualization score and the reflective observation score from the active experimentation score. The combination scores are referred to as abstract-concrete (AC-CE) and active-reflective (AE-RO).

According to a review of literature on learning styles and the health profession by Griggs et al,[23] the Kolb LSI was the most frequently used instrument. Although the reliability and validity of the instrument have been questioned, it is widely viewed as a useful measure of learning-style assessment.[30] Sims et al[31] found that the internal reliability ranged from .76 to .85 and test-retest indices from .24 to .66. A variety of reliability coefficients have been reported, but higher coefficients are reported for the computed scores (AC-CE, AE-RO) than the individual measures.[32] The LSI is somewhat weak on psychometric considerations, but this problem is typical of learning-style instruments.[33]

The PEPS, developed by Rita and Kenneth Dunn, assesses the multidimensional and instructional preferences of students, which is the outermost layer of learning style according to Curry's onion model.[34] It assesses individual productivity and learning style and analyzes the conditions under which an adult is most likely to achieve, create, produce, solve problems, make decisions, or learn.[20] The PEPS is a self-report instrument consisting of 100 questions relating to 20 learning-style elements. The instrument is scored on a 5-point Likert scale and takes approximately 25 minutes to complete.

Five major stimuli to which learners respond are examined by the PEPS: environmental, emotional, sociologic, physical, and psychological. These factors are not actually measuring the learners' internal strategies for gathering information but rather the external instructional conditions to which a learner is exposed.[35] The PEPS provides information about patterns through which learning occurs, not why the patterns exist. This gives students and teachers information about the learning environment, which is amenable to change.[36]

In 1979, investigators at the Ohio State University's National Center for Research in Vocational Education reported that the PEPS had ''established impressive reliability and construct validity.''[21] The authors of the PEPS report reliability results of greater than .60 for 68% of the test-retest reliabilities for the 20 factors.[35] Nelson et al[16] found test-retest reliabilities for the 20 subscales ranging from .39 to .87, with 40% having a correlation of more than .80. In the last 15 to 20 years, the PEPS has repeatedly shown predictive validity.[15,37,38]

Procedures

The Kolb LSI and PEPS were administered to undergraduate athletic training students from 50 randomly selected CAAHEP-accredited athletic training programs. All 10 districts of the National Athletic Trainers' Association (NATA) were represented proportionally according to the number of programs in each region. Program directors randomly distributed the LSI and PEPS to each of the 10 students and returned the completed surveys to the investigators. The students completing the survey were required to have attended grades 6 through 12 within the region in which their university is located. Intuitively, we felt that there could be differences in the learning environments and teaching styles throughout the country and, therefore, set this inclusion criterion. Regional breakdown was as follows: Region 1 (NATA Districts 8 and 10), Region 2 (NATA District 7 and Texas), Region 3 (NATA Districts 4 and 5), Region 4 (NATA Districts 3, 9, and Arkansas), and Region 5 (NATA Districts 1 and 2).

We scored the Kolb LSI ourselves, using chi-square analyses to identify any significant differences in distribution of learning-style type in athletic training students and any geographic differences in learning style among the 5 regions of the country. We conducted analysis-of-variance tests to determine if there were any differences in mean combination scores among the regions. The probability level was set at $P \leq .05$ for all tests.

The PEPS forms were returned to Price Systems, Inc, to be scored and analyzed. Descriptive statistics were completed on the 20 subscales of the PEPS to determine if there was a strong preference (indicated by a score greater than 60) or no preference (indicated by a score lower than 40) for the environmental variables that influence a student's ability to learn.

Table 2. Chi-Square Analysis of Learning-Style Preferences on the Kolb Learning Style Inventory*

Learning-Style Preference	Observed Results n (%)	Expected Results n (%)
Accommodator	55 (29.3)	47 (25)
Assimilator	55 (29.3)	47 (25)
Converger	41 (21.8)	47 (25)
Diverger	37 (19.7)	47 (25)

*$\chi^2 = 5.62$; $P = .132$; n indicates number of students.

Table 3. Kolb Learning Style Inventory Mean Combination Scores by Region*

Region	AC-CE Mean (SD)	AE-RO Mean (SD)
1	3.6 (11.3)	6.0 (11.3)
2	3.4 (12.0)	5.2 (14.0)
3	5.6 (12.2)	1.0 (13.8)
4	5.0 (12.0)	5.0 (11.0)
5	5.0 (10.9)	7.4 (12.7)

*AC-CE indicates abstract-concrete; AE-RO, active-reflective; and SD, standard deviation. See text for regional breakdowns.

RESULTS

A total of 193 undergraduate athletic training students completed the PEPS, while 188 students completed the LSI. Five LSI surveys were incomplete and, therefore, could not be used in the analysis. The overall return rates were 39% for the PEPS and 38% for the LSI.

We found no difference in the distribution of learning-style type using the Kolb LSI among athletic training students ($\chi^2 = 5.62$, $P = .132$) (Table 2). Learning-style type did not differ among the 5 geographic regions ($\chi^2 = 7.12$, $P = .849$). No significant difference in AC-CE ($F_{4,183} = .178$, $P = .95$) or AE-RO ($F_{4,183} = 1.970$, $P = .10$) combination scores was noted among the geographic regions (Table 3). The overall mean combination scores were 4.9 ± 11.5 for AC-CE and 4.9 ± 12.8 for AE-RO.

On the PEPS subscale scores, 62% of the athletic training students (120) had a strong preference for afternoon learning (Table 4).

DISCUSSION

Our purpose was to identify the learning styles and environmental preferences of undergraduate athletic training students in CAAHEP-accredited athletic training education programs. The secondary purpose was to compare these students'

Table 4. Productivity Environmental Preference Survey Subscale Means*

Subscale	Total Sample
Sound	52.36
Light	51.70
Warmth	48.53
Formal design	48.51
Motivated/unmotivated	49.80
Persistent	51.34
Responsible	47.77
Structure	58.61
Learning alone/peer oriented	54.00
Authority-oriented learner	57.15
Several ways	47.58
Auditory preferences	52.07
Visual preferences	44.68
Tactile preferences	53.46
Kinesthetic preferences	51.73
Requires intake	55.75
Evening/morning	42.58
Late morning	42.82
Afternoon	59.61
Needs mobility	55.54

*Scores above 60 indicate a clear preferences for the subscale; scores below 40 indicate no preference.

learning styles among geographic regions of the country to see if learning-style differences existed across the United States.

The Kolb LSI identifies a student's learning-style preference according to how much one relies on the 4 different learning stages (concrete experience, reflective observation, abstract conceptualization, active experimentation). Kolb[39] described each stage of the learning process and characteristics of individuals who have a preference for each. An individual who displays an orientation toward concrete experience emphasizes feelings as opposed to thinking, often making for a good intuitive decision maker. Those with an orientation toward reflective observation focus on understanding the meaning of ideas and situations by carefully observing and impartially describing them. They are good at appreciating various points of view and rely on their own thoughts and feelings to form opinions. Those who are oriented toward abstract conceptualization focus on using logic, ideas, and concepts and emphasize thinking as opposed to feelings. These individuals are often skilled in systematic planning and quantitative analysis. An orientation toward active experimentation focuses on influencing people and changing situations. The emphasis is on practical application as opposed to reflective understanding. The individuals who are oriented to this learning process are effective in getting things accomplished and are often willing to take risks in order to achieve their objective.

The Kolb LSI determines the preferred style of learning (accommodator, diverger, converger, or assimilator) based on the orientation of the learner to a specific stage of the learning cycle. Accommodators emphasize concrete experience and active experimentation. They are involved in new experiences and often carry out plans. They seek opportunities, take risks, and often adapt to changing immediate circumstances.[39] Accommodators rely on personal feedback and feelings as modes of perception and prefer to learn kinesthetically. Therefore, these students should be encouraged to learn by observing and then practicing hands-on activities, such as taping, brace fitting, stretching, palpation, and special tests for injury assessment. Accommodators also prefer to work with others, which is especially important for effectively communicating with athletes, coaches, and colleagues in the profession. Teachers can assist these students with their weaknesses by encouraging them to complete their work on time and by helping them to structure and commit to goals.

Divergers emphasize concrete experience and reflective observation. They perform well in ''brainstorming'' sessions and are imaginative and feeling oriented.[39] Divergers are sensitive and emotional, with an ability to understand people and recognize problems. While this quality of humanity is a very valuable trait in athletic training, divergers must be encouraged to make and stick to decisions. In a profession in which split-second decisions can be life saving, divergent students, who tend to have trouble making decisions and recognizing problems and opportunities, must be prepared to act quickly and confidently both on and off the field. Fortunately, divergers are excellent at using their imaginations. Presenting them with scenarios and allowing them to think about potential decision-making situations ahead of time may maximize this strength. Exercises modeled after the written simulation portion of the NATA Board of Certification certification examination could improve on the weaknesses of divergers by using their inherent strengths.

Convergers rely primarily on the abilities of abstract conceptualization and active experimentation. Their greatest strengths lie in problem solving, decision making, and practical application of ideas.[39] Convergers are less inclined to deal with people and are better at tackling tasks and technical issues.

Assimilators rely on the abilities of abstract conceptualization and reflective observation. They stress logic over practicality and are less focused on people and more concerned with ideas and abstract concepts.[39] They are more likely to be interested in areas of athletic training such as investigating patterns and mechanisms of injury and devising solutions to deal with those injuries. They should be encouraged to learn from previous experiences and focus their ideas and energy on the task at hand.

The Kolb LSI results of our study revealed a widely spread distribution of learning styles in athletic training students. In previous publications, accommodators and divergers have been associated with those in people-oriented professions.[2,3] Cavanagh et al[9] found that most of 192 nursing students had a predominantly concrete learning style. Concrete learners tend to fall within the classification of accommodator or diverger. Hendricson et al[11] examined 48 dental students using the Gregorc Learning Style Delineator and reported a preference for the concrete sequential dimension. Although a different learning-style instrument was used, the concrete preference was revealed.

Based on previous research, we hypothesized that a significantly greater percentage of athletic training students would be classified as accommodators and divergers on the Kolb LSI. However, analysis revealed that the learning style types were relatively evenly distributed among accommodators (29.3%), assimilators (29.3%), convergers (21.8%), and divergers (19.7%). Brower et al[6] also reported on the diversity of learning style among 40 athletic training students. Students were mostly assimilators (37.5%), followed by convergers (27.5%), divergers (20%), and accommodators (15%). Coker[5] examined the learning styles of athletic training students in the classroom and in the clinical setting and found that the students' learning

styles shifted depending on the learning environment. Therefore, it is important for educators to address these differences in learning style to maximize the educational experience.

Interestingly, it is believed that one's learning style translates closely into teaching style. Harrelson et al[4] administered the Kolb LSI, revised in 1985, at the 1999 NATA Professional Educators' Conference and found that 16% were accommodators, 8% divergers, 39% convergers, and 37% assimilators. Collectively, 76% of the educators were convergers or assimilators, and thus, more abstract learners. It is important not only for teachers to be aware of the diversity of their students but to also be in touch with their own learning styles. This enables them to incorporate teaching methods that are appropriate for all types of students, regardless of the type of learner.

The results of the Kolb LSI are very important to the education of undergraduate athletic training students. These results represent the unique diversity that exists among athletic training students. Because of this diversity, we believe it is unacceptable for educators to expect to reach all students if they adopt only one teaching style. Rather, athletic training educators must use a variety of instructional methods in the classroom and the clinical setting. Although guidelines can be given for teaching students in each learning-style type, Kolb encourages the teacher to guide students through all 4 of these learning styles in order to produce a more balanced learner.[25] The 4 classifications of learning style represent an ongoing cycle of learning that is continually repeated throughout life. Because learning is a cycle, the 4 stages occur time after time. The effective learner uses each stage and shifts from becoming involved (CE), to listening (RO), to creating an idea (AC), to making a decision (AE).[26]

Teaching methods have been recommended to reach students of each learning style. Kolb[26] found that concrete learners (accommodators and divergers) tend to use kinesthetic experience as a common mode of learning and preferred learning that included experiential components. Laschinger and Boss[38] extended this finding by advocating the use of discussion, role playing, and simulation in addition to traditional teaching methods. Athletic training educators can effectively influence concrete students by keeping those students' individual strengths in mind in both the classroom and the clinic. Using a variety of teaching methods is recommended, so that each type of learning style is taken into consideration. It is also important to expose students to teaching methods suitable for all of the learning styles to allow them to further develop those areas of learning in which they are not as strong. The more qualities of each learning style a student is able to embody, the more he or she will gain from the entire educational experience. For example, students demonstrating abstract learning-style types may become more people oriented by embracing the example set by their peers and teachers who demonstrate the qualities of concrete learners. The educator and student must understand that each of the 4 stages of the learning cycle must be experienced in order to become a balanced and effective learner. This requires students to become flexible learners and to strengthen the learning skills that are weak.

The PEPS analyzes the conditions under which a student is most likely to learn. In our study, the PEPS findings represented great diversity among students and indicated that all students' needs must be considered. Only one subscale, learning in the afternoon, had a mean score indicating a clear preference: 62% of the students in this study had a strong preference for learning in the afternoon. It is important to note that in most athletic training curriculums, classroom instruction is traditionally provided in the morning, while the afternoons are reserved for field experience. Keeping this in mind, it is critical to take advantage of those ''teachable moments'' that occur in the training room. It is during the afternoons that students are receptive to new information and practicing the skills they are taught in the classroom. Harrelson et al[12] also reported that male athletic training students displayed a preference for afternoon learning.

The students studied by Harrelson et al[12] also indicated a preference for structured learning experiences and the presence of authority figures; however, this information is inconsistent with our findings and with Draper's[13] results. Draper[13] administered the Babich and Randol LSI to 165 athletic training students sitting for the 1988 NATA certification examination and identified 63% as independent learners. Most athletic trainers preferred written to oral examinations, learned best kinesthetically, and studied for examinations primarily in the reading mode.

In our study, the PEPS did not reveal a kinesthetic and tactile preference among athletic training students. After administering the PEPS to athletic training students, Harrelson et al[12] also reported that students did not have a kinesthetic or tactile preference. These results conflict with the idea that students in the medical and allied health fields prefer hands-on learning. Harrelson et al[12] explained that the PEPS may contain a more stringent definition of kinesthetic and tactile activities, which could explain the discrepancy.

Shaver[40] examined the learning styles of 617 freshman and sophomore radiography students using the PEPS. She found that the students demonstrated preferences for structured-learning activities with authority figures present and for learning with peers in the morning and afternoon hours. Overall, kinesthetic learning was preferred by only 8% and tactile learning by 28%. Research examining environmental preferences of students in the health care fields using the PEPS is extremely limited and, therefore, a comparison between athletic training students and those in the allied health care fields is difficult.

Our secondary purpose was to examine the learning-style types (as defined by the LSI) across 5 geographic regions. We felt that learning-style differences across the various regions could reflect the diverse teaching strategies across the country. However, our findings suggest that there were no geographic differences in learning style. Great diversity is apparent among athletic training students, regardless of the region in which they were educated. These results must be cautiously interpreted because of the low number of subjects in certain regions.

A limitation of this study is the use of the Kolb LSI, revised in 1985, which was distributed to the athletic training students. Researchers[41,42] offered cautions about the use of this survey because a response bias that results from the consistent order of sentence endings may have inflated estimates of reliability and construct validity. Additional revisions have eliminated the response bias, and test-retest reliabilities were very high compared with the previous versions.[41]

CONCLUSIONS

Athletic training students are diverse. No predominant learning-style type appears to characterize the typical athletic

training student. Therefore, it is important for educators to address the needs of all students in both the classroom and the clinical setting. In addition, educators must provide an environment that stimulates and enhances a student's ability to learn. As athletic training programs continue to shift to accredited curriculums, educators must continually re-evaluate the effectiveness of their teaching strategies. We must establish a balance of in-class instruction and hands-on experience.

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