An Investigation of Undergraduate Athletic Training Students' Learning Styles and Program Admission Success

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Objective: The phrase *learning style* refers to the method one uses to obtain and use information to learn. Personal learning styles can be assessed by specifically designed inventories. We conducted this study to determine if undergraduate athletic training students possess a dominant learning style, according to the Kolb Learning Style Inventory IIA (KLSI IIA), the newest version of the Kolb Learning Style Inventory (KLSI), and whether this style is related to education program admission success.

Design and Setting: A 1 × 4 factorial design was used. The independent variable was learning style type with 4 levels (converger, diverger, assimilator, or accommodator). The dependent variable was successful versus unsuccessful admission into selected programs.

Subjects: Forty undergraduate students (21 men, 19 women) from 3 institutions (mean ± SD age, 20.7 ± 1.7 years; mean ± SD grade point average, 3.26 ± 0.43) participated in this study. No subjects had previously taken the KLSI IIA, and none had a diagnosed learning disability.

Measurements: The KLSI IIA was administered to the par-ticipants at their respective institutions. We used 2 separate χ^2 analyses to determine if the observed distribution of learning styles differed from the expected distribution. Additionally, a Mann-Whitney *U* test was performed to determine if the learning style distributions of those subjects who were successfully admitted to the selected programs differed from those who were not.

Results: No significant differences existed between the observed distribution and the expected distribution for those admitted and those not admitted ($\chi 2_3 = 3.8$, $P = .28$; and $\chi 2_3 = 3.1$, $P = .4$, respectively). Also, no significant differences existed between the learning style distributions of the groups when compared with each other (Mann-Whitney $U = 158$, $P = .5$).

Conclusions: Learning styles can be easily identified through the use of the KLSI IIA. We found no dominant learning style among undergraduate athletic training students and no particular learning style led to program admission.

Key Words: inventory, athletic training education program

P eople possess and use unique approaches to learn. These approaches are commonly referred to as learning styles. The method one specifically uses to obtain and then use information to learn is one's personal learning style.[1] Learning style inventories are commonly used to determine such styles.

The Kolb Learning Style Inventory (KLSI) is used extensively in learning style research.[1–17] The initial version of this questionnaire was created in 1976, and revisions were completed in 1985 and 1993.[3,6,10–12] This inventory is the most frequently used instrument for identifying learning styles.[18]

The KLSI classifies its respondents into 4 categories, which are representative of their dominant learning style.[3,6–9,12,13,17,19–22] These learning styles are termed *converger, diverger, assimilator,* and *accommodator*. The aforementioned styles are derived from the Kolb Experiential Learning Theory (KELT), and each style possesses distinct strengths and weaknesses with regard to learning experiences. Descriptions of each learning style are displayed in Table 1.

Learning style research in the field of athletic training has been limited, although its popularity has grown in recent years.[9,18,23] The paucity of research in this area prompts further investigation.

The effectiveness of athletic training education programs is critical to the profession. For athletic training students to eventually obtain employment, they must be skilled in a broad range of areas. Students use different methods to learn, and it is important for them and their instructors to recognize these styles. Instructors need to use the students' strengths and improve on their weaknesses to facilitate their total athletic training learning experience. The purpose of our study was to determine whether a specific learning style type among undergraduate athletic training students led to successful admission into athletic training education programs.

METHODS

A 1 × 4 factorial design was used in this study. The independent variable was the learning style type, as determined

Table 1. Learning Style Descriptions

Convergers	Divergers
Prefer:	Prefer:
• Science-based fields[21,24]	• Arts and humanities[13,21]
• To use hypothetical deductive reasoning[3,7,13,24]	• Not to act until they have considered all options[7]
• To work with things rather than people[3,13,24]	• Open-ended questions[19]
• To make their own decisions[6]	• To synthesize separate ideas into a whole[3]
• To problem solve in a practical manner[3,6]	• To work with people over things[3,6,13,17,19,24]
Described as being:	Described as being
• Technical[6]	• Emotional[19,24]
Tend to:	Tend to:
• Be comfortable making decisions based on their understanding of a problem[7]	• Be good at generating ideas[8,19]
• Do well on objective examinations[1] and conventional intelligence tests[21]	• Have active imaginations[3,8,13,24]
• Have a narrow range of interests[13]	• Have difficulty generalizing from one experience to another[7]
	• Have a broad range of interests[13,22,24]
Assimilators	**Accommodators**
Prefer:	Prefer:
• Math and basic sciences[21]	• Marketing and sales fields[21,24]
• Comparison and contrast–type questions[19]	• New experiences[3,8,13,24]
• Theoretical models and examples[3,8,13,17]	• Action[6,7,13,24] and hands-on experiences[7]
• To work with abstract ideas and concepts rather than people[6,19,24]	• Using trial-and-error methods and intuition to solve problems[3,6,13,17,24]
• To use inductive reasoning[3,7,13,17,24]	• To have information given to them rather than collect it themselves[3]
Described as being:	• To work with people over things[3]
• Introverts[17]	Described as being:
• Passive learners[17]	• Pragmatic[6]
Tend to:	• Active[3]
• Organize information[17]	Tend to:
• Depend on others to give them facts[8]	• Take risks[6,17,19,24]
• Examine the soundness of theories and ideas[7,19,24]	• Adapt well to situations[3,13,17,19]
• Not be concerned with practical application of ideas or concepts[7]	• Be good at carrying out plans made by others[3]

by KLSI version IIA (KLSI IIA), with 4 levels consisting of converger, diverger, assimilator, and accommodator. The dependent variable was successful versus unsuccessful admission into the professional component of the athletic training education programs.

Subjects

The subjects for this study were groups of undergraduate athletic training students enrolled in their last semester of preprofessional course work and observational clinical duties at 2 doctoral I institutions of higher learning and 1 junior college. Forty-seven volunteer subjects from the 3 institutions initially took part in the study.

The Commission on Accreditation of Allied Health Education Programs accredits the athletic training education programs at the 2 doctoral I institutions. The junior college does not offer an athletic training major. However, students are el-

igible to apply for selection to the athletic training education program at 1 of the 2 doctoral I institutions. The preprofessional classes completed at each institution are similar. Both programs require preprofessional students to take course work in emergency first aid, personal health, human anatomy, human physiology, athletic training practicum, and kinesiology. Clinical experiences in athletic training are also similar for these students. Observational hours are completed at each school to fulfill this requirement. The selection procedures at the universities also have some important similarities. Variables such as overall grade point average (GPA) and clinical evaluations of the students are used at each university. In addition, the acceptance-to-application ratio is comparable at both universities. The first university traditionally accepts 12 students per year of approximately 25, whereas the second university traditionally accepts 14 students per semester of approximately 30. These numbers vary because the number of applicants differs each selection cycle, but a 1:2 ratio is fairly consistent.

Despite the numerous similarities between the programs, some differences do exist. One university includes an interview and a faculty recommendation in its selection process, whereas the other university requires its applicants to take a proficiency examination consisting of written and oral/practical portions.

Some undergraduate students also choose not to pursue further athletic training education before the actual application and selection process. These students were not represented within this study, but it is important to remember that these students may self-select out of athletic training, and this decision may be related to their learning style.

No participants had been previously evaluated by the KLSI IIA, and none had a diagnosed learning disability. These criteria were determined through the use of an eligibility questionnaire. Before the study, the subjects were also requested to read and sign a GPA disclosure waiver form and an informed consent form that explained the purpose, risks, and benefits of the project. Approval was obtained from the Human Subjects' Research Committee.

Forty subjects were included in the final calculations for this study. Six participants completed the necessary paperwork required for the study and then withdrew their applications before selection procedures were complete. One participant was disqualified from the study because he had previously been evaluated using the KLSI IIA.

Instrumentation

The KLSI IIA was used to determine the learning styles of the subjects. The purpose of this inventory is to categorize respondents as convergers, divergers, assimilators, or accommodators based on their answers to a self-reported, 12-item questionnaire.[5,6,8–12,24] Each question begins with ''When I learn. . . ,'' ''I learn best when. . . ,'' ''When I am learning. . . , I learn by. . . ,'' or ''I learn best from. . . ,'' and 4 options for completing the sentence are supplied. The respondent ranks the 4 options, with 1 correlating with the respondent's least dominant learning style and 4 correlating with the respondent's most dominant learning style.[5–7,12,13,15,24] No ties should be made, and each question should contain 4 answers.[25] At this point, the respondent's duties were complete.

Hay/McBer, the distributor of the copyrighted inventory, supplied scoring directions for the questionnaire. Each answer

slot within the questionnaire corresponds with a step in the KELT. The steps are termed *concrete experience* (CE), *reflective observation* (RO), *abstract conceptualization* (AC), and *active experimentation* (AE).[3,4,6–8,10–12] Respondents placed the numbers 1, 2, 3, or 4 in the answer slots. Totals for CE, RO, AC, and AE were determined by adding the numbers in each answer slot by category. Next, the RO score was subtracted from the AE score, and the CE score was subtracted from the AC score.[26] These 2 remaining scores were then plotted on a grid consisting of 2 axes and 4 quadrants. The quadrants represent the 4 learning styles of converger, diverger, assimilator, and accommodator. The location of the scores plotted on the grid indicate the respondent's dominant learning style according to the KLSI IIA.[26]

Changes to the KLSI were completed in 1985, and the revised version was termed the *KLSI II*.[6] Further revisions of the KLSI II were recently completed to improve the instrument.[10,12,25] This newest version is referred to as the *KLSI IIA*.[9] Internal reliability of the inventory has been evaluated using the Cronbach α. The 4 basic scales (CE, RO, AC, and AE) and the 2 combination scores (AC-CE and AE-RO) of the KLSI IIA show very good internal reliability as measured by the Cronbach α: CE, .82; RO, .73; AC, .83; AE, .78; AC-CE, .88; and AE-RO, .81.[24,25] Internal consistency measurements of the KLSI II and KLSI IIA have also been completed using mean coefficient α values. These indexes were expected to decrease with the improvements made to the KLSI II. Response bias due to the consistent order of sentence endings in the KLSI I and KLSI II was reduced by scrambling the order of sentence endings of KLSI IIA. Based on these changes, the indexes were expected to decrease due to the anticipated elimination of response bias. Mean coefficient α values for the KLSI II ranged from .82 to .85, and mean coefficient α values for the KLSI IIA ranged from .52 to .78. Despite the decreases found, the values were still considered adequate in terms of internal consistency of the tool.[10] Additionally, test-retest reliability has been investigated. This measurement was expected to increase, and test-retest reliabilities for the 4 scales of the KLSI IIA across multiple administrations were very high in comparison with the KLSI II.[10] These values ranged from .92 to .99 for the KLSI IIA and .25 to .56 for the KLSI II.[10]

The validity of the instrument has not been as extensively investigated as its reliability. Construct validity of the KLSI and KLSI II has been examined, but the KLSI IIA has not been investigated with regard to validity.[11,13–16] Construct validity is determined by examining whether the inventory measures what it purports to measure as described in the KELT.[14] Factor analysis of the KLSI revealed poor word choices in descriptions pertaining to the CE category.[11] Also, results of the KLSI were not related to career choices or personality characteristics.[13,14] On the other hand, Merritt and Marshall's[15,16] comparisons of an alternate form of the inventory to the normative version revealed support for validity of the instrument based on the KELT. Despite these findings, the validity of the KLSI and KLSI II is questionable, but the inventory is considered reliable and is used a great deal in the determination and assessment of learning styles in many settings.[4,5,7,10,15,16,18,27]

Testing Procedures

Volunteer subjects reported to a specified classroom at their respective institutions on a predetermined testing day. Before testing began, the volunteers received a verbal explanation of the study, including a description of its purpose, risks, and benefits. Each subject then filled out an eligibility questionnaire and read and signed a disclosure waiver form allowing us to obtain the subject's current GPA from either the program curriculum director or the registrar's office of each institution. The volunteers also read and signed an informed consent form.

Subjects then completed the KLSI IIA. We read the directions supplied with the inventory to the subjects and answered pertinent questions at this time. In addition, 2 further instructions were given. First, the subjects were told there were no right or wrong answers to the questions. Each of the learning styles described is considered valuable, and the true purpose of the inventory is to help assess personal skills related to learning. Second, to ensure correct scoring, the subjects were instructed to rank the 4 sentence endings for each question and to not create ties.

Once completed, the inventories were collected to be scored at a later time. The information from the questionnaires and inventories was entered into a data collection form to maintain anonymity of the subjects. Learning style type results for each subject were retained until admission procedures for the athletic training education programs were completed. Then the learning style distributions of the successful and unsuccessful candidates were examined and compared with expected distributions and each other.

Statistical Analysis

We used a χ^2 test to determine whether the observed learning style types of those subjects successfully admitted to the athletic training programs were similar to the expected distribution of learning style types. The expected distribution was determined to be 25% convergers, 25% divergers, 25% assimilators, and 25% accommodators. A χ^2 test was also used to determine if the observed learning style types of those subjects not admitted to the athletic training programs were similar to the expected distribution of learning style types. Once again, the expected distribution was set equally. Using a Mann-Whitney U test, the learning style type distributions of the unsuccessful candidates were also compared with those candidates who gained successful admission to the selected athletic training programs. The probability level was set at $P \leq .05$ for all tests.

RESULTS

We found no difference between the learning style distribution of the subjects who were successfully admitted to the selected athletic training programs and the expected distribution ($\chi^2_3 = 3.8$, $P = .3$) (Figure 1). There was no difference between the learning style distribution of the subjects who were not admitted to the selected athletic training programs and the expected distribution ($\chi^2_3 = 3.1$, $P = .4$) (Figure 2). Additionally, no differences were found between the learning style distributions of those subjects who were admitted to the selected athletic training programs and those who were not when compared with each other (Mann-Whitney $U = 158$, $P = .5$). The mean $\pm$ SD GPA for all subjects was 3.26 ± 0.43, and the mean $\pm$ SD GPAs for those subjects admitted to programs (n = 27) and those subjects not admitted to programs (n = 13) were 3.50 ± 0.31 and 2.82 ± 0.20, respectively.
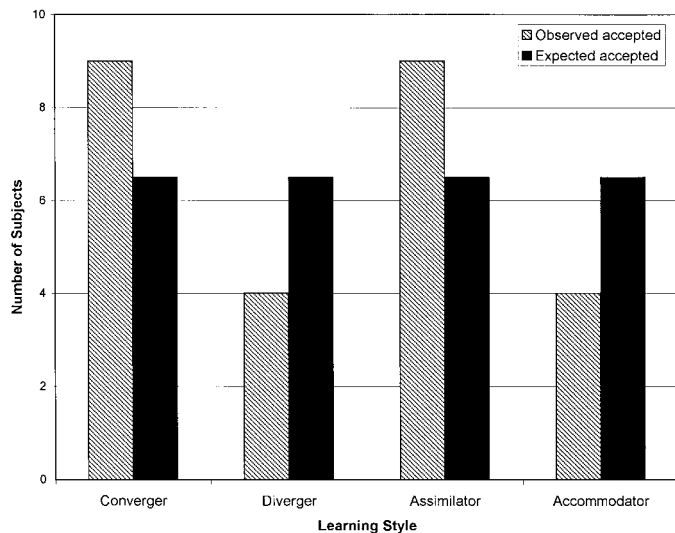
Figure 1. Observed and expected learning styles of subjects admitted to programs.
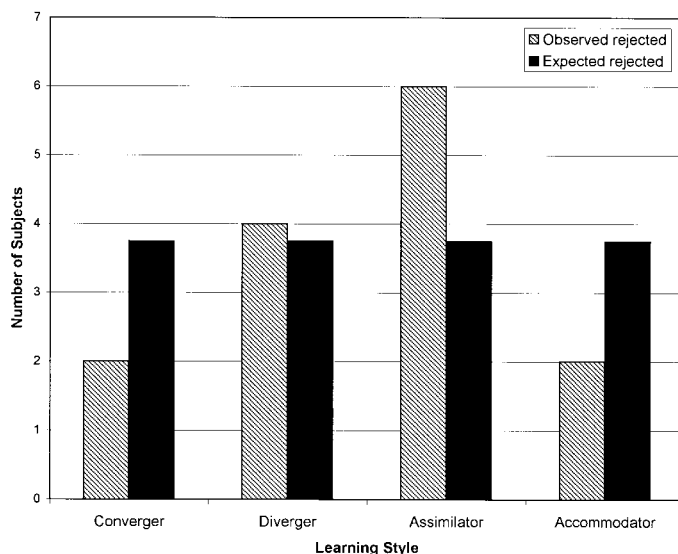

Figure 2. Observed and expected learning styles of subjects not admitted to programs.

DISCUSSION

Only one previous study, to our knowledge, has investigated the learning styles of undergraduate athletic training students. Recently, Leaver-Dunn et al[9] administered the KLSI IIA to 70 undergraduate athletic training students. They found that these students were mostly assimilators (38%), followed by accommodators (21%), convergers (21%), and divergers (20%). In comparison, the subjects involved in our study were mostly assimilators (37.5%), followed by convergers (27.5%), divergers (20%), and accommodators (15%). In both studies, most of the students were classified as assimilators, but the other categories were also represented. The results of our study revealed that no certain learning style among undergraduate athletic training students led to program admission.

The above-mentioned findings are unusual when compared with other fields of study. Research in other areas has shown dominant learning styles among nursing, physical therapy, medical, physician assistant, and medical technology students,[2,4,5,7,22,28] whereas the results of our study revealed that athletic training students had no dominant learning style. The results of other studies that have used the KLSI in some form are described in Table 2. Learning style researchers in medical technology, physical therapy, and physician assistant programs did not assess student learning styles using the KLSI.[22,28] However, dominant learning styles with characteristics similar to those described by Kolb were found. In medical technology and physical therapy, students (n = 100) preferred learning through concrete methods.[22] This is similar to the Kolb classifications of accommodator and diverger. Students (n = 42) in physician assistant programs preferred hands-on, step-by-step experiences.[28] This type of learning is consistent with the Kolb learning styles of assimilator and accommodator.

No previous researchers have investigated the relationship between learning styles and education program admission success. However, some have examined other measures of academic performance, such as overall GPA and examination scores.[1,6,8,23,29] The results of our study showed that no certain learning style was related to program admission, but learning style has affected other measures of academic performance in other fields. For example, nursing students categorized as assimilators have earned higher GPAs than their counterparts in other learning style classifications.[6] Also, medical students classified as convergers have performed better on objective examinations than divergers, assimilators, and accommodators.[1] In public health education, assimilators have scored better on written examinations in comparison with the 3 other learning style group members.[8] Lastly, in athletic training, academic variables rather than learning styles were considered predictors of success for students who took the National Athletic Trainers' Association Board of Certification examination.[23] This finding was verified again by Harrelson et al.[29] Therefore, it seems that, in terms of academic performance, learning styles of athletic training students have a limited ef-

Table 2. Learning Style Findings in Health Care–Related Fields

Field	Author	Sample Size	Learning Style	Percentage
Nursing	Jambunathan[2]	123	Assimilator	NA*
			Accommodator	
Nursing	Rakoczy and Money[4]	138	Assimilator	NA
Nursing	Joyce-Nagata[5]	334	Assimilator	42
			Accommodator	24
Medicine	Lynch et al[7]	227	Converger	45
			Assimilator	26
Athletic training	Leaver-Dunn et al[9]	70	Assimilator	38
Athletic training	Brower et al	40	Assimilator	37.5

*NA indicates not applicable since percentages were not supplied in all studies.

fect on academic success in comparison with students in other fields. Academic factors, on the other hand, seem to have a substantial effect on academic performance among undergraduate athletic training students, especially in terms of success on the certification examination.

Since academic variables seem to be important components in athletic training education, the mean GPAs of the subjects involved in this study were analyzed and comparisons were made by institution and admission status. The mean $\pm$ SD GPAs for subjects from each university were 3.22 ± 0.47, 3.11 ± 0.31, and 3.33 ± 0.41. The mean $\pm$ GPA for all subjects was 3.26 ± 0.43. Those subjects who gained successful admission to the selected programs possessed higher GPAs than those who did not. The mean $\pm$ GPA for those subjects admitted to programs was 3.50 ± 0.31, and for those not admitted to programs, 2.82 ± 0.20. In this study, GPA seemed to be related to admission success.

The subjects involved in this study consisted of 40 undergraduate athletic training students applying for admission to 2 selected athletic training programs. With regard to the large numbers of undergraduate curriculum athletic training programs, this subject pool was rather small. Our intent was to evaluate a significant number of athletic training students from similar programs to complete this study. Despite using a multisite approach, the total number of subjects was small. Also, these students were intended to represent typical undergraduate athletic training students, but this notion would be difficult to prove or disprove based on the small scope of this study. However, the results of this study have revealed a trend showing that these particular students do not have a dominant learning style. In addition, the learning styles of these individuals did not lead to successful admission into selected athletic training programs.

EDUCATIONAL APPLICATIONS

The findings of this study are helpful to both educators and students in demonstrating the importance of learning style identification. Most researchers agree that knowledge of one's personal learning style is advantageous.[6,17,19,28,30] The participants in this study were given the opportunity to request the results of their personal inventory. In addition, a brief explanation of the 4 learning styles, including strengths, weaknesses, and preferences of each style, was provided for the subjects. This explanation could prove helpful for some participants. Knowledge of one's learning style may be beneficial in that the participant will now be aware of his or her strengths and weaknesses in terms of learning experiences. Therefore, future learning may be enriched if the participants maintain their strengths and improve on their weaknesses.

Educators can also take part in this awareness of learning styles. By becoming knowledgeable about learning styles and assessing the learning styles of their students, educators can facilitate appropriate learning experiences based on these findings. Haislett et al[6] suggested providing a learning style assessment using an instrument such as the KLSI early in all students' academic experiences. In this way, students are sensitized to the fundamental strengths and weaknesses of their particular style, and they can use this information to improve their overall educational experiences.

Our study revealed no dominant learning style among undergraduate athletic training students admitted to athletic training education programs. Although knowledge about learning style is useful in preparing academic experiences, educators should not base program admission policies on student learning style.

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