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Construction and Validation of the Student-Athlete Environmental and Academic Orientation Survey (SEAOS)

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ABSTRACT

Many surveys exist that measure environmental orientations, yet few measure learning outcomes, such as self-efficacy, and even fewer specifically target student-athletes. Hence, this study created a survey, named the Student-Athlete Environmental and Academic Orientation Survey (SEAOS), which measured student-athletes' environmental attitudes, behaviors, and knowledge, academic self-efficacy, self-regulatory learning, motivation, and learning strategies. The SEAOS was pilot tested with 91 university student-athletes in Spring 2014. After revisions the final SEAOS was administered as a pretest-posttest to student-athletes in a treatment or control group in Fall 2014 and Spring 2015. The treatment group received environmental and academic mentoring, whereas the control group received only academic mentoring. Principal component analysis revealed seven constructs with each construct receiving Cronbach's alpha reliability coefficients above 0.7. Hence, the SEAOS was deemed valid and reliable. However, additional studies should examine the survey's efficacy in regard to environmental knowledge, motivation, and learning strategies for other student populations.

KEYWORDS
Environmental education, learning outcomes, student-athletes, survey

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Introduction

Recent research has investigated learning outcomes of environmental education (EE) programs (e.g., Mintz & Tal, 2014; Thomas, 2009). Although evaluation methods of these learning outcomes vary, they often involve an examination or battery of questions measuring academic constructs, such as critical thinking skills (Ernst & Monroe, 2004) and self-efficacy (Meinhold & Malkus, 2005). Other times, participants in EE programs complete surveys measuring environmental attitudes, behaviors, or knowledge in addition to

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completing separate learning outcome assessments (Hungerford, Volk, & Ramsey, 2000). However, since recent research has focused on both environmental orientations *and* learning outcomes, there is a need for a cohesive survey that measures both environmental and academic constructs. Measuring both domains in a single survey could also help alleviate burden time and response fatigue of participants.

Currently, surveys exist to measure environmental constructs, and some have proven reliable and valid across time and populations. For instance, some researchers (De La Vega, 2004; Manoli, Johnson, & Dunlap, 2007) elected to use the New Ecological Paradigm (NEP) survey (Dunlap, Van Liere, Mertig, & Jones, 2000) to measure environmental attitudes. The NEP has been adjusted by some researchers to be more appropriate for specific audiences, such as children (Manoli, Johnson, & Dunlap, 2007). But, some researchers have reported validity issues with the NEP, stating it measured multiple dimensions rather than its intended single dimension (Cordano, Welcomer, & Scherer, 2003; Ewert, Place, & Sibthorp, 2005). However, other researcher such as Larson, Green, & Castleberry (2011) have also successfully developed new surveys to measure children's environmental attitudes.

Additionally, some surveys also measure children's behavioral intent, such as the Children's Environmental Attitudes and Knowledge Scale [(CHEAKS) (Leeming, Dwyer, & Bracken, 1995)]. Studies which have used the CHEAKS reported reliability scores above 0.7 and have demonstrated discriminate validity between the attitudes and knowledge constructs (Carrier, 2009; Duerden & Witt, 2010; Makki, Abd-El-Khalick, & BouJaoude, 2003). Other surveys measure value orientations, which are patterns of basic beliefs related to specific classes of things, such as natural resources or wildlife, that act as an evaluation of participants' core identities and long-standing beliefs. For example, the Forest Values Scale (Vaske & Donnelly, 1999) contains nine items which place respondents on a values spectrum from biocentric to anthropocentric. In addition to the surveys mentioned here, several others can be found in the literature (Gagnon Thompson & Barton, 1994; Kaiser, Oerke, & Bogner, 2007; Weigel & Weigel, 1978).

However, researchers who measure critical thinking skills, self-efficacy, motivation to learn, and self-regulatory learning can select from a broader array of surveys. For instance, researchers have been studying and using psychometric surveys far longer than environmental orientations surveys. Furthermore, many psychometric surveys have demonstrated strong reliability and validity, such as the Motivated Strategies for Learning Questionnaire (MSLQ), which has established high reliability (Duncan & McKeachie, 2005), the College Self-efficacy Inventory (CSEI), which has demonstrated reliability and predictive validity (Gore, Leuwerke, & Turley, 2005), and the Children's Multidimensional Self-Efficacy Scale (CMSES), which has verified high validity (Choi, Fuqua, & Griffin, 2001). However, other surveys, such as the Self-Efficacy Scale (Sherer & Maddux, 1982), the College Academic Self-Efficacy Scale (Owen & Froman, 1988), and the Student Readiness Inventory (Le et al., 2005), have had accessibility issues or have become outdated.

Additionally, very few, if any, surveys have been designed to examine the environmental attitudes, behavior, and knowledge of student-athletes. Student-athletes, as a population, have few opportunities to achieve environmental

literacy. For instance, because of time constraints student-athletes are usually unable to join activities outside of their sports, and therefore miss opportunities to participate in environmental initiatives (Carodine et al., 2001). Moreover, few student-athletes choose majors that explore environmental concepts (Fountain & Finley, 2011).

However, the environmental impact of student-athletes is traditionally larger than that of other university students, which is one reason EE efforts should be targeting student-athletes. Despite being a healthy activity for an individual, athletics can be a detriment to the environment (Henly, 2013; Schmidt, 2006). In fact, in recent years, the UN Environment Program (UNEP) has led efforts to help athletic activities reduce their environmental impact through their Sports and Environment Program (Schmidt, 2006). Actions such as improving energy efficiency in athletics facilities, increasing recycling rates at events, and irrigating practice fields with rainwater have been implemented with professional and collegiate teams (Henly, 2013). However, little has been done to engage student-athletes in these environmental efforts (Henly, 2013; Pfahl et al., 2014).

Despite time constraints, student-athletes have opportunities to be environmental role models, especially those playing high-profile sports, who are admired by the student body (Mallen et al., 2010). However, even if environmental educational or literacy programs were developed for student-athletes, very few, if any, valid and reliable surveys exist that could effectively capture any possible impacts of these EE programs on student-athletes.

Problem Statement

A literature review for surveys designed to evaluate possible impacts of an EE program on student-athletes' environmental and academic orientations failed to reveal any surveys. Considering the potential impact that student-athletes could have as environmental role models and the need to examine their levels of environmental literacy as an underserved population, there is an important need for such a survey to be designed and validated.

Study Premise

Hence, in this study, an environmental education mentoring program aimed at influencing student-athletes' environmental and academic orientations at the University of Georgia (UGA) was used to examine the validity and reliability of the Student-Athlete Environmental and Academic Orientation Survey (SEAOS). Since the mission of the mentoring program at UGA is to instill in its student-athletes many of the same academic skills encouraged in environmental education programs, this setting was deemed a strong fit for the purpose of this study.

Purpose Statement

To develop a survey which could accurately and reliably assess the outcomes of an EE-based mentoring program on the environmental and academic orientations of university student-athletes. To also pilot test and analyze data from the survey to examine any underlying constructs within the survey.

Research Objective and Hypotheses

Objective 1: Develop a reliable and valid survey that measured student-athletes' environmental attitudes, behaviors, knowledge, academic self-efficacy, self-regulatory learning, motivation, and use of learning strategies, subsequently entitled the Student-Athlete Environmental and Academic Orientations Survey, or SEAOS.

Alternative Hypothesis 1a: Analysis will reveal that the SEAOS will provide valid and reliable data for student-athletes of both treatment and control groups.

Alternative Hypothesis 1b: Analysis will reveal that the SEAOS will provide data which supports the existence of several underlying dimensions of environmental and academic orientations within the survey.

Methods

In this study, a survey measuring environmental and academic orientations of student-athletes was created, entitled the Student-Athlete Environmental and Academic Orientations Survey (SEAOS). For the mentoring program utilized in this study, university student-athletes were paired with a mentor for one semester and met two to three times each week for hour-long sessions to develop studying, time management, and organization strategies to assist them with their academic work. The development of the survey was part of a larger study conducted by UGA which examined the outcomes of the EE-based mentoring program in further detail.

Study Population

The study population for the SEAOS was university student-athletes. The sample used to validate the SEAOS was composed of student-athletes enrolled in the UGA Athletic Association (UGAAA) academic mentoring program. The NCAA Division I sports represented in the sample included baseball, women's basketball, equestrian, men's and women's golf, gymnastics, soccer, softball, men's and women's swim and dive, men's and women's tennis, men's and women's track and field and cross country, and volleyball.

In development of the SEAOS, standard psychometric procedures from the literature were utilized to ensure reliability and validity of the SEAOS (Vaske, 2008), which are outlined in following steps:

1. A comprehensive literature review was conducted pertaining to environmental attitudes and academic orientations of student-athletes.
2. Appropriate existing survey items were identified.
3. Existing items were adapted and new items were created.
4. A draft survey was pilot tested.
5. Pilot data were analyzed and the survey was finalized.

The final survey was implemented and results were analyzed

Literature Review

A literature review revealed a few surveys that examined environmental or academic constructs. Surveys with robust validity and reliability were further examined for fit within this study. The criteria for acceptable validity included high factor loadings (≥ 0.5) with few cross-loadings. Additionally, constructs with eigenvalues greater than one were retained (Kaiser, 1970; Russell, 2002). For

reliability the acceptable criterion was Cronbach's $\alpha > 0.7$ (Vaske, 2008). Finally, a comprehensive set of items with related scales was compiled from previous surveys (Andrews & Clark, 2011; Larson et al., 2011; Leeming et al., 1995; Pintrich & De Groot, 1990; Solberg et al., 1993; Zimmerman et al., 1992). Some new items were also created and reviewed by a panel of experienced researchers in this subject area.

Constructs to be included in the SEAOS were selected based on the two theories guiding this study, Constructivist Learning Theory and the cognitive hierarchy proposed by Vaske and Donnelly (1999). Additionally, the inclusion of these constructs was confirmed after examining previous studies on the effect of EE and science education on academic orientations (Hines, Hungerford, & Tomera, 1987; Karaca, Armagan, & Bektas, 2016; Stern & Dietz, 1994). From those examinations, it became evident that certain constructs would be appropriate for this study's population. Subsequently, attitudes, behavioral intent, and knowledge were deemed appropriate environmental constructs to assess possible effects of EE programming on student-athletes' environmental orientations. Furthermore, self-efficacy, motivation, and use of learning strategies were also deemed appropriate academic domains to assess the effect of EE programming on student-athletes (Ernst & Monroe, 2004; Hungerford et al., 2000).

Some researchers seeking to measure environmental attitudes elect to use the revised New Ecological Paradigm Scale (NEP), but the NEP was not used in the SEAOS because it was considered inappropriate for the study population. The NEP measures general environmental worldview and values, but it has not proven to be a robust measure of environmental attitudes of younger participants (Larson, Green, & Castleberry, 2011). Instead, modified versions of the items which Larson et al. developed for children aged 6-13 years old, which were repeated with fourth, fifth, and seventh grade students in a study by Bergman (2015), were adapted for use in this study.

Behavioral intent was measured with items from the Children's Environmental Attitudes and Knowledge Scale (CHEAKS). Original CHEAKS items were reworded to meet this study's population, as the original version was meant for children under 18. Other items which had become outdated or did not suit this study's population were also removed. The knowledge construct of the CHEAKS was not used as it did not measure the intended knowledge provided within the EE program in this study.

To address self-efficacy, items from the College Self-Efficacy Inventory (CSEI) were selected based on use in previous studies such as Gore (2006), which looked at self-efficacy beliefs as they related to college outcomes; self-efficacy in Gore's study accounted for four to ten percent of variance in GPA scores when measured at the end of the semester. Selected items from the CSEI were reworded for the SEAOS. Additional self-efficacy items were adapted from the Self-Efficacy for Self-Regulated Learning construct of the Children's Multidimensional Self-Efficacy Scale (CMSES) (Bandura, 1989). Minor modifications were made to clarify wording and increase relevancy for university students, as the original CMSES was meant for high school students. Bandura developed the CMSES in 1989, and since its introduction it has been used in other studies which reported

reliability coefficients above 0.7. (Bandura et al., 1996; Bandura, Barbaranelli, Caprara, & Pastorelli, 2001).

In addition to self-efficacy, the SEAOS included items pertaining to academic motivations. The motivation items modified for this study were from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich & De Groot, 1990). Some of the items in the Self-Efficacy construct and the Cognitive Strategy Use construct of the MSLQ were selected and modified to provide greater clarity and a more student-centered perspective; Test Anxiety, Intrinsic Value, and Self-Regulation items of the MSLQ were not used, because they did not align with the objectives of this study or with the mission of the UGAAA mentoring program.

The content of the environmental knowledge questions was specific to the EE lessons developed for this study. Knowledge questions in the literature did not sufficiently capture the content in the provided EE curriculum, so it was necessary to create new questions. The EE curriculum in this study focused on five topics, and two questions were created for each topic, totaling ten questions in the environmental knowledge construct.

Adaptation of Existing Survey Items

Items from the following surveys were adapted for use within the SEAOS: Children's Environmental Attitudes and Knowledge Scale (Leeming et al., 1995), Children's Environmental Perception Scale (Larson, Green, & Castleberry, 2011), Children's Multidimensional Self-Efficacy Scale (Bandura, 1989), College Self-Efficacy Inventory (Solberg et al., 1993), and the Motivated Strategies for Learning Questionnaire (Pintrich & DeGroot, 1990). The number of items from each survey is displayed in Table 1. A full list of original items is provided in Table 8 in Appendix B.

Table 1. SEAOS Items Per Construct and Their Original Sources

SEAOS Items Per Construct and Original Sources		
Construct	# of Items	Original Source
Environmental Attitudes	6	Larson, Green, & Castleberry, 2011
Environmental Behavioral Intent	10	Leeming, Dwyer, & Bracken, 1995
Academic Self-Efficacy	8	Solberg et al., 1993
Self-Efficacy for Self-Regulatory Learning	8	Bandura, 1989
Academic Motivation	9	Pintrich & DeGroot, 1990
Use of Learning Strategies	12	Pintrich & DeGroot, 1990

Items for the Student-Athlete Environmental and Academic Orientation Survey (SEAOS) were adapted from existing surveys. The number of items per SEAOS construct is shown in Table 1. The original source of those items are also given.

Once applicable items were identified, they were reviewed by experienced researchers within this subject area. Some items were reworded for clarity, to be more personally relevant, or appropriate for this study's population, as personal relevancy, rather than a focus on the world or humanity, was recommended in the literature (Schindler, 1999).

Creation of New Items

Despite the number of survey items gathered from the literature search, some areas of intended study required the creation of new items. For example, the mission of the UGAAA mentoring program is to enable students to work independently and organize their classes and studying around athletic obligations. Thus, to measure the ability of student-athletes to balance all aspects of their lives, an item "I am confident I can keep up with my athletic training" was added among items which referred to the ability to keep up-to-date with schoolwork and other aspects of life. Items were initially created as groups of at least three to help promote stronger reliability and validity. New items were also evaluated by experienced researchers within this subject area, as well as by the stakeholders.

Pilot Testing

Once modified the new items were compiled into a draft survey, and a pilot test was conducted. In Spring 2014, the draft SEAOS was tested with 91 student-athletes at UGA. The pilot sample was divided randomly into a treatment group composed of 31 student-athletes and a control group composed of 60 student-athletes using a random number generator. Participating student-athletes completed the SEAOS as a pretest-posttest, since it was also being used to evaluate the pilot EE curriculum. The pretest was administered in early January, and the posttest was administered in early May. In addition to the pilot test, a focus group with stakeholders, which included the Director of the Student-Athlete Academic Center and the Mentor Coordinator, provided feedback on the pilot SEAOS.

During the focus group, stakeholders noticed some items did not reflect the mission or objectives of the mentoring and tutoring programs. Subsequently, some items were reworded or removed based on results from Cronbach's alphas, principal components analysis (PCA), and feedback from the stakeholders.

Table 2 displays Cronbach's alpha coefficients of pilot scores. Items with an alpha coefficient below 0.5 were removed to improve scale reliability. Inter-item correlations were also examined, and items with negative correlations were removed. Varimax rotation was utilized because the original surveys were shown to have strong construct validity.

Table 2. Cronbach's Alpha Reliability Coefficients and Eigenvalues for Pilot SEAOS

Cronbach's Alpha Reliability Coefficients and Eigenvalues for Pilot SEAOS		
Scale	Cronbach's α	Eigenvalue
Environmental Attitudes	0.79	2.71
Environmental Behaviors	0.82	6.09
Use of Learning Strategies	0.90	2.72
Academic Self-Efficacy	0.90	5.72
Self-Efficacy for Self-Regulatory Learning	0.93	5.68
Academic Motivation	0.97	9.74

Reliability tests were conducted on each pilot Student-Athlete Environmental and Academic Orientation Survey construct, to ensure each construct's Cronbach's alpha was above 0.7. The lowest Cronbach's alpha coefficient was observed with the environmental attitudes construct, with an alpha of 0.79. Items constituted a construct when eigenvalues reached at least 1.0.

Pilot testing revealed some issues with certain items. Three items in the environmental attitudes scale which addressed harming nature or ways in which humans can alter nature loaded on a separate construct. Those three items were negatively-worded which may have led participants to respond to them differently or erroneously, resulting in a second illusory component. To retain a single construct and to improve the Cronbach's alpha coefficient, those items were removed. Additionally, some items in the behavioral intent construct referred to behaviors that were outdated (e.g., writing letters, going door-to-door), hence these items were subsequently removed. Some items in the academic constructs also experienced issues in the pilot test. Consequently, 12 items were removed to improve loadings and reliability (See Table 3).

Table 3. Modifications to Final SEAOS Following Pilot Testing

Modifications to Final SEAOS Following Pilot Testing		
Items Removed	Item Reworded	Item Added
I need plants to live.	Original: I am confident I can understand material presented in my class readings. Modified: I am confident I can understand my class readings.	I am confident I can prepare an outline for a term paper.
People need to take better care of plants and animals.		
I need to take better care of plants and animals.		
I would give some of my own money to help the environment.		
I would be willing to use efficient light bulbs to save energy.		
I recycle some of the things I use.		
I am confident I can do well on my exams.		
I am confident I can do well on pop quizzes.		
I am confident I can take good class notes.		
I am confident I can effectively balance time between schoolwork and athletics.		
When I study, I go through readings and class notes and try to find the most important ideas.		
I make good use of study time.		
I make simple charts, diagrams, or tables to help organize class material.		
When I study, I pull together information from different sources, such as lectures, readings, and discussions.		
I ask the instructor to clarify materials that I don't understand.		
When I study, I write brief outlines of the main ideas from the readings and class notes.		
I attend class regularly.		
I make sure that I keep up with the weekly readings and assignments for class.		

Some items from the pilot Student-Athlete Environmental and Academic Orientation Survey (SEAOS) identified as having weak reliability and validity were modified or removed before the final SEAOS administration. One item was added after consultation with researchers experienced in the area.

Final Implementation

Final implementation of the SEAOS took place in Fall 2014 and Spring 2015. The SEAOS was administered as a pretest-posttest to student-athletes in the treatment and control groups. Student-athletes in the final study sample were randomly divided into the treatment or control group by the same means as the pilot test.

Items in the SEAOS pertaining to environmental attitudes and behaviors used a Likert-type scale, in which student-athletes were given five answer choices (i.e., from "Strongly Disagree" to "Strongly Agree") in response to several statements. Following the environmental behavior items, an open-ended question asked for any additional pro-environmental behaviors performed regularly.

The academic items used a seven-point semantic scale (e.g., from 1, "not at all true of me" to 7, "true of me"). Additionally, an open-ended question asked for any other study strategies used regularly. The environmental knowledge questions consisted of ten multiple-choice questions with four answer choices for each question. The content of the environmental knowledge questions pertained to main ideas presented in the EE curriculum.

Results

Final Implementation

The final study sample contained 33 student-athletes in the treatment group and 31 student-athletes in the control group. Both samples included student-athletes who were mostly freshmen or sophomores.

The final SEAOS contained seven constructs, which were followed by multiple-choice environmental knowledge questions, and concluded with sociodemographic items. Analysis of the SEAOS data revealed several constructs (See Table 4). Since the pilot test revealed strong item correlations, PCA using direct oblimin rotation was conducted to detect these constructs (Jennrich & Sampson, 1966). Table 5 displays the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity, which indicated PCA was appropriate for this data.

Table 4. Cronbach's Alpha Reliability Coefficients and Eigenvalues for SEAOS.

Cronbach's Alpha Reliability Coefficients and Eigenvalues for SEAOS			
Scale	Cronbach's α	Eigenvalue	% Variance explained within scale
Academic Motivation	0.95	6.52	72.5
Self-Efficacy for Self-Regulatory Learning	0.95	6.00	75.1
Academic Self-Efficacy	0.93	5.53	69.1
Use of Learning Strategies	0.93	6.78	56.5
Environmental Behaviors	0.89	5.20	52.0
Environmental Attitudes	0.82	3.39	56.5

The final Student-Athlete Environmental and Academic Orientation Survey (SEAOS) was administered, and Cronbach's reliability tests were conducted to confirm the structures hypothesized during the pilot test existed in the final

SEAOS. Coefficients were above 0.7, and eigenvalues were above 1. Additionally, percent variance explained by the main construct are displayed in Table 4.

Table 5. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity for SEAOS Scales

		Bartlett's Test		
Source	KMO	Approximate X^2	df	p
Environmental Attitudes	0.72	264.17	15	<0.001
Academic Self-Efficacy	0.81	575.07	28	<0.001
Use of Learning Strategies	0.83	555.69	66	<0.001
Environmental Behaviors	0.84	353.46	45	<0.001
Self-Efficacy for Self-Regulatory Learning	0.88	516.17	28	<0.001
Academic Motivation	0.90	568.81	36	<0.001

Principal components analysis was conducted on the posttest Student-Athlete Environmental and Academic Orientation Survey, and Table 5 displays the results of Kaiser-Meyer-Olkin and Barlett's tests, which indicated Principal Components Analysis was appropriate.

One difference in the revealed constructs in the final implementation of the SEAOS that was not present in the pilot test was that environmental behavior items on the posttest loaded onto two components. Based on the type of actions to which the items referred, the components were named "individual action" and "collective action." However, further tests of construct validity did not reveal that these two components resembled separate constructs. Inter-item correlations revealed that "collective action" items were still highly correlated with "individual action" items, with the exception of two pairs of items. The two-pair exception was deemed insufficient to qualify the "collective action" component as a separate construct, and the hypothesized single-construct structure was retained. The study sample may have perceived their own behavior patterns differently when performing the different types of actions in the SEAOS, leading participants to respond to these two item types slightly differently. Loadings for environmental behavior items are displayed in Table 6. Table 7 displays component loadings of each other SEAOS construct.

Table 6. Pattern and Structure Matrix for Principal Components Analysis

Pattern and Structure Matrix for Principal Components Analysis					
		Pattern		Structure	
Component	Item	A	B	A	B
A. Individual Action	3	**0.91**	-0.10	**0.89**	0.36
	4	**0.91**	-0.05	**0.87**	0.32
	1	**0.83**	0.02	**0.84**	0.40
	6	**0.80**	0.04	**0.81**	0.40
	10	**0.79**	0.01	**0.79**	0.37
	2	**0.64**	0.30	**0.78**	0.59
B. Collective Action	9	-0.11	**0.92**	0.31	**0.87**
	5	0.02	**0.77**	0.53	**0.80**
	8	0.21	**0.70**	0.37	**0.78**

Table 6 displays the pattern and structure matrix of two components identified in the environmental behavior scale in principal components analysis on the posttest Student-Athlete Environmental and Academic Orientation Survey. The Principal Components Analysis was conducted using oblimin rotation, and the subsequent components were named individual action and collective action. Bolded numbers indicate the items loaded onto that component.

Table 7. Matrix Coefficients for Principal Components Analysis using Oblimin Rotation for Pre- and Posttest SEAOS

Principal Components Analysis Loadings for Pre- and Posttest SEAOS			
Component	Item	Pretest (n = 140)	Posttest (n = 64)
Environmental Attitudes	5	0.54	0.83
	4	0.72	0.77
	3	0.45	0.76
	1	0.73	0.75
	2	0.78	0.74
	6	0.76	0.66
Academic Self-efficacy	3	0.88	0.92
	2	0.87	0.89
	8	0.87	0.83
	1	0.86	0.89
	7	0.84	0.82
	5	0.80	0.89
	4	0.69	0.70
	6	0.67	0.68
Self-Regulatory Learning	7	0.92	0.86
	4	0.91	0.82
	3	0.91	0.89
	5	0.91	0.94
	2	0.90	0.86
	6	0.89	0.93
	1	0.88	0.75
	8	0.87	0.86
Motivations	6	0.94	0.79
	8	0.94	0.92
	3	0.93	0.83
	4	0.92	0.88
	1	0.90	0.88
	7	0.87	0.82
	5	0.87	0.79
	2	0.85	0.88
	9	0.83	0.87
Use of Learning Strategies	1	0.86	0.83
	7	0.84	0.80
	10	0.80	0.78
	6	0.80	0.75
	4	0.80	0.80
	8	0.80	0.82
	11	0.79	0.67
	9	0.77	0.76
	3	0.77	0.65
	2	0.76	0.81
	12	0.72	0.77
	5	0.70	0.53

Results of Principal Components Analysis conducted on the constructs listed in Table 7 indicated a single component structure for those constructs. Items loaded strongly onto each component.

Discussion and Conclusions

The research objective of this study was to create a reliable and valid survey that measured student-athletes' environmental and academic orientations, and the steps taken to construct the SEAOS achieved this objective. Each hypothesized construct was confirmed through validity tests and received Cronbach's alpha values above 0.7. Additionally, items loaded onto six constructs at or above the predetermined threshold of 0.5. The constructs included academic self-efficacy, environmental attitudes, environmental behaviors, motivation, self-regulatory learning, and use of learning strategies.

This study successfully achieved its research objective. However, future studies using the SEAOS should seek a sample size of at least 200 to ensure robust results of principal components analysis. This study was restricted to a smaller sample, thus further research is needed to improve the efficacy of the SEAOS. In particular, a larger sample size would enable researchers to confirm the structure of the environmental behavior items and two sub-constructs, "individual action" and "collective action," which may or may not represent separate constructs.

Furthermore, despite pilot testing and corrections, the environmental knowledge questions did not appear to adequately measure knowledge gained from the EE curriculum. Participants, regardless of the number of EE lessons they completed, did not improve knowledge scores on the posttest. Both groups had equal knowledge levels on the pretest. These questions may have been too specific and hence may not have reflected the holistic approach of the EE curriculum. Therefore, the lack of significant results from the knowledge questions should not hinder the ability of future studies to successfully use the SEAOS to measure affective (e.g., attitudes) environmental constructs in university students.

Increasingly, EE programs are beginning to incorporate learning styles, pedagogy, and interdisciplinary curricula (Ardoin, Clark, & Kelsey, 2013), creating the need for a survey to evaluate such programs. The validated constructs that comprise the SEAOS are ideal for fulfilling this need. Moreover, if university student-athletes continue to require academic support and exposure to environmental knowledge, the use of the SEAOS in future studies would help improve the robustness of the survey and assist the senior administration of student-athlete development seeking support for interventional EE programs. Through continued efforts to improve the environmental literacy of university student-athletes, universities can work to cultivate a culture of sustainability on their campuses as well as contribute to positive academic outcomes in some of their at-risk students.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix A – SEAOS Items

Environmental Attitudes

1=Strongly Disagree, 5=Strongly Agree

Plants and animals are important to people.

I can easily harm plants and animals.

My life would change if there were no trees.

It makes me sad to see houses built where plants and animals used to be.

My life would change if there were no plants and animals.

I can easily harm nature.

Environmental Behaviors

1=Strongly Disagree, 5=Strongly Agree

I would be willing to save energy by using less air conditioning.

I would be willing to use less water when I bathe to save water.

I would be willing to ride the bus to more places to reduce air pollution.

I would be willing to turn off the water while I wash my hands to save water.

I have talked with my friends about how to help with environmental problems.

I turn off the water in the sink while I brush my teeth to conserve water.

I turn off lights when they are not in use to save energy.

I have asked what I can do to help reduce pollution.

I often read articles about the environment.

I turn off the water in the sink while I wash my hands to conserve water.

Academic Self-Efficacy

1=Not at all confident, 7=Very confident

I am confident I can…

Research a term paper.

Write a term paper.

Prepare an outline for a term paper.

Ask questions in class.

Keep up-to-date with my schoolwork.

Keep up-to-date with my athletic training.

Understand my textbooks.

Understand class readings.

Self-Regulatory Learning

1=Not at all well, 7=Very well

I can…

Finish my homework assignments on time.

Spend time studying when there are other interesting things to do.

Concentrate on school subjects.
Take notes in class.
Plan my schoolwork.
Organize my schoolwork.
Arrange a place to study without distractions.
Motivate myself to do schoolwork.

Motivation
1=Not at all true of me, 7=True of me
It is true that…
I believe I will receive good grades in my classes.
I can understand some difficult assigned readings.
I can learn the basic concepts taught in my classes.
I can understand some complex material presented by instructors.
I can do a good job on the assignments in my classes.
I can do a good job on the tests in my classes.
I expect to do well in my classes.
I can master the skills being taught in my classes.
I can outline class material to help organize my thoughts.

Learning Strategies
1=Not at all true of me, 7=True of me
It is true that…
I usually study in a place where I can concentrate on class work.
I find it easy to stick to a study schedule.
I ask the instructor to clarify materials that I don't understand.
I memorize key words to remind me of important concepts.
I try to relate ideas in class to those in other classes whenever possible.
When I study, I go over class notes and make an outline of important examples.
When reading, I try to relate class material to what I already know.
I have a regular place set aside for studying.
I have a regular time set aside for studying.
When I can't understand class material, I ask another student for help.
I try to identify students in class whom I can ask for help, if necessary.
I make time to review class notes or readings before an exam.

Environmental Knowledge
1. Which of the following is a greenhouse gas?
a. Carbon dioxide b. Hydrogen

c. Nitrogen d. Oxygen

2. Which of the following energy sources are fossil fuels?
   a. Hydropower b. Oil
   c. Solar d. Wind
3. What percent of Earth's freshwater supply is available for human use?
   a. 0.017% b. 0.05%
   c. 20% d. 100%
4. Choose the water conservation practice from the options below.
   a. Keeping the tap on while brushing teeth
   b. Keeping the tap on while washing hands
   c. Only running a full load of laundry
   d. Remaining in the shower once clean
5. What is the main source of energy used for transportation in the US?
   a. Coal b. Electricity
   c. Natural gas d. Oil
6. Which of the following is NOT considered alternative transportation?
   a. Carpooling b. Driving yourself
   c. Taking the bus d. Walking
7. What is the best example of local food?
   a. Food bought at the nearby Kroger
   b. Food grown in California
   c. Food grown within 400 miles or in the same state as you
   d. Food that is grown in the Western Hemisphere
8. What is one way to buy local food?
   a. Community garden
   b. Farmer's market
   c. Natural food store, such as Earth Fare
   d. All of the above
9. Approximately what percent of waste gets recycled at UGA?
   a. 10% b. 15%
   c. 50% d. 80%
10. The "R" action that prevents the most waste from being generated is:
   a. Recycle b. Reduce
   c. Reuse d. Reverse

Appendix B – Original Items Modified for SEAOS

Table 8. Original items adapted and modified for the Student-Athlete Environmental and Academic Orientation Survey

Sources of SEAOS constructs	
Source	Items
Larson, Green, & Castleberry, 2011	I like to learn about nature. I like to read about plants and animals. I would spend time after school working to fix problems in nature. I like to learn about plants and animals. I am interested in learning new ways to help protect plants and animals. I would give some of my own money to help save wild plants and animals. I like to spend time in places that have plants and animals. I would help to clean up green areas in my neighborhood. My life would change if there were no plants and animals. My life would change if there were no trees. Plants and animals are important to people. It makes me sad to see homes built where plants and animals used to be. People need plants to live. Nature is easily harmed or hurt by people. Plants and animals are easily harmed or hurt by people. We need to take better care of plants and animals.
Leeming, Dwyer, & Bracken, 1995	I would be willing to stop buying some products to save animals' lives. I would not be willing to save energy by using less air conditioning. To save water, I would be willing to use less water when I bathe. I would not give $15 of my own money to help the environment. I would be willing to ride the bus to more places in order to reduce air pollution. I would not be willing to separate my family's trash for recycling. I would give $15 of my own money to help protect wild animals. To save energy, I would be willing to use dimmer light bulbs. To save water, I would be willing to turn off the water while I wash my hands. I would go from house to house to pass out environmental information. I would be willing to write letters asking people to help reduce pollution. I would be willing to go from house to house asking people to recycle. I have not written someone about a pollution problem.

	I have talked with my parents about how to help with environmental problems. I turn off the water in the sink while I brush my teeth to conserve water. To save energy, I turn off lights at home when they are not in use. I have asked my parents not to buy products made from animal fur. I have asked other what I can do to help reduce pollution. I often read stories that are mostly about the environment. I do not let a water faucet run when it is not necessary. I leave the refrigerator door open while I decide what to get out. I have put up a bird house near my home. I do not separate things at home for recycling.
Pintrich & DeGroot, 1990	Compared with other students in this class I expect to do well. I'm certain I can understand the ideas taught in this course. I expect to do very well in this class. Compared with others in this class, I think I'm a good student. I am sure I can do an excellent job on the problems and tasks assigned for this class. I think I will receive a good grade in this class. My study skills are excellent compared with others in this class. Compared with other students in this class I think I know a great deal about the subject. I know that I will be able to learn the material for this class. When I study for a test, I try to put together the information from class and from the book. When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly. It is hard for me to decide what the main ideas are in what I read. When I study I put important ideas into my own words. I always try to understand what the teacher is saying even if it doesn't make sense. When I study for a test I try to remember as many facts as I can. When studying, I copy my notes over to help me remember material. When I study for a test I practice saying the important facts over and over to myself. I use what I have learned from old homework assignments and the textbook to do new assignments. When I am studying a topic, I try to make everything fit together. When I read material for this class, I say the words over and over to myself to help me remember. I outline the chapters in my book to help me study.

	When reading I try to connect the things I am reading about with what I already know.
Solberg et al., 1993	Research a term paper. Write course papers. Do well on your exams. Take good class notes. Keep up to date with your schoolwork. Manage time effectively. Understand your textbooks. Participate in class discussions. Ask a question in class. Talk to your professors. Talk to university staff. Ask a professor a question.
Zimmerman et al., 1992	Finish homework assignments by deadlines Study when there are other interesting things to do Concentrate on school subjects Take class notes of class instruction Use the library to get information for class assignments Plan your schoolwork Organize your schoolwork Remember information presented in class and textbooks Arrange a place to study without distractions Motivate yourself to do schoolwork Participate in class discussions