

Current Learning Styles of Undergraduate Animal-Studies Students in a 2-Year and 4-Year Degree Program

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Abstract

Understanding how students perceive and internalize information, termed learning style, is thought to be important in delivering a quality education. We compared Animal Sciences students from the University of Florida (UF) to those enrolled in the Zoo Animal Technology Program at Santa Fe College (SFC). We administered two learning style instruments: the Group Embedded Figures Test (GEFT) and the Gergorc Style Delineator (GSD). The GEFT scored students into field-independent, neutral, or field-dependent learning styles. The GSD scored students into four learning styles: Concrete-Sequential (CS), Abstract-Sequential (AS), Abstract-Random (AR) and Concrete-Random (CR). With the GEFT, 63% of UF students indicated a field-independent learning style, compared to 19% field-dependent and 18% neutral ($P < 0.01$). Of SFC students, 46% indicated a field-independent learning style, to 34% field-dependent and 20% neutral ($P < 0.01$). Within the GSD, 49% of UF students indicated a CS learning style compared to only 21% CR, 15% AS and 25% AR ($P < 0.01$). Of SFC students, no significant differences were found amongst GSD learning styles. These results demonstrated the demographics and learning preferences of students currently enrolled in two animal-centered curriculums at a two-year and four-year institution of higher learning.

Introduction

In the past 50 years in education it has been postulated that understanding learning styles is critical to understanding how students synthesize and process information. Gregorc (1979) defined learning styles as distinctive behaviors which serve as indicators of how

a person learns from and adapts to his (or her) environment and gives clues as to how a person's mind operates. Put simply, learning styles are preferences of the learner to a sensory modality which best suits them for receiving and internalizing information. Dobson (2009) described the four major sensory modalities as: visual (pictures, graphs, and tables), auditory (listening, discussion, question and answer sessions), kinesthetic (engaging in physical experiences or laboratories) and read/write (taking notes, writing reports).

Learning styles differ across academic disciplines (Mathews, 1994; Jones et al., 2003; Torres and Cano, 1994; Dobson, 2010; Garton et al., 1999). The importance of understanding students' learning styles has been demonstrated in many studies by students' higher achievement when taught through their preferred learning style (Dobson, 2009; Thomas et al., 2002; Dyer and Osborne, 1996). Further, a positive association was found in the Animal Science discipline that indicated students' achieved at a higher level when taught to their preferred learning style (Garton et al., 1999).

The focus of the study was to evaluate the learning styles of this generation's cohort of animal-studies students. We also compared students enrolled in the Animal Sciences program at a major state university (the University of Florida; UF) to students enrolled in another animal-centered curriculum at a state (community) college, the Zoo Animal Technology program Santa Fe College (SFC). As both are similar disciplines studying animal physiology and husbandry, our hypothesis was students preferred learning styles would not differ between the two programs.

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Materials and Methods

All procedures used in this study were determined to be exempt from review by the UF and SFC Institutional Review Boards.

The study was conducted in 2013 and the target population for this study was students enrolled in either the B.S. Animal Science's curriculum at UF ($n = 155$) or the A.S. Zoo Animal Technology Program at SFC ($n = 67$). Students enrolled at UF within the 4-year Animal Sciences curriculum were further evaluated depending on their enrolled degree option: Animal Biology Specialization (AB), Equine Specialization (EQ), and Food Animal Specialization (FA). The Zoo Animal Technology Program at SFC is unique as it has a Teaching Zoo on premises and students earn an Associates of Science Degree to either pursue a career within zoological societies, animal-care vocations or go on to pursue a 4-year degree in an animal-related field such as Animal Science. Students surveyed at UF were either enrolled in an Introduction to Animal Sciences course ($n = 123$) or Senior Seminar course ($n = 32$). Only students enrolled in an Animal Sciences discipline were analyzed for this study. The Introduction to Animal Sciences and Senior Seminar course are required of UF Animal Sciences students. All students surveyed at SFC were enrolled in a required Zoo Seminar course under one general degree option. Students were presented the learning style instruments at the beginning of the semester and could opt out if they wished. The two instruments chosen for this study were the Group Embedded Figures Test (GEFT; Witkin et al., 1971) and Gregorc Style Delineator (GSD; Gregorc, 1979).

The GEFT is a standardized instrument that has previously been used to assess individual learning styles in students enrolled in collegiate agriculture programs (Rudd et al., 2000) to include Animal Science students (Garton et al., 1999; Torres and Cano, 1994). The GEFT is a timed test and assesses student's ability to discern simple figures concealed within 18 complex figures. Students correctly identifying 10 or less simple figures in the allotted time were considered field-dependent learners. Students correctly identifying between 11 and 13 simple figures were considered neutral, and those correctly identifying greater than 14 simple figures were considered field-independent learners (Garton et al., 1999). The national average for the GEFT was reported as 11.4 by Wilkens et al. (1971).

The GSD has been described as providing metrics on a student's perceptions and ordering abilities (Hawk and Shah, 2007). The GSD is a self-assessment instrument where students rank ten sets of four words that best described them. Based on the student's rankings, a score of 10 to 40 is possible in four separate learning styles: Concrete-Sequential (CS), Abstract-Sequential (AS), Abstract-Random (AR), and Concrete-Random (CR). The highest score amongst the four learning styles was scored as that student's preferred learning style.

Raw score data for student's preferred learning styles using the GEFT and GSD instruments were analyzed by

SAS MIXED procedures (Version 9.3; SAS Institute Inc., Cary, NC, USA). Fixed effects for analyzing students at UF included the year in school (underclassmen, upperclassmen), gender (male, female) and degree option (AB, EQ, and FA). For comparisons between UF and SFC, fixed effects were school attended (UF, SFC) and gender (male, female). Statistical comparisons between the assessed learning modalities in the GEFT (field-dependent, field-independent) and GSD (CS, AS, AR, CR) were made by X2 analyses. Statistical significance was set at $P < 0.05$.

Results and Discussion

Education is currently embedded in the Information Age, and a paradigm shift in higher education is taking place. Reigeluth (1994) summarized the Industrial-Age factory model school system of compartmentalized learning into subject areas where students are expected to learn the same content in the same amount of time as outdated and quickly becoming obsolete. Watson and Reigeluth (2008) argue for a more learner-centered type of education where education is personalized to the individual student to promote maximum student engagement and success. We maintain that understanding a student's learning style can facilitate this type of student-centered education. Therefore to help facilitate this change, updating the current student trends in learning styles in animal-study centered curricula was the objective of this study.

Student Demographics

A total of 222 students completed both the GEFT and GSD instruments with 155 students from UF and 67 students from SFC. Of the UF respondents, 131 (85%) students were female and 23 (15%) male. For SFC respondents, 60 (90%) were female and 7 (10%) male. Under the UF Animal Sciences degree options, 68% of the respondents were currently enrolled in the AB degree option, with 17% under the EQ option and 14% FA. Of the 106 students in the AB option 86% were female 14% male, EQ option 93% female 7% male and FA option 59% female 41% male. As UF accepts a large number of transfer students into its Animal Science's program, of the students in the Introduction to Animal Science course only 17 (11%) were classified as underclassmen (freshman or sophomore). The remaining 138 students were classified as upperclassmen (junior or senior) and enrolled in either the introductory or Senior Seminar course.

Given current trends, our examination of the female to male ratio within both UF and SFC is not surprising. Of the 155 students surveyed at UF, 85% are female to 15% male; similarly, 90% are female to 10% male at SFC. These data differ sharply from data collected three decades ago with Animal Sciences students and a 45% female to 55% male ratio (Mollett and Leslie, 1986). The female population of this study was larger compared to an earlier study by Dyer and Osborne (1996) of students enrolled in Animal Sciences courses. In that study,

a 66% female to 34% male ratio was reported. Taken together, these data have significance as Witken et al. (1977) stated learning styles differ between genders. Indeed, many studies have corroborated gender differences in preferred learning styles (Dyer and Osborne, 1996; Philbin et al., 1995; Mathews, 1994; Torres and Cano, 1994). In our study, gender differences were not observed in SFC students and was most likely due to such a small sample size of males (n = 7). Yet, with a larger samples size our UF males had higher mean GEFT scores and may support these earlier studies conclusions.

The other interesting demographic data from our study of UF students is the number of students enrolled in the AB (68%) and EQ (17%) degree options, compared to the traditional Animal Science's FA (14%) degree option. The earlier study of Mollett and Leslie (1986) indicated only 34% of Animal Sciences students specified they intended to pursue veterinary or other post-graduate school (similar to the UF AB option), with the remainder indicating they anticipated their vocation to be in farming or an agriculture-related field. Our data appears to capture the current trends within UF and perceived national trends of students in the Animal Sciences who are more interested in learning about a wider range of animal species other than traditional livestock. These data may also support the conclusion drawn by Kauffman (1992) that Animal Science as a discipline is broadening its appeal to students by including species other than livestock in its curriculum.

GEFT Scores

While mean raw scores differed in the GEFT amongst degree options at UF, no differences were observed in percentage of students who were classified as field-dependent, neutral or field-independent learning styles, therefore data were combined for analysis. A greater (P < 0.01) percentage of UF Animal Sciences students were classified as having a field-independent learning style (98/155, 63%) compared to a field-dependent (30/155, 19%) or neutral (27/155, 18%) learning style (Figure 1A). Similarly, SFC students had a higher (P < 0.01) preference for a field-independent learning style (31/67, 46%) compared to field-dependent (23/67, 34%) or neutral (13/67, 19%) learning styles (Figure 1B).

When evaluating raw GEFT scores (Table 1), students at UF under the AB option scored higher (P < 0.05) compared to students enrolled in both the EQ and FA degree options. When UF student scores were combined and evaluated in comparison to SFC student scores, UF students scored higher (P < 0.001) with a combined GEFT score of 13.7 ± 0.32 when compared to SFC student mean scores of 11.7 ± 0.55. A gender effect was found in students at UF with males scoring higher (P < 0.05) with a mean score of 14.8 ± 0.64 compared to females 13.4 ± 0.36. No gender differences were found in SFC student scores, nor between classes (under and upperclassmen) at UF.

When evaluated by the GEFT learning style inventory, a higher percentage of UF and SFC students demonstrated a significant preference for a field-independent learning style. Torres and Cano (1994) described students with field-independent learning styles as viewing the world more analytically, find it easier to solve problems and were more likely to favor independent study. Conversely, those that indicated a preference for the field-dependent learning style are described as perceiving the world globally, find it more difficult solving problems and tend to favor the spectator approach to learning (Torres and Cano, 1994; Witkin et al., 1977).

For generational comparisons, we chose the GEFT due to earlier studies examining the field-independent and field-dependent learning styles of students in agriculture and the animal sciences. Interestingly, it appears the learning styles of Animal Sciences students using the GEFT have not changed significantly over the past two decades. In the 1994 study of Torres and Cano, of 21 Animal Science students surveyed 70% indicated a field-independent learning style. In a more robust study, Garton et al. (1999) reported of 187 Animal Science students surveyed, 56% indicated a preference for a field-independent learning style compared to only 22% field-dependent and 22% neutral. A similar study examining learning styles of agricultural education students, of 133 students surveyed, 55% indicated a field-inde-

Figure 1. Group Embedded Figures Test learning style inventory from students within the Animal Sciences Department at the University of Florida (Panel A) and students within the Zoo Animal Technology Program at Santa Fe College (Panel B).

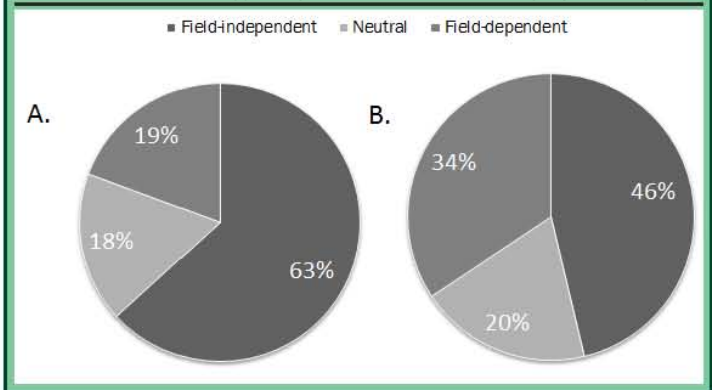


Table 1. Mean scores of students surveyed using the Group Embedded Figures Test (GEFT) enrolled in Animal Sciences at the University of Florida and Zoo Animal Technology Program at Santa Fe College.

Characteristic	No. of Students	Mean Score
<i>University of Florida</i>		
Degree Option		
Animal Biology	106	14.0 ± 0.36 ^A
Equine	27	13.0 ± 0.69 ^B
Food Animal	22	12.5 ± 1.04 ^B
Overall Mean	155	13.7 ± 0.32 ^C
<i>Santa Fe College</i>		
Zoo Animal Technology	67	11.7 ± 0.55 ^D

The GEFT is a timed test and assesses the student's ability to correctly identify simple figures concealed within 18 separate complex figures. Scores indicated the number of correctly identified figures. A,B indicated a significant difference (P < 0.05) amongst degree options at the University of Florida and C,D indicated a significant difference (P < 0.05) between students from the University of Florida and Santa Fe College.

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pendent learning style, compared to only 30% field-dependent (Dyer and Osborne, 1996). Taken together, these results would agree with previous studies that learning styles tend to be similar across like disciplines (Mathews, 1994; Jones et al., 2003). These results also appear to confirm Witkin et al. (1977) summary describing field-independent learners as gravitating to disciplines in the natural sciences.

Students at SFC were similar to UF students and indicated a higher preference for a field-independent learning style; however, their responses were less so with only 46% of respondents falling into this category. Interestingly, mean GEFT scores of the SFC students were significantly lower compared to UF students. These data may disprove our initial hypothesis of no differences between the two cohorts of students. These results may also indicate that learning styles may differ across students pursuing a 2-year compared to 4-year college degree, rather than a difference within a specific discipline. Data comparing learning styles between students attending community college or two-year programs and four-year university students is lacking. In one study, Henson and Schmeck (1993) showed differences in community college and university student learning styles. However, more robust studies are needed to draw any significant conclusions. With the large number of 2-year agricultural centered college programs across the United States, it would be worthwhile in future studies to examine learning styles amongst these populations of students.

GSD Scores

The GSD differs from the GEFT in that the instrument reveals two types of mediation abilities: perception and ordering. Additionally, the GSD separates respondents into four learning style categories (Gregorc, 1982). To our knowledge, no Animal Sciences students, nor students in 2-year college animal-centered programs, have been previously examined using the GSD instrument.

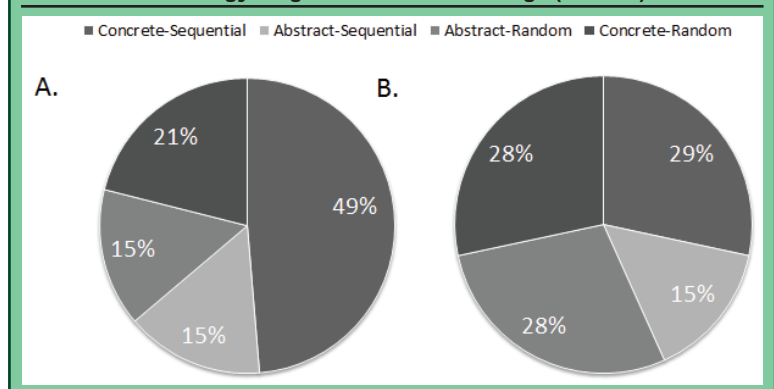
No significant differences were observed amongst the three degree options offered in the Animal Sciences department, nor by class (under versus upperclassmen) within an overall preference for a single learning style. Results of the mean raw scores of the GSD are depicted in Table 2. While raw scores did seem to differ amongst degree options, they did not impact the overall clear choice of UF students as evidenced with a higher ($P < 0.01$) preference for the CS learning style (74/153, 48%) compared to the AS (23/153, 15%), AR (23/153, 15%) and CR (32/153, 21%) learning styles (Figure 2A). The SFC students did not appear to have a higher preference amongst GSD learning styles (Figure 2B). When UF raw scores were compared to SFC students, significant differences were observed. The UF students scored higher ($P < 0.01$) than SFC students in the CS

Table 2. Mean scores of students surveyed using the Gregorc Style Delineator (GSD) enrolled in Animal Sciences at the University of Florida and Zoo Animal Technology Program at Santa Fe College.

Characteristic	No. of Students	Mean Score			
		CS	AS	AR	CR
<i>University of Florida</i>					
Degree Option					
Animal Biology	106	27.5 ± 0.5 ^A	24.9 ± 0.4 ^B	23.3 ± 0.5 ^C	24.6 ± 0.4 ^B
Equine	27	26.9 ± 0.8 ^A	23.4 ± 0.9 ^B	24.5 ± 1.1 ^B	25.3 ± 0.9 ^{A^B}
Food Animal	22	26.5 ± 1.6 ^A	25.0 ± 0.9 ^A	22.6 ± 1.2 ^B	25.0 ± 1.3 ^A
Overall Mean	155	27.3 ± 0.4 ^A	24.7 ± 0.4 ^B	23.5 ± 0.4 ^C	24.8 ± 0.4 ^B
<i>Santa Fe College</i>					
Zoo Animal Technology	67	25.6 ± 0.6 ^A	23.2 ± 0.6 ^B	25.7 ± 0.6 ^A	25.6 ± 0.6 ^A

The GSD is a self-assessment instrument where students rank ten sets of words that best describe them. Student's highest score amongst the four categories identified that student's preferred learning style. A-C within a row indicated a significant difference ($P < 0.05$) amongst mean scores.

Figure 2. Gregorc Style Delineator learning style inventory results from students within the Animal Sciences Department at the University of Florida (Panel A) and students within the Zoo Animal Technology Program at Santa Fe College (Panel B).



and AS learning styles, whereas SFC students scored higher ($P < 0.01$) in the AR learning style. No differences were found within CR styles.

Unlike the GEFT, we did not find any differences with regards to gender with the GSD. Furthermore, we did not find any preference to the four GSD modalities with SFC students. This would appear to lend even more support to disproving our initial hypothesis that there would be no differences in learning styles between UF and SFC students.

The results of the GSD learning style inventory indicated a significant preference to a preferred learning style with a majority of UF Animal Sciences students indicating a CS learning style. Gregorc (1982) described students with a CS preferred learning style as viewing and approaching experiences in an ordered and sequential manner. Students with this preference are able to discern between facts and are naturally structured and task oriented. Hawk and Shaw (2007) state the CS learner prefers direct, hands-on experiences, wants order and a logical sequence to tasks and follows directions well. Activities in the classroom that accommodate CS learners are worksheets, checklists, outlines, charts, field trips, diagrams and flow charts (Hawk and Shaw, 2007). AS learners are described as relying on logic and their intellect in their approach to critical thinking and prefer an environment that is ordered and mentally stimulating (Myers and Dyer, 2006). Activities in the classroom that accommodate AS learners are lectures, outlines,

reading, reporting, term papers and doing research (Hawk and Shaw, 2007). The AR learners are described as having feelings, concerned with emotions and their thinking, and find routine boring (Myers and Dyer, 2006). Activities in the classroom that accommodate AR learner are group work, mapping, discussions, role playing and keeping journals (Hawk and Shaw, 2007). Finally, the CR learner is described as having to rely on their intuition and instinct, and is more concerned with attitudes than facts (Myers and Dyer, 2006). Activities in the classroom that accommodate CR learners are brainstorming, case studies, hands-on learning, simulations, investigations and problem solving (Hawk and Shaw, 2007).

Summary and Implications

The results of this study demonstrated significant choices in the preferred learning styles of Animal Sciences students in both the GEFT and GSD learning style inventories. Data analysis of learning styles of SFC students showed significance in the GEFT but not the GSD. These results appeared to disprove our initial hypothesis of similar learning styles in animal-studies disciplines, as there were significant differences in preferred learning styles. This may be more of an indication of learning style preferences of students enrolled in a 2-year compared to a 4-year degree program and future research should explore this further. These data should be leveraged in animal-centered curriculums to facilitate change in current teaching methods to maximize student engagement and success in the classroom.

The challenge in higher education and more specifically students in animal-centered programs is how to accommodate a student's learning style in the classroom. While UF students, and to some extent SFC students, have a strong preference for a particular learning style, not all students scored the same. While many studies have shown greater student improvement when taught to their preferred learning style, these same studies demonstrated students whose learning style is not being taught to score worse than the targeted learning style students (Dobson, 2010; Thomas et al., 2002; Dyer and Osborne, 1996). It has been proposed that students being taught in an instructional environment that differs from their preferred learning style adapt and can actually benefit them by teaching important life skills on how to adapt to a less than optimum learning environment (Felder and Spurlin, 2005; Messick, 1976). However, Romanelli et al. (2009) proposed that teaching to one particular learning style alienates these students and instructors should alter their teaching methods to accommodate as many learning styles as possible.

We maintain that while transitioning the classroom from the Industrial-Age type education of typical lectures and exams, instructors should shift to a more learner-centered classroom environment. The difficulty in such an approach could be simplistic in a small classroom or more difficult with large-enrollment classes. A teaching strategy that is emerging in higher education due to

technological advancements is the concept of the "flipped classroom." The flipped classroom is a teaching strategy in which rather than students attending lectures and doing homework/reading on their own, students view lectures online on their own and come to class to engage in instructional activities. Bishop and Verleger (2013) stated the flipped classroom combines a unique blend of learning theories once thought to be incompatible: active learning and problem-based learning activities founded upon a constructivist ideology and instructional lectures derived from direct instruction methods founded upon behaviorist principles. There is emerging evidence that this method of teaching not only increased undergraduate student achievement but students positively responded to this teaching method (Moravec et al., 2010; Day and Foley, 2006). We propose that future research should experiment with this type of approach of teaching to facilitate the inclusion of the many different learning styles and evaluate their students' academic achievement. Regardless of the teaching strategy employed, as the direction of higher education is rapidly changing we contend as a recommendation for practice educators should be aware of how best their students learn and should alter their teaching approaches accordingly.

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