Changing Demographics in College of Agriculture and Life Sciences Students

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Abstract

The purpose of this study was to describe the pre-collegiate experiences of new students in the College of Agriculture and Life Sciences at Iowa State University. New students to the college completed an on-line questionnaire about their home residence and personal and social experiences. Survey data were matched with university records to make comparisons based on demographic characteristics (i.e., gender, race, high school class rank, and college major). The results of this study indicate more students were from farms than from any other demographic variable. Students who chose a major related to production agriculture were no more likely to report a higher family income from farm or agri-business than those that chose majors not tied to production agriculture. The highest percentage of pre-collegiate involvement in extracurricular activities was athletics. This study was guided by the collegiate outcomes model, which was adapted from the collegiate leadership development model.

Keywords: socio-economics, academic preparation, pre-collegiate experiences

Introduction

Millennial students have created a new set of challenges for higher education. These students have a closer relationship with their parents, increased focus on grades, highly involved in extracurricular activities, and are technologically savvy (Howe and Strauss, 2003). Educational reforms have addressed such issues and created a paradigm shift, encouraging more focus on learning and less on teaching (Huba, 2000).

The changing demographics have created additional challenges for higher education. The Western Interstate Commission for Higher Education (WICHE) has noted the nation is projected to produce fewer high school graduates in graduating classes between 2014 and 2023, (WICHE, 2016). According to WICHE (2016), "*The pending national plateau is largely fueled by a decline in the White student population and counterbalanced by growth in the number of non-white public-school graduates – Hispanics and Asian/Pacific Islanders in particular. Overall, there will be consistent declines in the number of White public high school graduates and robust growth in the number of public school graduates of color in the coming years* (p. 1)" In specific ethnic areas the population is expected to do the following:

- White public high school graduates are expected to decrease by 14% between 2014 and 2030.
- Hispanic high school graduates are expected to increase by 50% between 2014 and 2025.
- Asian Pacific Islander high school graduates are expected to increase by 30% between 2013 and 2030.
- Black public high school graduates are expected to decline by 6% between 2013 and 2030.
- American Indian/Alaskan Native public high school graduates are expected to decline each year.

The number of high school graduates will vary from region to region. In 2013, the Midwest had 22% of the nation's high school graduates and is projected to have 19% by 2030. Likewise, the northeast region is expected to decrease from 18% of the total high school graduates in 2013 to 16% in 2030. The western region accounted for 22% of high school graduates in the early 2000s and is expected to peak at 30% in 2024 and drop back to 28% by 2030. In the southern region high school graduates are projected to increase to 47% in 2025 and by 2030 high school graduates will decrease slightly to 45%.

This shift in demographics has also been noted by Buchanan (2008) who studies the area of animal science. The shift in demographics is towards more women, more diverse students and students who are from non-rural communities will continue to increase. According to the United States Census Bureau (2015), the US is projected to become more racially and ethnically diverse. Specifically, dramatic changes are expected to be seen in the Hispanic (Latino) population with it expected to grow from being 17.4% in 2014 to 28.6% in 2060. In 2014, 48% of the population identifies as Hispanic and it is expected by 2060, 64.4% of people under the age of 18 will identify as being Hispanic. Hoover

(2013) in The Chronical of Higher Education shared that a "*sharply increasing diversity will soon hit many states and institutions with freight-train force* (paragraph 11)." She also shared, "*as these changes take hold, meeting the needs of minority students, especially those from underrepresented groups, will place a greater role in defining institutional success* (paragraph 15)."

In addition to dealing with changing demographics, higher education's funding streams have shifted significantly and, in many cases, caused institutions to look at different budgeting resource models. Cuts in state and local appropriations after the 2001 recession resulted in an increased percent of total operating revenues of public institutions coming from student tuition (Baum, 2012). In fact, "*the steadiest source of new revenue between 1998 and 2008 was from tuition*" (Baum, 2012, p. 14). For many institutions, these demographic changes and economic pressures have resulted in an increased attention in out-of-state recruitment to maintain enrollment and meet demands for a well-educated workforce.

For example, Iowa State University has experienced the same issues. In 1999, 12.7% of the college enrollment was non-resident, compared to 28.2% in 2016 (Iowa State University, 2016). In addition, the college has become more ethnically diverse. In 1999, 2.9% of the college undergraduate population was non-white, and in 2016, 9.01% of the undergraduate population was non-white (Iowa State University, 2016). The college has also seen changes in the gender make-up of the college. In 1999, 41.6% of the college enrollment was female, compared to 50.68% in 2016 (Iowa State University, 2016).

Research has highlighted the importance of demographics and pre-collegiate experiences when examining college experiences (Dugan and Komives, 2007; Foreman and Retallick, 2012). Dyer et al. (2000) found that students who lived in a rural setting were more likely to complete a degree in a college of agriculture than students without those experiences. Results of previous research indicated that these trends have changed in the College of Agriculture and Life Sciences at Iowa State University. Between 1985 and 2003, the percent of students who reported living on a farm decreased from 52% to 46%, while students who reported living in a town over 2500 or an urban setting increased from 38% to 44% (COA, 1996 and 2003; Scofield, 1992). Slightly less than two-thirds of the students stated they were enrolled in a high school agricultural science program. In Texas, almost 60% of the responding students reported that their immediate family is not involved in agriculture or life sciences (Rayfield et al., 2013). Research conducted in California showed that students who were exposed to agriculture at the high school level were more likely to choose an agriculture major in college than those without exposure (Swan and De Lay, 2014).

Similar trends were found when looking at extracurricular activities. Members of 4-H and FFA were more likely to complete a degree in a college of agriculture than students without those experiences (Dyer et al., 2000). However, trends show less student involvement in these activities traditionally viewed as related to College of Agriculture students (COA, 1996 and 2003; Scofield, 1992). In 1985, 49% of new students were involved in FFA and 52% were involved in 4-H, compared to 2003 where 42% were involved in FFA and 43% in 4-H. During the same period, other activities, such as music and athletics increased.

There are several factors that influence a student's decision to decide what to major in once they enroll in college. Students who had experience within the agriculture industry and FFA and 4-H experiences prior to college enrollment have shown to be the highest ranked influencing factor (Swan et al., 2014). Rayfield et al. (2013) found that parents or guardians were reported as the person to have the most influence on the respondent's decision to major within the College of Agriculture and Life Sciences.

Conceptual Framework

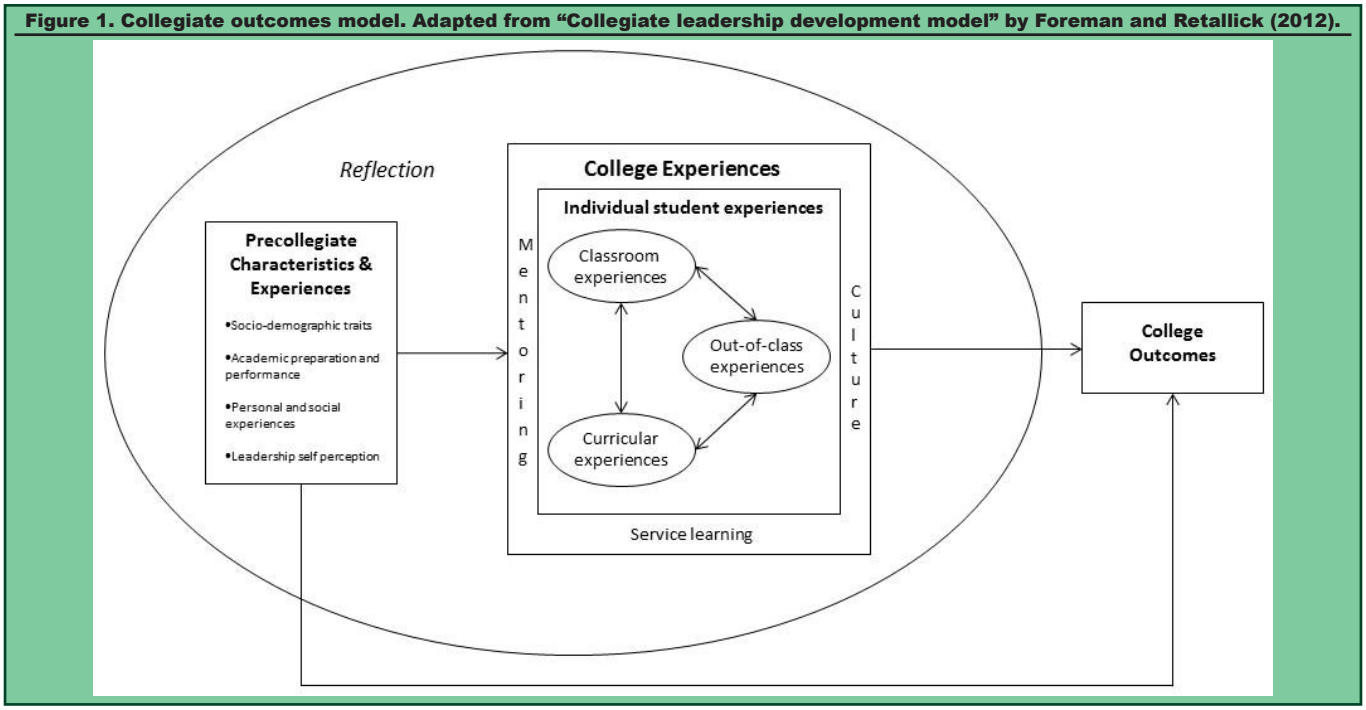
The Input-Environment-Output (E-I-O) model (1993) focuses on the need to understand student qualities and characteristics when entering an educational institution. The model focuses on the nature of the educational environments with which the student comes into contact and the qualities and characteristics as they leave an institution. The model contends that the outcomes in student development are determined by the inputs and learning environments. The inputs are also the influence outcomes, which the environment in the model serves as a mediator. Astin (1993) explains the relationship between environment and student outcomes cannot be understood without considering student inputs. In applying the I-E-O Model (1993), researchers have developed a conceptual framework that consider the importance of pre-collegiate experiences in reaching college outcomes (Foreman and Retallick, 2012; Renn and Reason, 2013). "*What students came to college with largely explained how they developed in college. Eighteen or more years of experience provided a strong foundational grounding on which college experiences built*" (Dugan and Komives, 2007, p.13). Renn and Reason (2013) went so far as to suggest that some pre-collegiate characteristics may be as important in reaching college outcomes as the college experience.

An adaptation of the Collegiate Leadership Development Model (Foreman and Retallick, 2012) was used as the conceptual framework for this model. The model includes the role of pre-collegiate characteristics and experiences and college experiences to reach college outcomes (Figure 1). This study focused on the role pre-collegiate characteristics and experiences has on the college recruitment process.

Purpose and Research Questions

Changing demographics and income generated by tuition dollars has increased the attention on recruitment and retention of undergraduate students and resulted

Figure 1. Collegiate outcomes model. Adapted from "Collegiate leadership development model" by Foreman and Retallick (2012).



in a need for additional information about incoming students. The purpose of this study was to describe the pre-collegiate characteristics and experiences of all incoming College of Agriculture and Life Science students.

Three research objectives guided this study:

- Describe the socio-demographic traits of new students in the College of Agriculture and Life Sciences and determine if there are socio-demographic differences based on choice of major and residence (e.g. in state versus out-of-state).
- Describe the academic preparation and performance of the new students in the College of Agriculture and Life Sciences and determine if there are differences in academic preparation and performance based on choice of major and residence.
- Describe pre-collegiate personal and social experiences of the new students in the College of Agriculture and Life Sciences and examine differences in pre-collegiate personal and social experiences based on choice of major.

Methods

This study was a part of a larger study designed to examine the pre-collegiate characteristics and experiences of incoming students and identify the factors that influence students' decisions to attend the College of Agriculture and Life Sciences at Iowa State University. Incoming full-time students (N=1010) were surveyed. The Institutional Review Board approved the study protocol and all participants were provided modified informed consent.

Instrumentation

The university database and a researcher-designed questionnaire were used to meet the research objectives of this study. Demographic and academic information was collected from student records received directly from the university registrar's office (i.e., gender, race, high school class rank, and college major). The researchers chose to obtain this information from official student records to reduce the length of the on-line questionnaire and ensure the accuracy of the data.

Researcher-designed questions were used to collect data about pre-collegiate characteristics and experiences. Students were asked to indicate their home residence and were given six categories from which to choose (i.e., farm, rural, urban <2,500, urban 2,500–10,000, urban 10,000-25,000, and urban over 25,000). Respondents were asked if their family was involved in a farming or agriculture-related business. Respondents who indicated their family was involved in farming or agriculture-related business were asked a follow-up question to learn if the farm or agriculture-related business was family owned. In addition, students were asked what percent of their total family income was derived from farming or agriculture – related business.

To learn more about student involvement in high school extracurricular activities, students were given a list of extracurricular activities and asked to select the ones in which they participated. Based on their responses, follow-up questions were asked to gather information about the extent of their participation.

Validity

A group of faculty, staff, and administrators reviewed the instrument for face validity. In addition, the instrument was field tested for content validity by a group of continuing College of Agriculture and Life Sciences students. Based on the feedback of these two groups, changes to content, question format, and data collection procedures were made to improve the validity of the instrument.

Data Collection and Analysis

As subjects completed the survey, Qualtrics (Qualtrics Labs, Inc, Provo, UT) recorded the responses. E-mail addresses were used to match students' university record information with survey results. All identifying information was removed before data analysis began. SPSS (Version 18) was used to analyze the data.

The researchers modified Dillman's (2007) five-step data collection approach. Foreman and Retallick (2012) suggested that undergraduates would view pre-notice as junk mail and would be less likely to respond favorably to follow-up e-mails. The first e-mail described the purpose of the study, explained general consent, and included the survey link. The distribution list obtained from the university registrar's office contained 1010 subjects. Subjects were contacted one to five times via e-mail over a fourteen-day period to reduce non-response. Those who responded were removed from the e-mail list and not contacted again. This process resulted in 597 responses (50.11% response rate). Early and late respondents were compared to control for non-response error (Linder et al., 2001) and the analysis showed no differences based on gender or majors.

Two continuous variables were recoded into categorical variables for analysis. The residence variable was recoded into three categories: 1) in-state, 2) contiguous states, and 3) non-contiguous states. The major was recoded into two categories: 1) production agriculture majors (i.e., Agricultural Studies, Agricultural Education, Agricultural Business, Agronomy, Animal Science, and Agricultural Systems Technology) and 2) non-production agriculture majors (i.e., Agricultural Biochemistry, Animal Ecology, Biology, Culinary Science, Diet and Exercise, Dietetics, Environmental Science, Food Science, Forestry, Genetics, Global Resource Systems, Horticulture, Industrial Technology, Microbiology, Nutritional Science, and Public Service and Administration in Agriculture).

Research question one used university records data to describe the socio-demographic characteristics of new students. A t-test using the recoded major variable as the independent variable and type of residence (i.e., farm, rural acreage, and urban) as the dependent variable was calculated to determine whether the type of residence where students grew up influenced whether they chose a major closely related to production agriculture. A similar t-test was calculated to determine if the percent of total family income derived from farm or agribusiness influenced major. An ANOVA using the recoded residence variable as the independent variable and type of residence as the dependent variable was calculated to see if there were differences in where a student grew up based on whether they were from in-state, contiguous states, or non-contiguous states.

Research question two addressed academic preparation and performance. Class rank of students was gathered from university records and used to describe the pre-collegiate academic preparation and performance. A t-test using the dichotomous major variable and high school class rank as the dependent variable was calculated to determine if students there were differences in high school class rank based on the college major they selected. An ANOVA using residence as the independent variable and high school class rank as the dependent variable was calculated to determine whether there was a relationship between the state of home residence and high school class rank.

Research question three focused on pre-collegiate personal and social experiences. Descriptive statistics were used to describe students' pre-collegiate extracurricular involvement. A Chi-squared statistic was calculated to determine if there was a difference in whether or not students with production agriculture majors were more or less likely to have participated in various pre-collegiate activities.

Results

University enrollment statistics indicated 1010 new full-time College of Agriculture and Life Sciences undergraduate students enrolled in fall 2012, of which 481 (47.6%) were male and 526 (52%) were female. Multicultural students made up 10% (101 students) of the new student college enrollment. Seventy-six percent of the students were residents, 23% were non-resident students, and 1% were foreign students. Of the 597 students who responded to the survey, 61.2% (365 students) were female and 38.4% (229 students) were male. Five hundred and thirty-one respondents were white (89.1%) and 66 respondents (10.9%) were non-white.

Socio-Demographic Traits and Differences

Home residence was assessed using six categories (i.e., 1=farm, 2=rural, 3=urban <2,500, 4=urban 2,501–10,000, 5=urban 10,001–25,000, and 6=urban over 25,000). The results of this study indicated more students (30.9%) were from farms than from any other demographic variable. The second largest place of res-

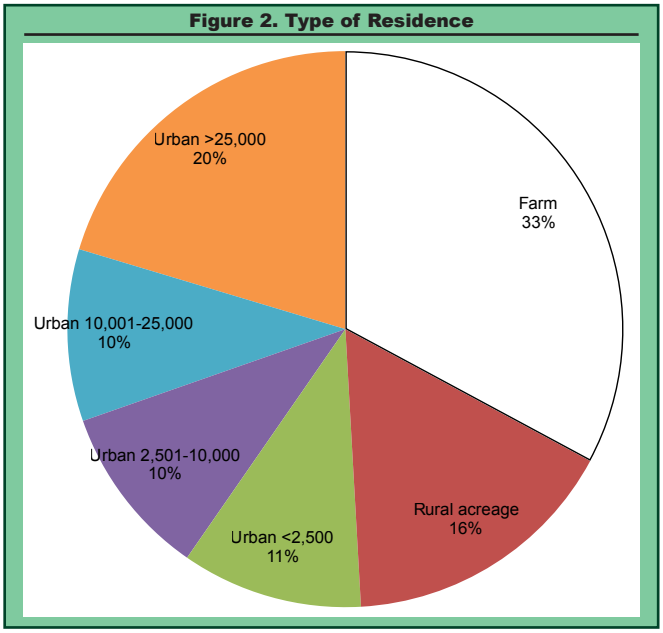
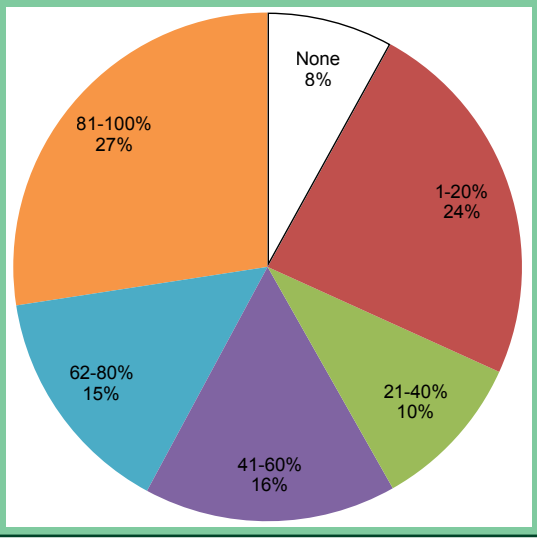


Figure 3. Percent of Total Family Income Derived from Farm or Agriculture Business



idence was urban, over 25,000 (19.1%) (Figure 2). Students who chose majors related to production agriculture (M=2.78, SD=2.18) were more likely to grow up on a farm or rural area and less likely to grow up in an urban area than those who chose majors not related to production agriculture (M=4.29, SD=2.34, t(558)= -7.85, p=0.000). In addition, 308 students (51.7%) indicated that their family was involved in farming or an agriculture-related business, of which 87.9% were family owned. Eighty-two students indicated that 81%-100% of their family income was derived from a farm or agribusiness. In contrast seventy-one students indicated that 1 to 20% of their family income was derived from a farm or agri-business, and twenty-four students indicated that none of their family income came from farm or agri-business sources (Figure 3).

Students who chose a major related to production agriculture (M=3.91, SD=1.69) were no more likely to report a higher family income from farm or agri-business than those that chose majors not tied to production agriculture (M=3.79, SD=1.87, t(117.22)=0.51, p=0.61). ANOVA results showed statistically significant differences based on residence (i.e., in-state, out-of-state contiguous, and out-of-state non-contiguous) and whether a student reported being from a farm or rural area (Table 1). Because the ANOVA provided significant results, a Tukey post hoc test was conducted to compare and contrast differences between groups. Significant differences were found between each of the three groups (i.e., in-state, contiguous states, and non-contiguous states) (Table 2).

In-state students were more likely to report being from a farm or rural area than out-of- state students. Of the out-of-state students, those from contiguous state were from more rural backgrounds than those from non-contiguous states.

Academic preparation

High school class rank ranged from 19 to100 percentile. Thirty-four students (5.7%) were ranked under 50%. Two-hundred and sixty-two (43.9%) ranked above the 80 percentiles, with 72 (7.1%) of those students ranking between the 95 and 100 percentile. A t-test revealed no difference in high school class rank based on whether a student chose a major related to production agriculture (M=63.54, SD=32.53) or one not related to production agriculture (M=65.65, SD=32.72, t(518.61)= -0.77, p=0.44). Students from contiguous states had the highest class rank and in-state students had the lowest class rank. ANOVA results showed a difference in high school class rank based on residence (Table 3). A Tukey post hoc was conducted to compare and contrast mean differences between groups. Significant differences in high school class rank were found between in-state students and students from contiguous states (Table 4).

Pre-collegiate personal and social experiences

Students were involved in a wide variety of extracurricular organizations. Seventy-six percent were involved in athletics, 50% were involved with National Honor Society, 45.8% were involved in music, 40.8% were involved in FFA, 37.2% were involved in 4-H, and 35.2% were involved in faith-based organizations (Table 5).

Table 1. Analysis of Variance for Residence and Type of Residence

Dependent variable	Groups	SS	df	MS	F	P	η2
	Between	433.76	2	216.88	44.91	0.000*	0.138
	Within	2690.02	557	4.83			
	Total	3123.78	559				

Note. *p < 0.05

Table 2. Tukey HSD Post Hoc Results for State of Residence and Home Residence

Test	(I) State of Residence	(J) State of Residence	Mean differences (I-J)	SE	P	Cohen's d
	in-state	Contiguous	-1.53	0.25	0.000*	4.35
		non-contiguous	-2.88	0.36	0.000*	
	contiguous	in-state	1.53	0.25	0.003*	8.48
		non-contiguous	-1.35	0.41	0.000*	
	non-contiguous	in-state	2.88	0.36	0.000*	3.95
		Contiguous	1.346	0.413	0.003*	

Note. *p < 0.05

Table 3. Analysis of Variance for High School Class Rank and Residence

Dependent variable	Groups	SS	df	MS	F	P	η2
	Between	10869.46	2	5434.73	5.19	0.006*	0.017
	Within	619085.18	591	1047.52			
	Total	629954.64	593				

Note. *p < 0.05

Table 4. Tukey HSD Post Hoc Results for Residence and High School Class Rank

Test	(I) State of Residence	(J) State of Residence	Mean differences (I-J)	SE	P	Cohen's d
	in-state	Contiguous	-10.39	3.55	0.010*	0.38
		non-contiguous	-8.71	5.06	0.198	
	contiguous	in-state	10.39	3.55	0.010*	1.81
		non-contiguous	1.68	5.80	0.955	
	non-contiguous	in-state	8.71	5.06	0.198	1.46
		Contiguous	-1.77	5.79	0.955	

Note. *p < 0.05

Table 5. Pre-collegiate Involvement in Extracurricular Activities

Organization	Frequency	Percent
Athletics	455	76.60
National Honor Society	298	50.17
Music	273	45.96
FFA	243	40.90
4-H	222	37.37
Faith/Religious-based	210	35.53
Student Government/Council	171	28.79
Drama/Speech	154	25.93
Newspaper/Yearbook	64	10.77
Boy's State/Girl's State	53	8.92
Academic Bowl	45	7.58
Scouts	43	7.23
FCCLA	30	5.05
FBLA/BPA	20	3.37
DECA	8	1.34

Pearson Chi-squared revealed significant differences in pre-collegiate extracurricular activities based on whether the student chose a major related to production agriculture. Students with production agriculture majors were significantly more likely to have been involved in athletics ($\chi^2(1,N=594) = 4.82$, $p=0.018$), student government ($\chi^2(1,N=594) = 4.86$, $p=0.017$), music ($\chi^2(1,N=594) = 5.75$, $p=0.010$), FFA ($\chi^2(1,N=594) = 44.74$, $p=0.000$) , and 4-H ($\chi^2(1,N=594) = 36.071$, $p=0.000$). While, students with majors not related to production agriculture were more likely to be involved in scouts ($\chi^2(1, N=594) = 7.33$, $p=0.006$). No significant differences based on college major were found in any of the other activities listed in table 5.

Summary

Higher education has faced new challenges with millennial students. Changing demographics and shifting higher education funding streams have caused institutions to examine recruitment strategies of in-state and out-of-state students to maintain enrollments and meet workforce demands. The results of this study indicated socio-demographic traits (i.e. type of residence and percent of family income derived from farm or agriculture business), academic preparation and pre-collegiate extra-curricular activities provided differences between in-state and out-of-state students. Therefore, as institutions create plans to recruit and retain millennial students, they should take into consideration socio-demographics, academic preparation and pre-collegiate experiences in their recruitment and retention plans of undergraduate students. Colleges of agriculture will no longer be effective approaching recruitment and retention with a one size fits all approach. If institutions review the WICHE reports by region intentional recruitment efforts need to take place to recruit high school graduates from the various regions.

As the student demographics continue to change and become more diverse, more effort will be needed to develop an inclusive college environment and curriculum. Colleges must be prepared for shifts in enrollment to majors that are more broad and diverse, especially beyond the traditional production-oriented majors. Production majors will see an increase of students who have little to no production background and, as such, colleges will need to re-evaluate both the curriculum as well as the appropriate instructional methods.

While these results are limited to the students who participated in this study, the process of learning more about pre-collegiate experiences in an effort to increase the effectiveness of recruitment is important. We recommend colleges conduct research to customize recruitment efforts and not rely solely on traditional recruitment efforts (i.e. FFA, agricultural educators, and extension professionals). For example, based on the findings of this study, effort should be made to differentiate recruitment efforts based on whether or not you're recruiting within or outside the state.

It is important to not make assumptions about backgrounds of students when planning visits and preparing printed materials. For example, talking about university opportunities, such as intramural sports and music opportunities could be just as important in helping prospective students feel that they "fit" at an institution as talking about departmental clubs and organizations.

A limitation of this study includes the data only being from one College of Agriculture and Life Sciences institution. The analysis of data offers significant insight for other intuitions who wish to focus on the changing demographics relating to socio-demographics, academic preparation and pre-collegiate experiences.

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