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Lonnie Hobbs, Jr.
Kansas State University, Manhattan, KS, lhobbs@ksu.edu

Zelia Z. Wiley
1Kansas State University, Manhattan, KS, zwiley@ksu.edu

Raymond Thomas
Kansas State University, Manhattan, KS

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ASSESSING THE SUCCESS OF THE 2020 KANSAS STATE RESEARCH AND EXTENSION SUMMER RESEARCH PROGRAM: A VIRTUAL RESEARCH EXPERIENCE

***Lonnie Hobbs, Jr.¹, **Zelia Z. Wiley¹, and Raymond Thomas¹**

¹Kansas State University, Manhattan, KS

***Email of lead author: lhobbs@ksu.edu; **Email of Corresponding author: zwiley@ksu.edu**

Abstract

Ethnic minorities, and specifically African American students are not participating in graduate programs at the same rate as non-minority students. In 2006, Kansas State University College of Agriculture Diversity Programs Office (DPO) established the Kansas State Research and Extension (KSRE) Summer Research Fellows Program to expose African American and other ethnic minority students to the agricultural sciences graduate research opportunities. Due to the Covid-19 pandemic, the 2020 KSRE Summer Research Fellows Program was held virtually to protect the health and safety of participants. The purpose of this study was to evaluate the effectiveness of the virtual program. Data from five 2020 participants were collected using a 5-point Likert scale assessment and analyzed as a case study and by descriptive statistics. As a result of this case study, participants successfully gained knowledge of graduate school and careers in agriculture. Findings will be utilized to further enhance student experience in the program.

Keywords: Ethnic Minority, African American, Virtual Programs, Graduate School Preparation, Summer Research Program

Introduction

The number of U.S. ethnic minority students pursuing higher education in agriculture has increased in recent years; however, ethnic minority students still represent less than 5% of the enrollment in agricultural programs of study (Food and Agricultural Education Information System [FAEIS], 2019). Ethnic minority is defined as a group or population whose ethnicity differs from the majority group (Bulmer, 1996; Berthoud et al., 1997). For the purpose of this research, ethnic minority groups are defined based on the Kansas State University Registrar classification, which includes American Indian/Alaska Native, Asian, Black/African American, Hawaiian/Other Pacific Islander, Hispanic/Latino, and Multiracial (Kansas State University Office of Institutional Research, 2021). The number of ethnic minority students in graduate programs is relatively lower when compared to non-minority groups (Okahana et al., 2020). In the 2019 survey of graduate enrollment and degrees conducted by the Council of Graduate Schools (CGS) and the Graduate Records Examinations (GRE) Board, only 24% of students enrolled in graduate programs were underrepresented minority students; 12.8% of which were Black/African American students (Okahana et al., 2020).

Another trend of significance is the level of participation by Black/African Americans in graduate programs and careers in agricultural sciences. Only 6.1% of graduate students enrolled in biological and agricultural sciences graduate programs in 2019 were African Americans (Okahana et al., 2020). The establishment of 1890 Land Grant Institutions, historically black colleges, and universities, through the Second Morrill Act aided in increasing the number of African Americans pursuing undergraduate degrees in agricultural sciences. Yet, the challenge is that few of these institutions offer a diverse selection of graduate level degrees in the agricultural sciences related

fields. Thus, to continue their education in agricultural sciences, some African American students often transition to 1862 Land Grant Institutions even though they may have preferred an 1890 institution.

Like the national trend, the percentage of ethnic minorities and African Americans at Kansas State University (KSU) is relatively small. In the Fall of 2020, only 13.6% of graduate students at KSU were from underrepresented minority ethnic groups (Kansas State University Office of Institutional Research, 2021). Regarding African Americans, only 4% of the graduate student population at KSU were African American. Compared to the university enrollment percentages, the College of Agriculture's graduate student population showed even smaller enrollment numbers for the underrepresented minority population. For example, only 6.6% of the graduate students in the College were underrepresented minority; with only 2.7% of the College graduate student population being African American. Research has shown that ethnic minorities have a misperception of agriculture resulting in them choosing other careers outside of the agricultural sciences. Thus, there is a need to increase the number of African Americans entering graduate programs, and more specifically in agriculture. However, the success of African American students in agricultural graduate programs depends on their ability to perform well in the realm of research and academics, as well as the guidance offered through mentorship and advising (Bagaka et al., 2015; Estrada et al., 2018). Therefore, exposure to research practices and mentorship is a critical part of the successes of African American students in agricultural graduate programs.

In 2020, due to the Covid-19 pandemic, many internship and research opportunities available to students were canceled due to health and safety concerns. Summer research programs provide opportunities for students to gain practical experience outside the classroom environment. This is particularly important for juniors and seniors who, in anticipation of graduation, are seeking research opportunities to find full time employment or graduate school to further their education. Rather than canceling the 2020 KSRE Summer Research Fellows Program, DPO continued the program in an online virtual format. Using Zoom and Microsoft Teams, the fellows participated in research with their mentors and took part in a series of academic and professional development seminars during the eight-week program. This allowed the students to gain experience when it came to the statistical analysis side of the research process. The objectives of this study were to: (1) examine if the 2020 student participants gained knowledge of graduate school and careers in agriculture, and (2) examine if students felt the program was beneficial.

Literature Review

Background

In many of the careers and graduate school opportunities in science, technology, engineering, and mathematics (STEM), students are expected to understand the concepts and application of research (Li, 2014, 2018; Li et al., 2020). Students are provided classroom knowledge about concepts and focus areas so they can achieve success once they enter the workplace or graduate school. However, they are expected to not only understand the concepts, but understand how to apply them to both research and practical situations once they graduate (Wu and Sankar, 2013). However, undergraduate students often find graduate school intimidating due to unfamiliarity with research applications and procedures. Thus, there has been a push to increase the number of research opportunities available to undergraduate students in the STEM areas (Pender et al., 2010;

Wayment and Dickson, 2008). Participation in undergraduate research experiences has been suggested to inspire students to pursue graduate degrees and careers in STEM areas (Russell et al., 2007). Yet, many students may not have the opportunity to pursue such research opportunities during the normal school year (August – May) due to their demanding class and work requirements (Knox et al., 2006). Thus, they are missing out on the benefits generated from undergraduate research opportunities.

Summer Research Programs

Summer research programs provide students the opportunity to gain research experience outside the normal school year. Students gain practical experience in their chosen area of study and gain skills that can be useful in furthering their education or pursuing a career (Hunter et al., 2007). Students also benefit through recognition for publishable research from the professional community in their fields of interest (Kremer and Bringle, 1990). Additionally, these programs serve as ways for universities to recruit prospective students into graduate programs. Faculty members benefit through assistance with research projects and the development of student-mentor relationships prior to student enrollment in graduate programs (Petrella and Jung, 2008). Therefore, students, faculty, and the university benefit from undergraduate research programs. Not only do they provide an additional recruitment avenue for graduate programs in agriculture, but they also offer an opportunity to assist African American students in bridging the gap between undergraduate and graduate programs, as well as assisting schools to diversify their student populations (Fechheimer et al., 2011; Knox et al., 2006).

Virtual Research Experience

Distance learning can provide an opportunity to further educate students in situations where health, safety, and distance are factors in developing and managing a program (Valentine, 2002). Thus, the effectiveness of distance learning has improved with its increased popularity over time (Dung, 2020). More specifically, virtual research experience (VRE) has been found to enrich all stages of the research experience. Virtual research experience provides access to data, tools, computational resources and collaborations which can lead to faster research results (Carusi and Reimer, 2010). Students can gain valuable research knowledge and skills through virtual research opportunities as a research-oriented environment can be established (Gordon and Edwards, 2012). However, there are special management challenges that can arise from a VRE such as internet connection issues, low student participation, and lack of inter-personal relations (Dung, 2020; Posey et al., 2010). Yet, these challenges may be alleviated by proactive planning and clear student expectations prior to program implementation (Gordon and Edwards, 2012). When combined with the theoretical model of experiential learning, this could allow for the effective implementation of learning programs even at a distance.

Summer Research Experience for Undergraduates

The Kansas State Research and Extension (KSRE) Summer Research Fellow Program was first implemented in the summer of 2006. KSRE Summer Research Fellow Program is an eight-week summer research experience where student participants are provided the opportunity to conduct hands-on research with a faculty mentor in the College of Agriculture at KSU. The program is managed collectively by program coordinators and the College's Diversity Program Office staff. Consistent with the goals of the DPO and KSRE, the summer research program's objectives include: (1) prepare students from underrepresented groups for the professionalism and

rigorous work of graduate programs in the agricultural science areas; (2) expose students to hands-on research in the agricultural sciences; and (3) assist students in developing research skills through introduction of analytical methods, reading academic journals, and improving writing skills. Further, this program provides participants access to College's faculty research mentors, encourages participants to pursue graduate education, and exposes participants to career opportunities in the agricultural sciences.

For the duration of the program, students are assigned a specific research project to complete. Program participants are required to complete a minimum of 35 hours of work per week with their faculty mentors and are compensated in the form of a stipend. Additionally, all participants receive housing, meals, and traveling assistance. Upon completion of the eight weeks, students give an oral PowerPoint presentation to the KSRE Summer Research Fellows Program coordinators, research mentors, the College's administrators, and KSRE leadership. The presentations allow students to showcase their project outcome, knowledge gained in research, and overall summer experience. Each student also submits a written abstract of their research to program coordinators for display on the DPO website.

In addition to research, the program curriculum encompasses several graduate school preparation and professional development seminars. Graduate school preparation seminars are held by representatives from the graduate school faculty at KSU to increase students' knowledge of how to successfully matriculate through graduate school. Graduate school seminar topics include graduate school applications, graduate school acceptance and attendance, financial support for graduate school, networking, and career development, communicating research to the public, and effective presentation skills. Concurrently, additional professional development information is provided to students by program coordinators and the DPO staff through presentations and reflective discussions.

2020 KSRE Summer Research Program

Due to the Covid-19 pandemic, the 2020 KSRE Summer Research Fellows Program was forced to operate remotely via Zoom and Microsoft Teams. The cohort utilized these platforms to work with mentors, participate in professional development seminars and collaborate with the DPO staff on completing their research projects. As a result of this, student participants did not have the physical capability to conduct their research in the lab/field with their mentors. Therefore, much of their research duties consisted of literature review, statistical analysis, and interpretation of results. In addition to conducting research, participants attended virtual webinars where they interacted with agricultural industry professionals related to their areas of study. The virtual webinar experiences were two-fold; the first series consisted of KSU faculty and staff led professional development seminars, and the second series was presented by corporate partners along with a panel presentation by KSRE Summer Research Fellows alumni. There were weekly group sessions and individual check-ins to support the fellows in this new virtual format.

Methodology

Theoretical Framework

The number of ethnic minorities who have completed doctorates and secured research positions in academia and industry is low compared to non-ethnic minorities (Tapia and Lanius, 2000). To understand the increase in the participation of ethnic minorities in this research, a model of

assumed relationships among knowledge, attitude, and behavior were employed (Swanson, 1972; Wiley et al., 1997). Researchers have noted that experiences in agricultural sciences leads to attitude and behavioral changes towards agricultural sciences (Wiley et al., 1997). According to Kolb's (1984) theory, experiential learning is described as the process in which knowledge is developed through hands-on experience. Practical hands-on experience gives students an opportunity to apply what they have learned in the classroom and receive feedback and ultimately learn by doing. The learning by doing approach has been found to be instrumental in providing students the opportunity to apply knowledge learned in the classroom setting to real world experiences (Cheek et al., 1994). However, these experiences must be properly structured to have an impact on students and increase students' knowledge of the subject matter. Thus, this study applies these theories to examine the virtual 2020 KSRE summer research program. Experiential learning has been found to be a key component of educational development in the agricultural education (Cheek et al., 1994). Thus, the KSRE summer research program is an educational tool to increase students' knowledge and attitude towards graduate school and careers in agriculture.

Data Collection

This quantitative study used a pretest-posttest quantitative design to examine the impact of the virtual KSRE Summer Research Fellows Program on participants from 1890 Land Grant Institutions. The target population for the program was African American undergraduate students from 1890 Land Grant Institutions. The 2020 KSRE cohort hosted a total of eight students, five from 1890 Land Grant Institutions two from 1862 Land Grant Institutions, and one from a private institution. However, for the purpose of this study, the researchers focused only on the students from the 1890 Land Grant Institutions for the analysis. Thus, the sample consisted of five (n=5) students from five different 1890 Land Grant Institutions. Given that the KSRE program usually consists of five to eight participants annually, and this study only examines the 2020 cohort, analyzing the 5 students sufficed for this study.

A twelve question five-point Likert scale survey was used in the pretest-posttest focused on understanding students' perceptions of the agricultural sciences, pursuing a graduate degree, and the importance of cultural competencies in both the academic and professional work environment. Question responses consisted of 1 indicating "strongly disagree", 2 indicating "disagree", 3 indicating "neutral", 4 indicating "agree", and 5 indicating "strongly agree." To manage the program, pretest-posttest and overall program evaluations were administered to the students to complete via online links using the Qualtrics system. Once the electronic surveys were completed, the Qualtrics program aggregated all survey responses on a question basis (e.g., all responses for question 1 were grouped together) and descriptive statistics were calculated and analyzed.

Data Analysis

The study used a combined method of case study and descriptive statistics. A case study is used to gain a deep and adaptable understanding of a complex issue in practical and true to life circumstances (Crowe et al., 2011). The descriptive statistics used included frequencies and means, and were used to summarize the data of pretest-posttest and overall program evaluations. The data were analyzed following the methods of Wiley and Hobbs, Jr. (2021). Thus, average responses were examined using the following ranges: 1.00-1.49=strongly disagree; 1.50-2.49=disagree; 2.50-3.49=neutral; 3.50-4.49=agree; and 4.50-5.0= strongly agree. For the pretest-posttest data, there were two variables of interest assessed to identify if students gained knowledge of graduate school and careers in agriculture: desired response and average change in mean from pre-test to

post-test. The desired response variable denotes the answer which the researchers would like the participants to select for each question. Desired responses are extreme values consisting of “1” (strongly disagree) or “5” (strongly agree) and serve as the base variables for the study. For example, question (6) in the instrument states “Attending graduate school is too expensive for me.” The desired response for this question is “1” indicating the students strongly disagree to this statement. By this response, the researchers can infer the student is more likely to attend graduate school given, they feel it is not too expensive.

The average change variable was calculated by taking the difference of the pretest and posttest means. The researchers analyzed the value and sign of the average change variable to assess if the participants gained knowledge and if the knowledge gained was in the direction of the desired outcome. First, the researchers examined if the average change variable is equal to zero. If not, this indicates a change in the response from pretest to posttest. Therefore, the researchers interpret this to signify the participants gained knowledge. Next, the sign of the average change variable is evaluated based on the desired response to identify if the means from pre-test to post-test increased or decreased in the direction of the desired response. As previously stated, the desired response variables consist of a “1” or “5.” Therefore, the preferred sign of the average change variable is positive for questions with desired response “5” indicating an increase from pretest to posttest response towards “strongly agree.” In contrast, a negative average change variable is preferred for questions with desired response “1” indicating a decrease in the average response towards “strongly disagree.” In the example above for question (6), the desired response is “1”, meaning the preferred sign of the average change variable is negative. If the average change is negative, this indicates the student selected an answer closer to “strongly disagree” on the posttest. Therefore, the researchers interpret this to signify that the program positively impacted the student’s perception of the cost of graduate school.

Results and Discussion

Demographics

Table 1 shows the cases, 1890 Land Grant Institutions, and their respective research areas. Case 1 was a female junior, Animal Science major from North Carolina A&T State University; her research area was in Animal Sciences and Industry. Case 2 was a female junior, Animal Science major from Prairie View A&M University; her research area was in Grain Sciences and Industry. Case 3 was a female, recent graduate, Animal Sciences major from Southern University and A&M College; her research area was in Grain Sciences and Industry. Case 4 was a female junior, Animal Sciences major from Tuskegee University; her research area was in Animal Sciences and Industry. Finally, Case 5 was a female junior, Food Sciences major from Virginia State University; her research area was Food Science and Industry. As noted earlier, all the cases from the 1890 Land Grant Institutions were females. This follows a similar trend for Land Grant Universities in general, as the number of women enrolled in undergraduate agricultural programs is greater than the number of men (United States Department of Agriculture, 2017; United States Department of Education, 2020). As a result of the gender enrollment trend in agriculture, the program had more women applicants and participants than men.

Table 1. 2020 Participating 1890 Land Grant Institutions and Research Areas

Cases	Institutions	Research Area
Case 1	North Carolina A&T State University	Animal Sciences and Industry
Case 2	Prairie View A&M University	Grain Sciences and Industry
Case 3	Southern University and A&M College	Grain Sciences and Industry
Case 4	Tuskegee University	Animal Sciences and Industry
Case 5	Virginia State University	Food Science and Industry

Pre-test Post-test Survey Questions

Table 2 shows results for KSRE pre- and post-test survey questions. The results show that average responses for all questions moved in the desired direction except questions 3 and 5. More specifically, average response of questions 1, 4, 6, 8, and 9, all decreased towards desired response “1.” This is displayed by the negative average change variable for each question. The researchers considered questions 1, 4, and 8 to indicate the program was successful in changing the student’s perceptions of careers in agriculture. Likewise, questions 6 and 9 indicate students’ knowledge and perception of graduate school changed after participating in the KSRE Summer Research Fellows Program. However, student responses to question 3 “after graduation, my primary focus will be to secure a job rather than applying to graduate programs” displayed a positive average change of 0.96, despite the desired response “1”; indicating that a negative average change variable was preferred. Similarly, question 7 “when I hear the words agricultural sciences I usually think of farms with crops and animals” also displayed a positive change variable despite the preferred negative average change. Although this differs from the desired outcome, the authors considered this to show participants successfully gained knowledge of careers in agriculture.

The average responses from questions 2, 10, 11, and 12 also indicates students’ gained knowledge of careers in agriculture. This is shown through the positive average change variable indicating the average response increased in the preferred direction towards desired response “5.” Surprisingly, question 5, “I know someone who has a career in agricultural sciences,” decreased in the opposite direction of the desired response. The average change for question 5 showed a -0.17. Questions 11 and 12 infer that the students understand cross cultural communication and cultural differences are needed to be successful for most careers in agricultural sciences. This is shown through the 0.8 and 0.25 average change increase in the mean for questions 11 and 12, respectively. Given the push for diversity, equity, and inclusion in the agricultural sciences, the survey instrument allowed the researchers to assess the benefits of the KSRE summer research program as it relates to students understanding of graduate school and careers in the agricultural sciences. More specifically, the researchers consider the pre- and post-test results to indicate that the overall 2020 program was successful in changing the students’ perceptions of graduate school and careers in agricultural sciences.

Table 2. 2020 Pre-test Post-test Results

Question	Pre-test mean	Post-test mean	Avg. Change	Desired response
1. I know very little about careers in or opportunities resulting from a graduated degree in agricultural sciences.	2.33	1.50	-0.83	1.00
2. Most careers in the agricultural sciences require a graduate degree.	2.00	2.13	0.13	5.00
3. After graduation, my primary focus will be to secure a job rather than applying to graduate programs.	1.17	2.13	0.96	1.00
4. Growing up on a farm is necessary for a career in the agricultural sciences.	1.67	1.00	-0.67	1.00
5. I know someone who has a career in the agricultural sciences.	3.67	3.50	-0.17	5.00
6. Attending graduate school is too expensive for me.	2.67	2.00	-0.67	1.00
7. When I hear the words "agricultural sciences", I usually think of farms with crops and animals.	2.67	2.86	0.22	1.00
8. When I hear the words "agricultural sciences", I seldom think of laboratories with testing equipment.	2.50	2.00	-0.50	1.00
9. The coursework and expectations in graduate school are too difficult to handle.	2.00	1.50	-0.50	1.00

Table 2. Continued

Question	Pre-test mean	Post-test mean	Avg. Change	Desired response
10. Our world is very dependent on people who work in the agricultural sciences.	4.67	4.86	0.19	5.00
11. Cross cultural communication is needed for careers in the agricultural sciences.	3.83	4.63	0.80	5.00
12. Understanding racial and cultural differences is needed to be successful in the agricultural sciences.	4.50	4.75	0.25	5.00

Table 3 displays the program evaluation results. The students provided favorable responses to the program evaluation, indicating they were satisfied with the KSRE program. For instance, students strongly agreed (question means 4.5-5.0) that the program gave them some ideas to think about, was worth their time, and they learned something they can use. Additionally, the cohort strongly agreed that their mentor was knowledgeable about his or her research; also, they strongly agreed that their program coordinators and mentors were helpful. All respondents strongly agreed that the program helped them get closer to their future goals as reflect by the mean value of 5. However, the students gave the lowest rating (3.75) to “the location was enjoyable” question. This could likely be due to the online nature of the program lacking in-person aspects that could have made assistance more accessible. Despite this, they students strongly agreed that the learning environment was inclusive and friendly.

Table 3. 2020 Program Evaluation Results

Question	Mean
Was well organized	4.13
Gave me some ideas to think about	4.88
The accommodations (i.e., online technical support) were satisfactory	4.25
Mentor was knowledgeable of his/her research	4.88
Was worth my time	4.88
I learned something I can use	5.00
The location was enjoyable	3.75
The program coordinators and mentors were helpful	4.88
Helped me get closer to my future goals	5.00
Provided opportunities that were enjoyable	4.75

Table 3. Continued

Question	Mean
Made me aware of what K-State college of ag has to offer	4.75
My learning environment was inclusive and friendly	4.75
The online platform was inclusive and easy to navigate	4.38
The research project what you expected?	4.13

The pretest and posttest results suggest that the 2020 KSRE program was successful at impacting students' perspectives about opportunities in the agricultural sciences, and the feasibility of graduate school despite its virtual status. This is displayed through the change in post-test means towards the desired response. Furthermore, the program evaluations infer the students were satisfied with the program and they felt the program provided them benefit as it relates to their future goals. Thus, overall, the researchers consider the program a success, and should be continued in the future.

Conclusion

In 2020, KSRE Summer Research Fellows Program was the only research undergraduate program at Kansas State University (KSU) to be held during the summer. Through the efforts of the Diversity Programs Office (DPO) in the College of Agriculture and KSRE, the program was able to operate remotely allowing student participants to gain research experience in their selected fields. The objectives of the study were to examine if the 2020 student participants gained knowledge of graduate school careers in agriculture and examine if students felt the program was beneficial. The pre-test and post-test survey results show the virtual program impacted positively student's perceptions on the agriculture sciences, pursuing graduate level degrees, and the importance of cultural competencies in an academic or professional environment. This is evidenced by the average response between pre-test and post-test for majority of questions moving in the direction of the desired response. Further, program evaluation results indicated that the students were satisfied with their experiences as they felt the program was beneficial and helped them get closer to their future goals. The success of the 2020 program shows that despite challenges such as those associated with the pandemic, it is still possible to plan and implement an effective summer research program in a virtual setting.

Information collected from this study will be used by the College's DPO to improve program planning for enhanced student experience. Also, the information will be employed to expose African American and other ethnic minority students from 1890 Land Grant Institutions to the academic rigors and opportunities of graduate school and to careers in the agricultural sciences. The results of the study will be used as a standard to evaluate the success of future summer research programs. DPO plans to continue the partnership with the KSU graduate school, KSRE, and corporate partners to aid African American students in a successful transition from their undergraduate experience to graduate school and careers in the agricultural sciences.

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