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Editorial: Dear Readers

Laura Levi Altstaedter, *Executive Editor, TPRE*

This is our third year publishing *Theory & Practice in Rural Education*. Our editorial leadership is honored to work with our authors, reviewers, and you, our readers, in fulfilling our mission to disseminate high-quality articles addressing theoretical, empirical, and practice-related issues in Rural Education.

In this issue, our authors explore timely topics across the rural education continuum. Our authors in the Research Forum report on studies carried out both in K-12 and higher education contexts, focused on the following areas: the relationship between high school sports participation and academic achievement, predictors for college enrollment and STEM major choice among rural students, rural teachers' perceptions of technology effectiveness and integration, the relationship between definitions of *rural* and university student success outcomes, and how prepared college students' were for the pivot to online learning during the COVID-19 pandemic. Our authors in the Practice Forum explore the following themes, within both K-12 and higher education contexts: lessons learned from the implementation of an alternative pathway to a teaching program, implementation of a professional development model for rural STEM teachers, and implementation of conspicuous collaboration in educator preparation programs. This issue also includes a book review on one of the field's first texts in rural teacher education.

TPRE is hosted by ECU Library Services and its publication is currently supported through East Carolina University's Rural Education Institute. All manuscripts submitted to TPRE undergo a double-blind review process, which involves the coordinated efforts of the staff, including the Journal's Executive Editor, Managing Editor, Assistant Managing Editors, Associate Editors, and Reviewers.

The following people and their continuous support for TPRE have contributed to the publication of this issue: Dr. Kristen Cuthrell, Director of East Carolina University's Rural Education Institute; Dr. Jan Lewis, Director J. Y. Joyner Library; Dr. Diane Kester, Managing Editor; Dr. Robert Quinn, Associate Editor for the Research Forum; Dr. Martin Reardon, Associate Editor for the Practice Forum; Dr. Irina Swain, Associate Editor for Digital Projects; Ms. Hannah Shano, Assistant Managing Editor; Ms. Marisa Faulkner, Assistant Managing Editor; Joseph Thomas, Assistant Director for Collections and Scholarly Communication, Joyner Library; and John McLeod, Director of the UNC Press Office of Scholarly Publishing Services. We are especially grateful for the reviewers on our editorial board and the authors who contributed their work to this issue.

We are currently considering manuscripts for our next general issue, which we publish every Spring, and our exciting guest-edited special issues on *Equity, Inclusion, and Diversity in Rural Schools and Communities* (forthcoming in Fall 2021) and *Rural STEM Education* (forthcoming in Fall 2022). We invite scholars and practitioners in the field of Rural Education to contribute their work for the Research Forum, the Practice Forum, the Digital Projects Forum, or the Book Reviews Forum. Manuscripts for our general issues are typically due in the fall with publication dates expected in May. Manuscripts for our special issues are typically due in late winter with publication dates expected during the fall.

If you are interested in becoming a peer reviewer, please go to the journal's website (http://tpre.ecu.edu) to register. Edit your profile and navigate to the tab "Roles" where you may select "Reviewer" and submit your interests concerning rural education.

Laura Levi Altstaedter, PhD; Executive Editor

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Student Preparedness for Emergency Remote Learning

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The recent worldwide pandemic, COVID-19, pushed students of all ages to remote learning in a matter of days. This abrupt change in the mode of delivery of instruction affected students differently. The researchers share findings of a study conducted among university preservice education students from Texas and Ohio concerning students' preparedness for this drastic change. The study sought to identify and document recurring themes about the students' experiences of remote learning and to determine how significantly socioeconomic status (SES), sociocultural values (SCV), and socioemotional learning (SEL) aspects impacted students' transition to remote learning at these universities. Implications for university instructors and ways to improve educational experiences during such unprecedented times are discussed.

***Keywords*: emergency remote learning, socioemotional learning, socioeconomic status, sociocultural values, Change Management Model, rural education, rural students**

"Education is what remains after one has forgotten what one has learned in school."
Albert Einstein

The COVID-19 pandemic first became known as a potential major health risk in the fall months of 2019. It was not until the midwinter months of 2020 that the full potential of what this virus could do as far as loss of life worldwide was fully known. In attempts to get ahead of the curve and slow the spread of the virus, many countries worldwide imposed mandatory shutdowns of places of business where virus spread was most likely to occur. All personal grooming, gyms, workout centers, dine-in eating, and other non-essential businesses were shuttered. Schools were included in this lockdown approach to control the virus spread. This drastic halt meant that nearly 264 million school-age children (Global Education Monitoring Report Team, 2017) across the globe were not in school. Instead, many of these P-12 students received online learning opportunities.

The next level of lockdown came to colleges and university campuses around the world. Students in institutions of higher education (IHE), both public and private, were sent home, encouraged to stay away from campus, and were pushed to online learning. This rapid emergency pivot to online learning (Casey, 2020) would not happen without student and faculty issues. Issues of disparity of resources, mental health problems, and the frustration and unpreparedness of the overnight move from face-to-face (F2F) learning to virtual learning were experienced by many (Casey, 2020; Hodges et al., 2020; Hussein et al., 2020; Mishra et al., 2020).

In recent months, much focus has been on emergency remote learning (ERL) and its effects on different populations (Adnan & Anwar, 2020; Aguilera-Hermida, 2020; Arrington, 2020; Casey, 2020, Hodges et al., 2020; Rapanta et al., 2020). The purpose of this mixed-method study was to identify and document recurring themes about the experiences of what has come to be known as "emergency remote teaching (ERT)" (Hodges et al., 2020, p. 2) among undergraduate students who attend two Schools of Education in either a historically black college or university (HBCU) or a predominantly white institution (PWI) in Texas or Ohio, respectively. The study focused on the socioemotional, socioeconomic, and sociocultural impact on students' preparedness to meet the demands of ERL.

Conceptual Framework

The undergirding or theoretical framework for this study can be found in Lewin's (1947) Change Management Model. His model is known as Unfreeze – Change – Refreeze, a three-step process of change. Burnes (2020) investigated and referred to Lewin's work as a "robust approach to understanding the complexity of human behavior and how it can be changed" (p. 52). As one of the foremost psychologists of his day, Lewin is best known for this three-step model of change. The first phase of change, unfreezing, entails preparing the organization to embrace the change, understanding that the existing status quo cannot continue. The second phase, change, comes after the uneasiness generated in the unfreeze stage and involves the people in the organization identifying new ways to do things. In this phase, people begin to embrace the change and make changes to support the new direction. In phase two, it is here that people within the organization need to know how the change will favor them personally for the change to be successful. Time and communication, and the need to feel highly connected, are critical to the changes happening effectively (Mind Tools Content Team, 2020). Finally, in the third phase, refreeze, the organization adopts the change. During the refreezing phase the initiators of change can remodel or reshape what they need to change, so it takes on a new form. What is refrozen should not be identical to what was unfrozen. It should take on a much better form. The new form can include a cultural shift as well as leadership that will support the changes. The refreezing also ensures the change is permanent.

When considering this theoretical framework in light of the recent pandemic, COVID-19, it is easy to see the parallels. Never before had any major catastrophe caused such worldwide disruption to the education system as the recent pandemic. COVID-19, within days, brought a screeching halt to P-20 face-to-face (F2F) instruction across the globe. This disruption came for many reasons that included federal and state lockdown, fear, necessity, and possibly the most significant reason, the uncertainty of what real force the virus might have on the world's population. Lewin's (1947) first step of unfreezing happened when suddenly, across the globe, nearly 264 million (Global Education Monitoring Report Team, 2017) school-aged children were closed out of school buildings and forced to school using online platforms. Subsequently, in the United States alone, nearly 20 million students enrolled in colleges and universities across the country also found themselves receiving all coursework via the internet or other online means. The unknown of COVID-19 precipitated what Lewin describes in detail as the "fluidity necessary for change" (Lewin, 1943, p. 559) to ERL.

Considering Lewin's (1947) second phase in light of COVID-19, the change occurred seemingly overnight when most public schools for children and institutions of higher education (IHEs) globally opted to cancel all F2F classes, including labs, internships, and field experiences. This major shift to ERL was brought about because "the forces pressing for change are greater than those resisting change" (Burnes, 2020, p. 50).

The third phase, the freezing process, depicts the changes necessary "to bring about the permanence of the new situation" (Lewin, 1943, p. 559). Little did IHEs, particularly, realize how COVID-19 would affect the learning process; many saw the shift to ERL as a short-term arrangement to get past COVID-19. At the time, no one would have believed ERL would have continued through the summer and even into the fall semester of 2020. As a result, the freezing process began to push IHEs to provide professional development to tackle

ERL demands. Several IHEs actually canceled classes entirely for a week or so in order for professors to make the rapid pivot to remote teaching. Most professors were not prepared for the drastic change in teaching format from F2F to remote teaching (Arrington, 2020; Casey, 2020). Essentially, COVID-19 caused a rapid pivot to alternative instructional methods [unfreezing of the way we typically did things], that led to changes in the ways instructors taught and students learned [change here is not seen as an event, but rather, a dynamic process as a break in continuity], to finally a paradigm shift that was inevitable for integrating technology in our teaching-learning process. This shift enables us to teach students with the methods in which they would not only feel comfortable, but also, they can match the demands of the 21st century [refreezing of a new way - not merely going back to the old way when COVID is over] (Mishra et al., 2020).

Literature Review

IHEs located in rural America were particularly faced with unique challenges transitioning to the remote offering of courses this past spring. In the report prepared by the Alliance for Research on Regional Colleges, the researchers found that rural public colleges:

- are underfunded, relative to other public colleges,
- are essential partners in building public health infrastructure,
- provide an access point for educational opportunities in rural communities, and
- need more financial support to serve their communities through COVID-19 and beyond (McClure et al., 2021).

The first and the last findings are important as they address the fundamental purpose of this study. The needs of college students in rural institutions vary. Whereas faculty may ask themselves, what are our students learning, and most college and university instructors focus on student learning outcomes (SLOs) and less on their experiences as they matriculate through the program, most faculty in rural institutions also consider external factors that impact student learning. The abrupt presence of COVID-19 and the sudden requirement to change business as usual prompted faculty in rural IHEs to consider not only the content and presentation of content to students but also the context in which students ultimately acquire knowledge and skills. An important factor is students' preparedness and experiences of actually navigating the higher education system without always relying on faculty intervention. Two things are evident: the critical role of the student-faculty meeting in person and the lack of faculty and students' preparedness for the sudden shift to remote engagement. In retrospect, reflecting on an unusual spring semester, this study in remote learning was geared to evaluate the impact of this mode of instruction on teacher education students.

While education shifted in response to COVID-19, many IHEs were grappling with ERL that could afford students an educational experience worth their money. Besides, there was a need to understand the educational experiences of students living in rural areas of their respective state, who, in light of existing educational inequities, were seen to be further exposed to inequitable access due to limited resources or disproportionate distribution of resources to rural communities. Anticipating an increasing likelihood that remote learning will continue into the future, it is vital that IHEs, and policymakers, understand and account for the disparities in students' home learning environments that make meaningful participation in online learning more challenging.

The conversation to date on disparities in remote learning environments has been incomplete. It narrowly focuses on access to the internet and technology and often leaves out multiple other factors that can impact remote learning. Spievack and Gallagher (2020) highlight some of the factors that impact school-age students:

- Linguistically isolated students may need additional language support to complete their classwork and may struggle if their parents or guardians do not speak sufficient English;
- Living in crowded conditions can make it hard to focus on schoolwork, a challenge

exacerbated when more family members are at home;
- Students without access to a computer or internet may be unable to sign into online classes and complete their assignments;
- If no adult in the household has completed a high school education, students with more advanced schoolwork may not have access to the help they need;
- Students with disabilities may lose access to critical supports they received at school when learning at home;
- Students living in poverty are more likely to lack educational and other resources that support learning at home and face stressors that make remote learning more difficult.

Given the wide variety of methods, practices, and tools associated with online teaching and learning, applications and approaches vary significantly within and across K-12 and higher educational settings (Dixson, 2010). Every pedagogical situation reflects different student experiences and instructional needs; online teaching across these varied settings must address the particulars of each educational context (Aguliera & Nightengale-Lee, 2020).

The current study looked at some of these same issues focusing on the effect of socioeconomic (SES), sociocultural (SCV), and socio-emotional learning (SEL) needs and their impact on students' preparedness to meet the demand of online/virtual learning in two baccalaureate programs. We approached this study from the perspective of Change Management Theory.

Many of the graduate-level programs have online course offerings that students can choose to take. Most of the undergraduate programs are F2F. However, in situations such as these where the current pandemic has necessitated online and virtual courses, it is essential to determine student preparedness and needs. Given that there is limited information about student needs and options for success, we must get this information straight from the students instead of speculating on student experiences.

Struggles with Engagement

This overnight pivot from F2F to online teaching and learning created stress in ways not previously fully known when students are on campus or commuting to attend classes. Most professors understand the need to engage students in various ways and not merely lecture the entire class period. However, engaging students and maintaining their focus during ERL have issues that differ from those in F2F teaching.

No Need to Prepare for Class

Turner et al. (2020) discovered the lack of transition students faced as they often woke up and connected with a Zoom class. This lack of transition time meant students were not fully prepared, either physically or mentally, since some students reported attending class in their pajamas, merely moving from bed to desk, and not having the drive-time to class, all of which impacted students' ability to adjust their mental and psychological state.

Staying Focused During Class

Several studies (Hussein et al., 2020; Mollenkopf & Gaskill, 2020; Turner et al., 2020) documented the struggles students faced when "attending" class virtually from home. Students, both traditional and non-traditional, reported they not only had to attempt to focus on their own studies, but also care for children now at home learning online, care for elderly parents, some of whom were even sick with COVID-19, and juggle home chores – not ever visible while attending class F2F.

None of the distractions noted above even accounted for the environmental changes students faced. Students now met with challenges like the ever-present roommate or girl/boyfriend, no real study space like the dorm or campus library offered, and disruptions like pets and other family members simply going about life, to name a few (Mollenkopf & Gaskill, 2020; Turner et al., 2020). In different ways, employment became a distraction since the students' schedules had changed, and economic hardships became a reality with other family members out of work (Mollenkopf & Gaskill, 2020).

For some students, paying attention is difficult at best in any situation, but the pivot to emergency online teaching and learning created even more challenges. As Turner et al. (2020) expressed, “The front stage of the classroom collided with the backstage of people’s homes. The students and the faculty had a view into each other’s worlds” (p. 86). This *virtual window* allowed students and faculty to see areas of each other’s lives never before seen. People’s animals, children, and other distractions made focusing on the class demands that much more difficult (Hussein et al., 2020).

Student Mental Health

The argument that this emergency pivot to online learning would affect both professors and students is easily made with the literature (Adnan & Anwar, 2020; Chandler et al., 2020; Hussein et al., 2020; Mishra et al., 2020; Rapanta et al., 2020; Turner et al., 2020). An area not so understood is student mental health during and after emergency remote teaching and learning. Universities certainly understand that students often struggle with mental health issues, hence providing counseling services, hotlines to address violence and suicidal issues, success coaches, advisors, and other student service supports.

Emergency remote learning isolated students from many of those services and further compounded mental health issues. Son et al. (2020) found that participants expressed the following concerns that affected physical and emotional health, based upon a scale of mild to severe:

- Concerns for health – 91%
- Difficulty concentrating – 89%
- Disruption in sleep patterns – 86%
- Disruption in eating habits – 70%
- Increased social isolation – 86%
- Depressive thoughts – 44%

Aguilera-Hermida (2020), Mishra et al. (2020), and Hussein et al. (2020) further documented students’ concerns for their own mental health during remote learning while dealing with COVID-19. Turner et al. (2020) suggested that a possible way to ameliorate students’ mental health concerns was to provide various levels of social presence: attentional, budgeted, entitled, competitive, and invitational. Connecting students with professors and connecting students with students are vital for all parties.

In summary, many of the challenges students faced during the transition to ERL were compounded by fear of the pandemic as well as other environmental factors. This study went beyond what is typically associated with challenges of online learning to assess students' perceptions and experiences when the shift to remote learning was sudden and mandatory.

Methodology

This study used a mixed-methods approach where the researchers gathered quantitative data on students’ demographics, students’ knowledge and skills of navigating their learning management systems, equipment types, and overall students’ experiences. The researchers gathered qualitative data on students’ perceptions of online or hybrid instruction. Qualitative research methods were used to understand some social phenomena from the perspectives of those involved while contextualizing issues in their particular socio-cultural-economic milieu and sometimes to transform or change social conditions (Glesne, 2006).

A multi-site interpretive case study methodology was used to investigate the sudden transition to remote learning, a phenomenon that has impacted America today. IHE students’ lived experiences as they ended F2F learning was important in understanding some of the challenges and successes they encountered along the way. Furthermore, the researchers obtained, from the students, recommendations for instructors on strategies that can increase student chances of success in an online course. These recommendations were compared to the recommendation in the literature on best pedagogy practices for remote learning.

Research Questions

1. How prepared are undergraduate students for remote learning?

2. How is students' preparedness for remote learning linked to technology access and skills?
3. What are students' perceptions of the impact of remote learning on their academic performance?
4. What are some recommended strategies that could support student success?

Profile of Participants

The researchers used purposeful (convenient) sampling (Elfil & Negida, 2017). A multiple-choice and open-ended questionnaire was distributed online to 106 education majors taking remote classes. A total of 83 (78.3%) responded. The survey was conducted between March 25 and August 30, 2020, after the students had weeks of emergency remote learning using synchronous systems options implemented via Zoom and Adobe Connect video conferencing and online meetings. The profile of the participants is outlined in Table 1. A large proportion of the participants, 91.6% (n = 76), were female. Most of the participants, 83.1% (n = 69), were in the 18-24-year-old age group. A total of 97.6% (n = 81) of the participants were juniors (54.2%, n = 45) and seniors (43.3%, n = 36) at their institution. More than half of the respondents were African American (60.2%, n = 50).

Table 1
Profile of Participants

Characteristic	n	%
Gender		
Female	76	91.6
Male	7	8.4
Total	83	100.0
Age		
17 years or younger	1	1.2
18-24 years	69	83.1
25-34 years	9	10.8
35-44 years	2	2.4
45 years and older	2	2.4
Total	83	100.0
Classification		
Sophomore	2	2.4
Junior	45	54.2
Senior	36	43.4
Total	83	100.0
Race/Ethnicity		
African American	50	60.2
Caucasian	25	30.1
Hispanic	8	9.6
Total	83	100.0
Institution Type		
HBCU	58	69.9
PWI	25	30.1
Total	83	100.0

Data Analysis

The researchers used a frequency distribution data analysis technique, which allowed the researchers to get the big picture of the data. The researchers were able to see how frequently specific items were selected and the percentages for the same variable from the frequency distribution. The frequency distribution data were then presented as *Bar graphs*.

Table 2

Quantitative Results

Item	n	%
6. What type of technology do you use for virtual/online learning?		
Desktop computer	3	3.6
iPad	10	12.0
Laptop	65	78.3
Phone	5	6.0
7. How would you describe your transition to virtual or online learning?		
Extremely Difficult	6	7.2
Moderately Difficult	33	39.8
Moderately Simple	32	38.6
Simple	12	14.5
8. How would you describe your knowledge and skill level when navigating Canvas/eCourses/ Blackboard?		
Advanced	13	15.7
Proficient	48	57.8
Basic	21	25.3
I have never used any	1	1.2
9. After transitioning to virtual/online course offering, what was the most difficult for you?		
Assignments	21	25.3
Communication	28	33.7
Instruction	32	38.6
I did not transition to virtual/online	2	2.4
10. After transitioning to virtual/online course offering, what was the most difficult for you?		
Accessing Course Resources	41	49.4
Accessing Faculty	32	38.6
Accessing Technology	10	12.0
11. Select the top three challenging aspects of virtual/online learning.		
Using Zoom	28	11.25
Collaborating with peers	64	25.70
Managing time	59	23.69
Distractions	56	22.49
Access (Wi-Fi, Electricity)	42	16.47
12. Which of the following choices would you prefer?		
Fully Online with added Assignments	13	15.7
Fully Online with no added Assignments	21	25.3
Virtual Meetings with Added Assignments	20	24.1
Virtual Meetings with No Added Assignments	29	34.9

Qualitative data analysis involved coding, theme development, and thematic analysis. Open coding was used, which involved breaking down, examining, conceptualizing, and categorizing data (Strauss & Corbin, 1990). After the initial open coding, axial coding was used. Axial coding consists of linking subcategories to other categories in a relational manner, denoting phenomenon, context, intervening conditions, and consequences (Strauss & Corbin, 1990).

Finally, a thematic analysis approach (Hess-Biber & Leavy, 2004) was utilized to infuse both coding methods to establish underlying themes and descriptive analysis to interpret individual experience to gain insight into the students' experience (Sande, 2013). Using this approach, the researchers interpreted the data, trussing the findings to current literature and the conceptual framework.

Results

This mixed-methods multi-site interpretive case study provides results from both quantitative and qualitative perspectives. As important as the quantitative data is for future practice and remote learning development opportunities, understanding students' lived experiences now offers insight that humanizes this rapid pivot to online learning.

First, quantitative results are offered that give survey results from both institutions. Then, qualitative data are presented that offer discussion of recurring themes. These data postulate student preparedness for remote learning.

Quantitative Results

The results of specific survey items are presented in Table 2, followed by a discussion of each item.

Access and Use of Technology

Item 6: What type of technology do you use for virtual/online learning? A large proportion of the participants (78.3%, n = 65) used a laptop for virtual/online learning, while some of the remaining participants used a desktop computer (3.6%, n = 3) or an iPad (12.0%, n = 10; see Figure 1). A small proportion of the participants (6.0%, n = 5) used a phone for virtual/online learning.

Figure 1

Item 6: What type of technology do you use for virtual/online learning?

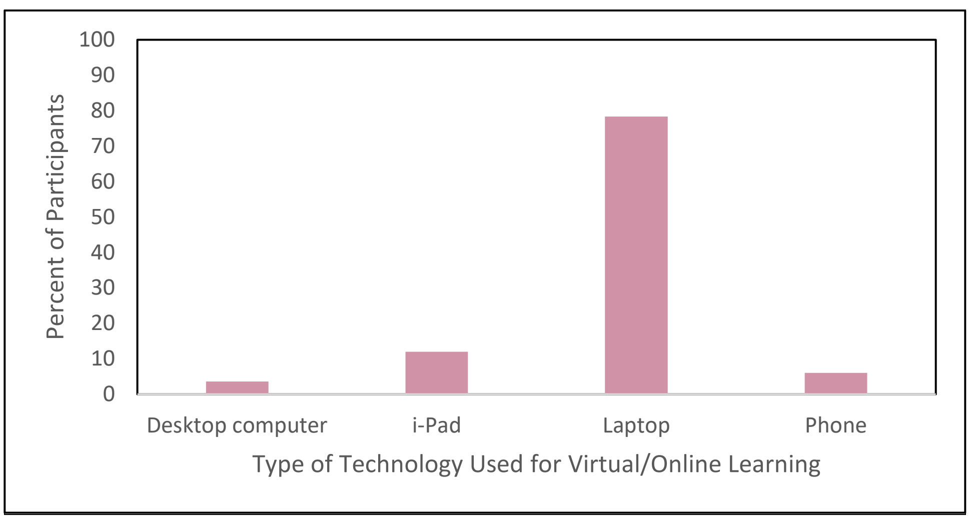
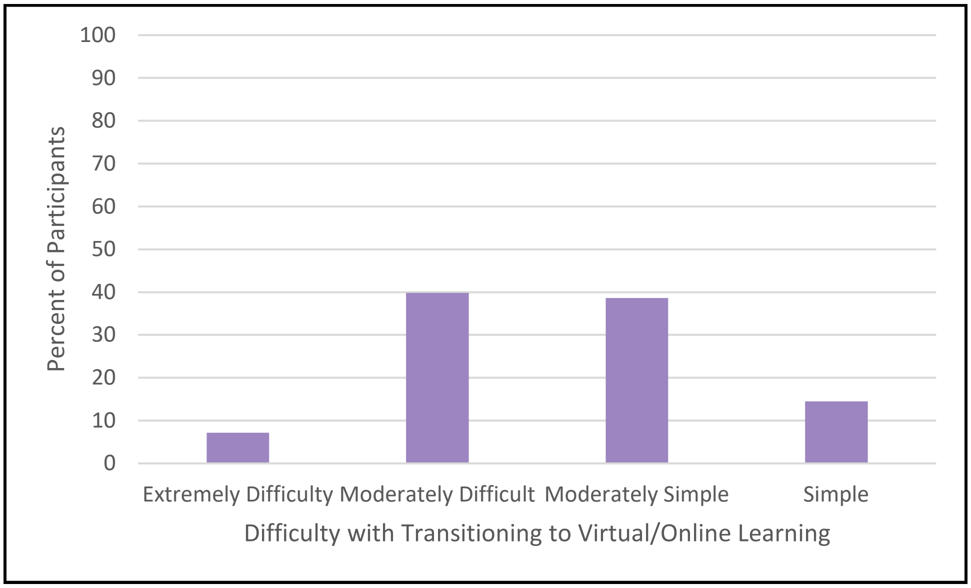


Figure 2

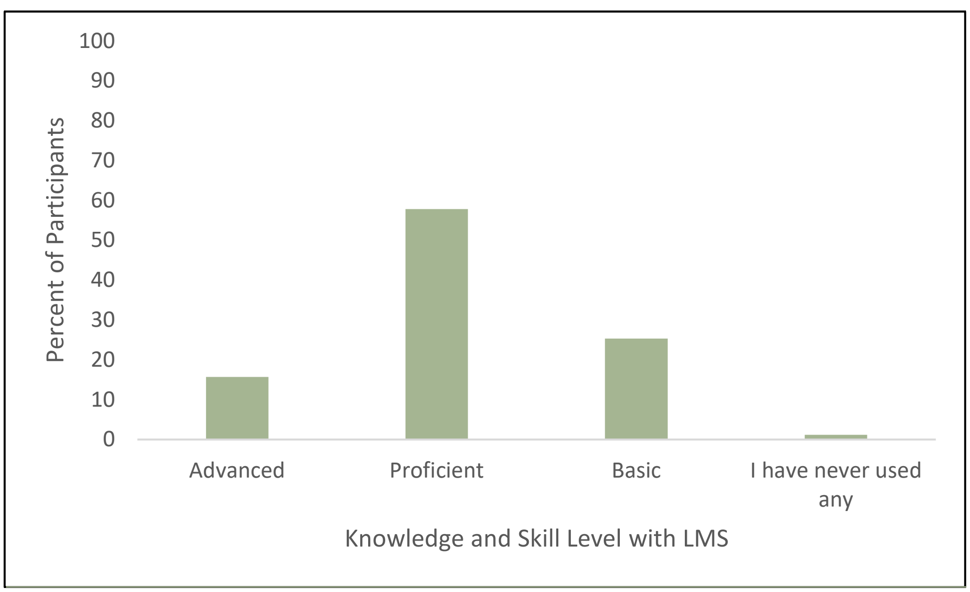
Item 7: How would you describe your transition to virtual or online learning?



Item 7: How would you describe your transition to virtual or online learning? Just under half of the participants (47.0%, n = 39) reported difficulty with transitioning to virtual/online learning, and just over half of the participants (53.0%, n = 44) reported that the transition was simple (see Figure 2).

Figure 3

Item 8: How would you describe your knowledge and skill level when navigating Canvas/ecourses[1]/Blackboard?



1*eCourses is a Moodle learning management system.

Item 8: How would you describe your knowledge and skill level when navigating Canvas/ecourses/Blackboard? Nearly three-quarters of the participants (73.5%, n = 61) reported being advanced or proficient in knowledge and skill level when navigating their learning management system (LMS; see Figure 3). In comparison, 26.5% (n = 22) of the participants reported a "Basic" or "I have never used any" knowledge and skill level.

Difficulties after Transitioning to Virtual/Online Learning

Item 9: After transitioning to virtual/online course offering, what was the most difficult for you? A total of 25.3% (n = 21) of the participants reported difficulty with assignments, 33.7% (n = 28) of the participants reported difficulty with communication, and 38.6% (n = 32) of the participants reported difficulty with instruction. The remaining 2.4% (n = 2) of the participants did not transition to online learning (see Figure 4).

Item 10: After transitioning to virtual/online course offering, what was the most difficult for you? Most participants (49.4%, n = 41) reported difficulty accessing course resources (see Figure 5). The remaining participants reported difficulty with accessing faculty (38.6%, n = 32) and accessing technology (12.0%, n = 10).

Students' Preference

Item 12: Which of the following choices would you prefer? Even though most participants (34.9%, n =29) would have preferred virtual meetings with no added assignments over the other options provided, other participants preferred fully online with added assignments (15.7%, n = 13), fully online with no added assignments (25.3%, n = 21) or virtual meetings with added assignments (24.1%, n = 20; see Figure 6).

Figure 4

Item 9: After transitioning to virtual/online course offering, what was the most difficult for you?

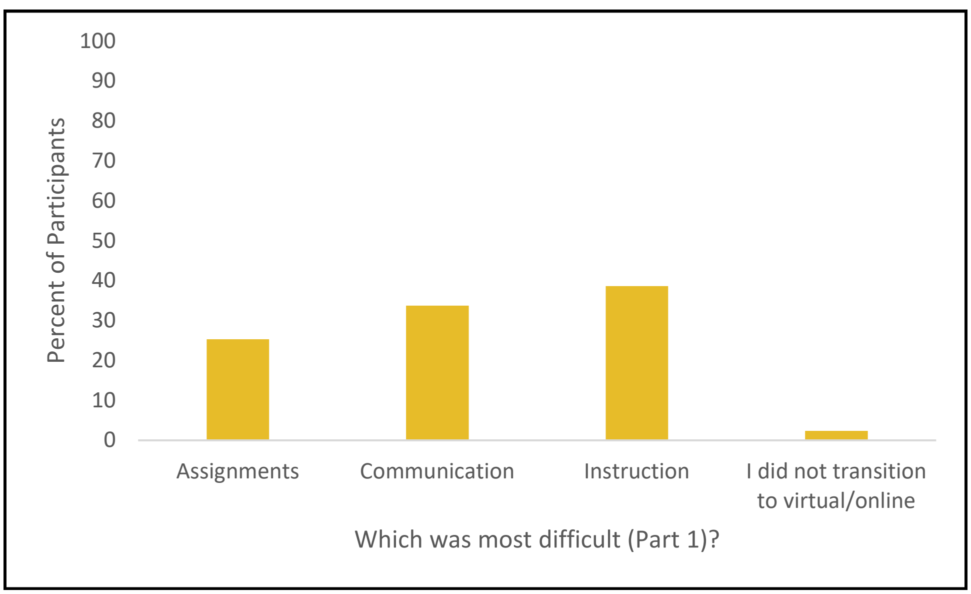
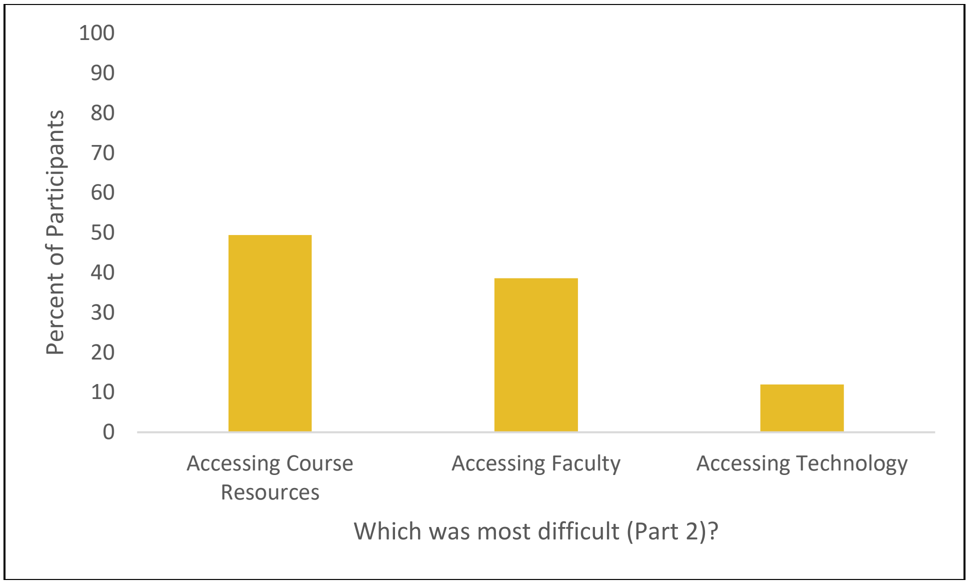


Figure 5

Item 10: After transitioning to virtual/online course offering, what was the most difficult for you?



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Student Ratings on Areas of Need

For Items 13 and 14, students ranked what they considered an immediate need to be successful and then responded to open-ended questions about their learning experience using remote methods. In Table 3, we see that most students ranked communication as their number one area of immediate need (40.91%) whereas, 33.33% ranked it as their second area of need. Students ranked engaging in research and project activities as their least area of need. It seemed students were comfortable conducting their own research and working on projects in remote settings.

Figure 6

Item 12: Which of the following choices would you prefer?

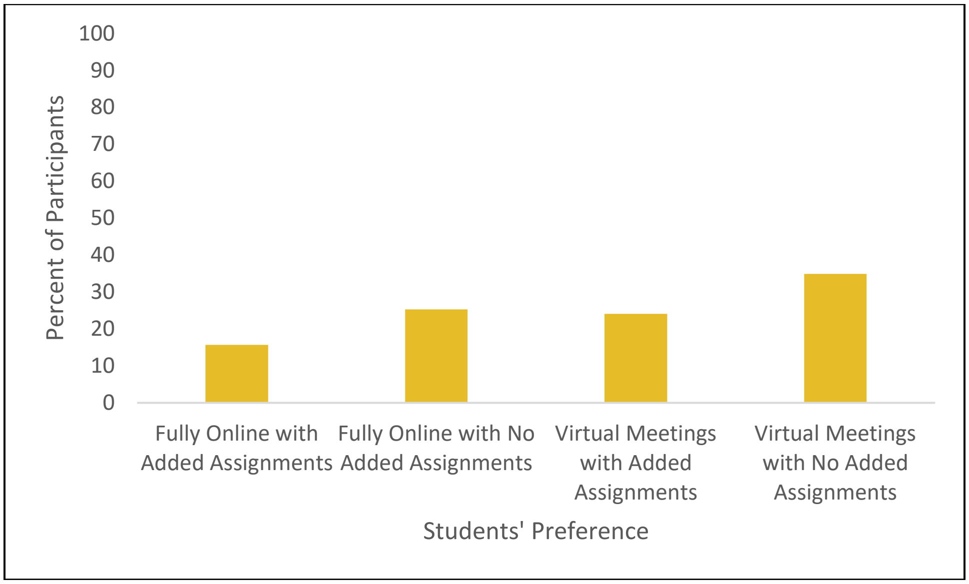

Table 3

Q13 - Moving forward, what would be your immediate need in order to be successful in an online platform? Rank the following in order of importance.

#	Question 13	% Ranking 1		% 2		% 3		% 4		% 5		% 6		% 7		Total %
1	Increased orientation and training on eCourses[1] and Canvas	22.73	15	13.64	9	10.61	7	22.73	15	12.12	8	9.09	6	9.09	6	66
2	More communication and weekly updates by faculty	40.91	27	33.33	22	18.18	12	1.52	1	4.55	3	1.52	1	0.00	0	66
3	Video description accompanying assignments	9.09	6	22.73	15	36.36	24	19.70	13	7.58	5	1.52	1	3.03	2	66
4	Supply of additional technology	4.55	3	12.12	8	15.15	10	24.24	16	25.76	17	15.15	10	3.03	2	66
5	Alternative assessment methods- more test and quizzes	4.55	3	1.52	1	7.58	5	9.09	6	19.70	13	36.36	24	21.21	14	66
6	Alternative assessment methods- more research and projects	0.00	0	3.03	2	3.03	2	15.15	10	12.12	8	25.76	17	40.91	27	66
7	More social-emotional support	18.18	12	13.64	9	9.09	6	7.58	5	18.18	12	10.61	7	22.73	15	66

Qualitative Results from the Open-Ended Question

In this section, the researchers discuss the findings from the qualitative data. A consistent approach is needed to begin coding the data, and there are several approaches that can be used in a disciplined way. Creswell (2014) described a systematic process for coding data in which specific statements are analyzed and categorized into themes that represent the phenomenon of interest. After coding, theme development, and thematic analysis, the researchers identified 11 recurring themes. The researchers noted that many of the themes corroborated findings from the qualitative data. Student responses are included in the discussion of each theme.

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Table 4

Item 14: In a few words, state two or three things that can be done to make online/virtual learning more manageable and increase your chances for your success.

Recurring Themes	Rate of response
Unclear directions for completing assignments	19.23%
Excessive Assignments	17.31%
Faculty Communication	14.42%
Need for Faculty Proficiency	11.54%
Excessive Virtual Meeting Times	11.54%
Need for Student Support	8.65%
Technical difficulties Access	8.65%
Technical Knowledge/Skills	2.88%
Need for Reasonable Expectations	1.92%
Mental Health	3.85%
External or home impact	4.81%

Unclear Directions for Completing Assignments

Students' main concern during the ERL transition was that information on how to complete assignments was unclear. Students indicated that faculty needed to "[h]elp the students understand as if it were face-to-face class meetings." Some students indicated that "there ha[d] been a lack of instruction and communication between professors and students when it comes to assignments." It is important to note that both faculty and students had to navigate these unchartered waters simultaneously. The need for more guidance to complete course work, especially assignments, seemed important to students at both institutions. As indicated by the results on Items 6 and 7 above, the use of technology was not an issue for many students. However, students needed more explicit directions on how to complete their assignments, as indicated in Item 9.

Excessive Assignments

The second area of most significant concern for students was that there seemed to be more assignments. This unusually high volume of assignments, unexpectedly assigned, may have been the instructors' way of compensating for not meeting F2F. However, when this occurs in all courses simultaneously, the burden on the students seemed insurmountable. Students' responses included:

> *Don't add too much work into the class.*
>
> *What would help me most is not being loaded with assignments because we are working online. We have about 4-6 classes at a time, and that means work for each class. Giving us a ton of work to keep us busy is not helping me learn. It is easier when we do zoom meetings/lectures.*
>
> *Don't add additional assignments and projects for your students. It creates more stress for all of us, and it is very unnecessary.*
>
> *During a pandemic, less work should be given because you never know what people are going through. If work must be given, it should be given with consideration in mind.*
>
> *Bombarding students with many additional assignments that would normally not happen in the classroom is not good.*

The students' responses, which is consistent with the quantitative data in Item 12, captured students' preference, which mainly included no added assignments. The majority of the students preferred fewer assignments while learning remotely. The majority of the students preferred virtual meetings with no added assignments.

Faculty Accessibility and Communication

Students described their challenge with getting in touch with their instructors. Many instructors typically have office hours and open-door policies during those hours. Students are typically seen streaming into faculty offices for guidance for various situations. Alternatively, students remain behind after a regular class meeting to ask questions they otherwise did not ask in class. The ability to do this was taken away with remote learning. Students noted their inability to reach faculty during times of need. Students stated:

> *Professors not responding promptly to student questions also makes matters worse.*
>
> *Increasing communication would help virtual learning significantly, as well as increasing emotional support.*
>
> *[Professors need] to increase communication with students.*

The students' responses, consistent with the quantitative data in Item 10, clearly demonstrate that students across both institutions needed assistance but did not receive as much help as they needed. Analyzing Item 9, students considered communication vital to their success in the program. Furthermore, the need for communication was ranked highest in Item 13 (40.91% of the students ranked it number one).

Need for Student Support

Closely linked to communication was the need to provide student support. The support did not necessarily have to be through email communication. The support was needed for students to be successful in meeting course expectations. Students indicated that they needed:

> *More updates, more resources.*

> *Provision of spaces to promote quiet, distraction-free learning.*

> *Displaying the work in a more easy-to-read format.*

> *Also, I believe that more instructional support videos, such as videos that explain more difficult content, could be added to help struggling students grasp the content in their online courses.*

> *More clar*ity on certain assignments.

The quantitative data analysis revealed that student needs for support were ranked high. "Video description accompanying assignments" was ranked high as a second and third post prevalent need after communication (See Table 3).

Excessive Virtual Meeting Times

Students described their challenges in having excessive virtual meetings. The researchers found this information intriguing, given that the class meeting times remained the same when students transitioned to remote learning. However, the meetings via Zoom and Adobe Connect still seemed more excessive than necessary for the students.

> *Less zoom meetings would be great.*

> *I can barely get my work done because there are so many zoom meetings.*

> *Students shouldn't have to turn on their camera at home.*

> *Meeting online provides several constraints; personally, I would prefer a typical distance educatio*n setting.

Based on the response for Item 11, accessing remote conferencing tools was of relatively low consequence; however, coupled with access to Wi-Fi, many of the students in rural IHEs experience challenges. Students may have augmented this challenge using mobile hotspots. However, with poor phone reception, remote meetings might still be a challenge.

Need for Faculty Proficiency

Given the challenges mentioned above, it seemed faculty needed to gain proficiency in communicating expectations, navigating the learning management systems (LMS), and supporting students to ensure student success. Students clearly perceived some level of competence or lack thereof. Students indicated that:

> *Professors actually teaching instead of just assigning assignments.*

> *I wasn't too bothered by online classes, but if we are going to be fully online, having professors know what they are doing would be great. This is the only thing I would change is people being more tech-savvy.*

> *I do not have an issue with any of the online courses except when professor does not know how to use technology. Besides that, the experience is not so bad under the circumstances.*

> *Professors need to have more knowledge on technology.*

Technical Difficulties

Students experienced numerous technical difficulties. Unlike the initial expectation of limited resources, all students seemed to have access to technology (See Item 6 results). The challenge was access to virtual platforms due to internet access (See Item 11 results). Students indicated that:

> *Mainly because internet connection issues can cause for information to not be communicated properly.*

> *Some professors have no leniency when it comes to meetings, sometimes Wi-Fi is not working and there are outages; so when you can't make a meeting due to something you can't control.*

External and Psychological Impact

Students identified external factors as impacting their ability to succeed through remote learning. Some students directly indicated mental health issues due to the pandemic. The high level of stress was attributed to more work than usual.

> [O]ffering virtual therapy sessions to students and bringing awareness to the importance of healthy mental states would have helped students like myself.
>
> I feel like I have no life due to all the work that is being thrown at me.
>
> Students get extremely stressed [with too much work].

Besides the direct mental impact on the student, other home factors impact their success.

> Understand that we are dealing with things at home so assigning more work being more stress.
>
> It would be beneficial if test deadlines were scheduled after 7 PM or weekends. Everyone in my household is on the internet until 5 PM. I often loose [*sic*] connection when I'm working online from 8-5.
>
> I also have 3 children at home, and they also have half online and half in school work and I am managing my work and keeping up on their work.

Based on the responses from Item 11, managing time and distractions ranked third and fourth. Combined, these two categories ranked much higher. Students rated time management and distractions highly because this comes with not being on campus where students may have more time focused and devoted to learning and less on family or employment. This added layer of challenges made ERL more difficult given that most instructors maintained the usual F2F routines and expectations. Students' educational lives might be even more challenging in the years ahead as they deal with the pandemic's economic consequences and a new academic environment that currently includes a combination of F2F and remote courses.

Technical Knowledge/Skills

The quantitative data analysis showed that nearly three-quarters of the participants (73.5%, n = 61) reported being advanced or proficient in knowledge and skill level when navigating their LMS. However, 26.5% (n = 22) of the participants reported a "Basic" or "I have never used any" knowledge and skill level. However, it should be noted that the technical difficulties stemmed from using a novel LMS for the students. Compounded by limited communication, students had numerous challenges completing their work given this new platform. Even though most students did not seem to have limited technical knowledge and skills when using computers or accessing remote conferencing tools (2.88% from the qualitative data), Item 8 directly asked about knowledge and skills navigating their LMS, thus showing significant association. However, it is essential to note that the students who transitioned to a new LMS simultaneously as they transitioned to ERL experienced the most difficulty in this area.

Implications for Stakeholders

The benefits of this research are to faculty and students. Information gathered could help faculty and universities tailor their virtual and online course offerings to ensure maximum benefit and success. Using Lewin's (1947) *Change Management Theory*, many of the challenges discussed can be mitigated, keeping in mind that institutions in rural settings have unique needs. Phase one, *unfreezing*, involves preparing the organization to embrace the change. Phase two, *change,* comes after the uneasiness generated in the unfreeze stage and involves the people in the organization identifying a viable process of finding new ways to do things. Finally, phase three, *refreeze*, is where the organization adopts the change. Some of the changes may require a cultural shift. After reviewing the students' responses on each item presented, the following are presented as possible refreezing options for optimal transition to remote learning.

Communicate Frequently Using Various Methods

From a sociocultural perspective, students expressed the need to engage with their instructors more so for affirmation and guidance. Knowing the instructors were "there" even with an online presence seemed to provide a sense of security (Turner et al., 2020). Students needed clear communication concerning assignment expectations since some changes occurred during the transition to remote learning. Finally, they needed to understand through the communication channels of email, texts, and virtual meetings, how to get support if they were ill and unable to attend to class requirements or if external factors beyond their control prohibited immediate involvement with class activities (Mollenkopf & Gaskill, 2020). Effective communication would address the concerns highlighted in survey Items 9 and 10, where one-third (33.7%) of the study's participants reported difficulty with communication, and just over one-third (38.6%) of the participants reported difficulty accessing faculty, respectively. It would also address the same recurring theme of faculty access and communication in the responses to open-ended questions.

Assign Meaningful Activities

Research into effective online instruction offers three conclusions: (1) online instruction can be as effective as traditional instruction; (2) to do so, online courses need cooperative/ collaborative (active) learning; and (3) strong instructor presence (Dixon, 2011). This new environment makes it all the more important to align resources with evidence-based practices proven to help students succeed.

Provide More Student Support

The need to provide more student support, such as course resources, was a recurring theme within the responses to the open-ended questions, with almost half of the participants (49.4%, n = 41) reporting difficulty with accessing course resources, per survey Item 10 (see Table 2). From a socioemotional perspective, the need to support students during this COVID-19 period seemed to have increased. Regarding instructional practices, whether emergency-response or otherwise, it is vital that future efforts better understand the potential for distributed teaching and learning networks for differentiating students' schooling experiences (Holmes et al., 2020). These could include increased flexibility for content delivery, representations of learning and assessment; collaboratively developed expectations, and a better understanding of the "experience of learning" rather than its outcomes alone.

Virtual Meetings Fatigue

Instructors must find a balance that will ensure optimal balance between actual online meetings and much-needed time for assignment completion. In fact, 41.0% of the study's participants would have preferred fully online classes (with or without added assignments), per survey Item 12 (see Table 2). It would also address the same recurring theme of excessive virtual meetings present in the responses to open-ended questions.

Digital Divide

This study shows that participants did not have trouble accessing or using the hardware or software. This indication of proficiency as per their response to survey Item 10 (see Table 2), where only a few participants (12%, n = 10) reported difficulty accessing technology. Additionally, their responses to survey Items 6 and 8 (see Table 2) indicated the same, where almost all participants had access to a desktop computer, laptop, or iPad, and nearly three-quarters of the participants reported being advanced or proficient in knowledge and skill level when navigating their LMS, respectively. The concerning issue was access to the internet, expressed in their responses to the open-ended questions. Rural adults are also less likely than suburban adults to have multiple devices or services that enable them to go online (Perrin, 2017). Rural residents go online less frequently than their urban and suburban counterparts. Perrin (2017) states that roughly three-quarters (76%) of adults who live in rural communities say they use the internet on at least a daily basis, compared with more than eight-in-ten of those in suburban (86%) or urban (83%) areas (Perrin, 2017).

Perhaps, COVID-19 provided the catalyst that will provide greater broadband internet access to Ohio's rural counties. Recently, Governor DeWine signed H.B. 2 that immediately earmarks $20 million for broadband expansion, with a request to the legislature for another $200 million. Lt. Gov. Husted (Ohio) spoke of creating an inclusive environment in the post-COVID-19 world since many families and children could be working online. "As jobs are being created, we now are going to give more families an opportunity to participate in the modern economy, education, and healthcare system" (Dyches, 2021).

Strong and Proactive Coaching

Programs that address multiple barriers to success and include a robust and proactive coaching component can help students navigate these new realities, support students staying in school, and address inequities exacerbated by the crisis (Aguliera & Nightengale-Lee 2020). The researchers are not advocating a "hand-holding" scenario for both faculty and students but an efficient and expedited process supporting faculty transition and allowing faculty to provide the same to their students.

Humanizing Pedagogy

What do we know about what is going on in households where students seem unable to complete their tasks? The data shows the challenges faced through remote learning from students' perspectives and the need for instructors to consider *humanizing pedagogies* when working with students in rural settings (Mehta & Aguilera, 2020). Students shared their personal experiences during online learning in Item 14. However, what methods are students using to address these challenges, and what can faculty and institutions do to assist students with more favorable experiences, enhance learning further, and make student learning more responsive, engaging, and impactful? Students provided some suggestions for how instructors can assist them. Some of these concerns may be addressed on an individual faculty level, or the institution can present some best practices for all instructors to implement. Mehta and Aguilera (2020) made a call to all instructors and teachers to recommit to critical humanizing pedagogy, whether instructors conceive of their teaching and learning as online or in person.

Crisis-Informed Pedagogy

From this experience with the pandemic, stakeholders now know that a crisis can arise at any time, and all should be ready to adjust. Crisis-informed pedagogy does not imply that you should avoid complex issues. Instead, it means that all stakeholders (administrators, teachers, students, and parents) should treat [unforeseen] issues appropriately, sensitively, and with an awareness of nuance and complexity (Aguliera & Nightengale-Lee, 2020). To the best of one's ability, anticipate possible land mines or sources of controversy and contention and navigate through them strategically.

Funding and Finances

Finally, COVID-19 has put immense pressure on state and college budgets from a socioeconomic perspective. To accomplish most of these recommendations, institutions will need to fund a variety of projects. These include faculty training, additional resources for faculty and students, investment in quality LMSs, purchasing good quality video conferencing tools, purchasing bandwidth for students in remote areas, and overall investing in efficient communication systems and alerts, so student needs are addressed promptly.

Using the findings of this study and those of McClure, et al. (2021), the importance of rural public colleges, whether HBCU or PWI, in a post-COVID world should not be missed. Two key takeaways from McClure, et al. (2021) include: rural public colleges "provide an access point for educational opportunity in rural communities," and these same colleges will need further funding to better "serve their communities through COVID-19 and beyond" (McClure, et al., p. 7). The current study revealed that students made the overnight pivot to ERT, but not without challenges. The students valued the education their rural public college provided them, and therefore, continued to attend class virtually, complete assignments, and interact with their classmates and instructors as best they could. They faced the challenges of COVID-19 with the mission of becoming teachers in a post-COVID-19 world, many of whom will teach in rural schools, and as such, will be able to relate well with their future students who have lived some of the same experiences. The cultural shifts of the refreeze (Lewin, 1947) have the potential to affect P-20 rural education for university educator prep programs and local school districts alike.

Limitations

Some limitations exist for this study. First, the study involves only two institutions located in rural parts of Texas and Ohio; one was an historically black college (HBCU), and one was a predominantly white institution (PWI), thus limiting the generalizability across all rural institutions, whether they be HBCU or PWI institutions. Second, the swiftness with which the emergency pivot to remote learning happened and the need to capture data as quickly as possible while the experience was fresh in students' minds did not provide the opportunity for the researchers to pilot the survey to ensure it would capture the information necessary for the study (Mollenkopf & Gaskill, 2020). The participants themselves provide a limitation since all of them were upper-level students, many having already learned the nuances of university classroom life, thus having advantages over first-year students who may have found the experience quite different. Furthermore, since learning occurred remotely, not all students necessarily lived in a rural environment. Not all students in rural IHEs live in rural communities. Finally, since the survey data was collected electronically, students may not have provided nearly the amount of qualitative data that face-to-face interviews might have garnered.

Conclusion

While COVID-19 is undoubtedly not the first virus to disrupt conventional education (Adnan & Anwar, 2020), it was undoubtedly the first to facilitate a global emergency pivot to remote learning. More importantly, the long-term effects of this emergency pivot are yet to be realized. Participants of the current study noted an increase in mental health issues as a result of COVID-19 due to various reasons, further supporting the research of others (Aguilera-Hermida, 2020; Hussein et al., 2020; Mishra et al., 2020).

What is currently known from this study is that university students have provided insight into ways to improve remote learning. Greater communication from instructors is crucial to student success, as Rapanta et al. (2020) supported. Students must have the security of instructor presence in the seemingly distant remote learning world (Turner et al., 2020). Creative lesson design and quality virtual interactions could generate more significant opportunities for student focus (Aguilera-Hermida, 2020; Hussein et al., 2020; Turner et al., 2020). Lastly, when schools reopen, they could be spaces of justice, high expectations, creativity, and processing the collective trauma of COVID-19 (Love, 2020).

Recommendations for Future Research

While this research has presented the perspectives of students from two institutions, providing data from rural stakeholders, the researchers acknowledge that additional research activities are needed:

1. Impact of faculty preparedness on student success.
2. Role of communication and support.
3. Modifying expectations for remote learning (What is reasonable?).
4. Technical knowledge and skills (Are these non-issues for today's students?).
5. External factors (What is entirely outside of an institution's control?).
6. Impact of faculty living in rural communities on rural IHEs.

Understanding the link between these foci and the effect on student success is essential. More importantly would be studies showing which of the focus topics, when manipulated, would increase student success during online and in-person teaching. Finally, the authors are curious about the impact faculty, from rural communities who implemented *Humanizing Pedagogy,* had with students attending IHEs in rural settings during the recent pandemic, compared with their counterparts.

"*It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change*." Charles Darwin

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Rural Schools and the Digital Divide: Technology in the Learning Experience and Challenges to Integration

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In this era of rapid technological innovation, teachers in rural public schools employ a variety of educational technology tools to facilitate student learning. However, little information is known about these teachers' usage frequencies and perceptions of effectiveness of technology in the learning process. Furthermore, limited research exists related to the barriers rural teachers face in their adoption and use of technology. Utilizing a quantitative approach, this study investigated these perceptions among rural teachers. Findings revealed rural educators have differing opinions on usage and effectiveness of various web-based technologies and software. Teachers revealed personal trial and error as the most common way of new technology knowledge and skill acquisition. Participants reported budgetary issues as the largest barrier to technology implementation, followed by student internet access at home. Suggestions are provided so administrators and teachers can adopt and integrate appropriate educational technology tools to maximize student learning.

***Keywords*: rural schools, educational technology, teacher perceptions, digital divide, barriers to use of technology**

The rise of educational technology as a critical element in the teaching and learning process has presented rural school districts across the country with an invaluable tool for overcoming challenges created by geographic isolations, remote populations, and financial constraints. Crucial to the development of 21st-century skills such as communication, collaboration, and creativity, teachers who actively employ technology produce students with higher levels of critical thinking and communication skills (Schafft, 2016). However, rural schools encounter significant infrastructure-related challenges, such as little to no access to broadband or, in some cases, no internet connection at all. Even for districts with access, students are still disconnected at home, including up to 28% in rural areas (Handal et al., 2018). An example can be found in Pendleton and Mingo counties in West Virginia where 35% of households lack Internet access or a reliable electronic device (American Civil Liberties Union West Virginia, 2020). Access to technology may help to reduce obstacles for rural schools such as outdated resources and access to higher education partnerships. Innovative technology usage can promote a collaborative learning community, provide opportunities to earn post-secondary credits via distance learning, and offer possibilities to move away from teacher-centered strategies such as lectures and individual student work (Yang & Kwok, 2017).

This quantitative investigation aimed to improve understanding of rural teacher usage frequencies and perceived effectiveness of various software programs and web-based technologies. Furthermore, the researcher-designed questionnaire examined ways in which rural teachers acquire technology skills and their largest barriers to implementation. Previous findings (Croft & Moore, 2019; Gray et al., 2010) investigated rural teachers and technology, but omitted usage frequencies, perceptions, and knowledge acquisition. Additionally, although researchers examined barriers to technology by content area (Makki et al., 2018; McCulloch et al., 2018), little exploration of barriers rural teachers encounter appears in the literature.

For the purpose of this study, usage was operationally defined as the frequency in which educational technology was employed for instruction inside and outside of the classroom. Perception was defined as how rural teachers viewed, comprehended, and construed the effectiveness of technology.

Literature Review

Use of Technology in the earning Process

School systems across the United States encourage the use and implementation of technology for teachers and students alike. Guided by standards and mission statements from national organizations such as the International Society for Technology in Education (ISTE), districts seek to leverage technology to prepare students with knowledge, skills, and dispositions to be successful in a competitive, global job market (International Society for Technology in Education [ISTE], 2014). On the federal level, the United States Department of Education (2010) stated "technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content" (p. ix). However, prior research suggests well-placed intentions and increased connectivity do not necessarily prepare teachers for successful technology adoption (Blanchard et al., 2016). This issue is particularly common in rural communities, especially those located in high-poverty settings, with large numbers of underrepresented students. This lack of effectiveness creates an opportunity gap which further limits achievement levels of disadvantaged students (Harris & Hodges, 2018).

Previous studies found teachers who implemented technology-enhanced innovations achieved better results than physical textbooks themselves. A synthesis of nearly 30 meta-analytic studies (totaling more than 1,000 articles over a 40-year span) revealed significant increases in student achievement when technology was used compared to technology-free instruction at small to moderate levels. Specifically, students in a classroom where technology is utilized performed 12 percentile points higher than those in a traditional setting (Tamin et al., 2011). Links between student achievement and motivation suggest this bond takes on a larger importance for high-needs students than for other students (Jones & Dexter, 2018). Furthermore, teacher expectations and practices have a large impact on students. Technology-based teaching practices have been shown to increase student engagement and motivation, which positively impacts student achievement (Christensen & Knezek, 2017; Knoblauch & Chase, 2015).

Although teacher access to technology has improved, concerns remain about the perpetuation, or widening, of a digital divide amongst teachers and students in rural areas. The digital divide is defined as "the inequality in access to technology that exists between communities due to regional and demographic differences, particularly socio-economic groups" (Tustin, 2014, p. 4). studies revealed teachers of rural and underrepresented students were less knowledgeable about techniques to effectively implement technology (Davis & Hall, 2018; Kalonde, 2017). A 2015 study in Washington state examined student achievement and teacher quality; a wide range of quality measures, including licensure exam score, experience, and effectiveness, revealed low-income schools featured unequal distribution of quality teachers. The most prominent disparities were found in seventh grade reading and mathematics (Goldhaber et al., 2015).

Technology in Rural Schools

While some educational research focuses on rural contexts, there is little with an emphasis on the usage of technology in rural schools (Blanchard et al., 2016). Rural communities have been associated with uneven educational opportunity and development, especially related to change brought about by technological advancements (Islim et al., 2018). In the learning process, technology is an essential tool in the acquisition of 21st-century literacy skills, regardless of income, language, or geographical setting. For rural schools, technology may provide students with options, experiences, and resources which promote attainment of these abilities on par with their urban and suburban peers (Kalonde, 2017; Miller, 2010). Technology can be used to promote critical thinking and support student expression of their own perspectives and voice. Encouraging students to explore identity in a conscious manner of their rural contexts may increase development of identity and voice (Wang et al., 2019).

Rural districts, from Appalachia to Native American reservations in the West, face unique financial barriers which present large challenges to satisfy their students' most basic needs. Often, poverty is more prevalent in rural American than urban areas. According to the 2010 Census, poverty rates were much higher in rural areas (up to 57% of the local population) than in cities (up to 37%). Schools considered to be "completely rural" as opposed to "partly rural" feature higher rates of child poverty and students living with grandparents instead of the parents (Holder et al., 2016). These factors, combined with gaps in the Elementary and Secondary Education Act such as funding for new programs to help poor children instead being used to fill holes in budgets, put rural schools in a disadvantageous position when it comes to securing funding for their teachers and students. Although unintended, the Title I formula allocated more resources to larger, but less poor, school districts and disproportionately flowed away from small, rural schools. This stemmed from a lack of adequate oversight of how money was used and poorly crafted language allowed for school administrators to use money for purposes other than the original intention (Weiss & Ellerson, 2014).

A lack of financial resources influences schools in a variety of ways. High poverty rates in rural settings negatively impact teacher salaries, technological resources, and teacher training (Eppley, 2017; Goldhaber et al., 2015). Previous research revealed rural schools are more likely to face significant obstacles related to financial resources from dwindling tax bases, technological access, quality of teaching and supply, and disciplinary problems than schools located in suburban settings (Knoblauch & Chase, 2015; Kormos, 2018).

Rural schools are also presented with a myriad of logistical challenges. These schools often feature limited support staff, which are assigned to cover multiple schools over dozens of miles (Weiss, 2019). Recruitment of staff and faculty is another challenge facing rural schools. Districts located in remote areas particularly struggle to attract new employees, and when they are successful, they suffer high turnover rates. Rural schools face higher turnover rates than urban and suburban schools, which leaves vacancies often filled by underqualified teachers (Tran et al., 2018). A lack of experienced teachers with the use of technology may hinder future implementation. New faculty who lack an experienced and qualified mentor are less likely to use technology in an effective manner in their teaching practices (Redding & Walberg, 2012).

Logistical issues are also prevalent related to Internet access. Rural areas may struggle to implement technology due to limitations brought upon by slow bandwidth. In many rural areas, school and home access to internet providers remains spotty, leaving schools to find new ways to deliver learning materials (Weiss & Reville, 2019). Slower internet speeds may limit teacher access to instructional materials such as images, videos, and document downloads (Redding & Walberg, 2012). However, innovative school districts have devised ways to combat a lack of internet service at home and local access to public libraries. Clay County Elementary School in Kentucky, with support from Partners for Education, purchased tablets for each student which provided access to a 10,000-book digital library. Students download age-appropriate books and materials onto their device while at school to provide access at home, over the summer, and during school closures such as snow days (Croft & Moore, 2019).

Rural student demographics, such as a high frequency of English language learners, special needs students, and lower percentage of college-bound students highlight additional challenges. For ESL learners in under-funded rural schools, educational technologies can close language and learning gaps for students with disabilities and English language learners (Pazilah et al., 2019). Furthermore, rural schools may be isolated geographically with limited access to higher education learning partnerships, such as dual enrollment courses, and resources (Harris & Hodges, 2018). However, the small size of rural schools offers benefits for teachers and students. Teachers in rural schools have reported high levels of autonomy and greater work satisfaction. In addition, teacher/student relationships have been found to be typically closer than those in urban and suburban schools (Tran et al., 2018).

Teacher Perceptions of Technology Integration

Teacher beliefs and attitudes regarding technology's role in teaching and learning impact the manner in which technology is incorporated. Prior research found teacher attitude is the most essential element in technology implementation (Chung, 2011; Yang & Kwok, 2017). Khlaif (2018) affirmed any successful educational practice transformation needs an establishment of positive attitudes from users of the technology. A 2018 study by Islim, Ozudogru, and Sevim-Clark found teachers with a positive perception of technology reported high comfort and confidence levels with integrating technology into their teaching practices. There is also a need for teachers to be able to achieve what they consider reasonable technology-related goals. For technology to be successfully integrated on a large scale, objectives should not be distant in scope, and there should be a reconciliation between teachers and technology (Heath, 2017; Prasojo et al., 2019).

Teachers from all grade levels who believed students benefit from technology use are more likely to incorporate it into their teaching than those who did not (Edwards, 2016). Even though administrators may often perceive that technology is used as a way to occupy students' time and attention or as a reward for good behavior (Jones & Dexter, 2018), a 2011 survey of 126 teachers revealed participants believed technology helped students demonstrate higher order learning skills and become more efficient (Goldman & Kabayadondo, 2016).

Teacher perceptions about the impact of technology in learning reflects how it influences the learning process. Whereas knowledge about the usage of technology in teaching generally refers to understanding, beliefs refer to suppositions, commitments, and ideologies about the role of technology in teaching and learning (Domingo & Garganté, 2016). A better understanding of teacher perceptions can foster increased dialogue and collaboration between colleagues to promote coordinated technology practices across grade levels and content areas. Prior research found teachers are likely to acquire new technology skills and implementation ideas from colleagues, which may lead to an increase of independent internet searches related to technology acquisition (Alt, 2018; Blanchard et al., 2016). Based on the available literature, this study seeks to better understand the use of technology by rural teachers in terms of usage frequency, perceptions of effectiveness, and obstacles to implementation. The research questions are: How do rural teachers acquire new technology skills? How frequently do rural teachers use educational technology? What is the perceived effectiveness of educational technology according to rural teachers? What are the largest barriers to integration of educational technology for rural teachers?

Methodology

Instrument

This quantitative study utilized survey research methodology to examine K-12 rural schoolteachers' acquisition of technology skills, usage frequency, perceived effectiveness, and barriers to effective practice. For the study, *rural schools* were operationally defined as those located in a small town or rural area with less than 25,000 people (National Center for Education Statistics, 2014). A State Department of Education list of email addresses for each K-12 building principal provided contact information. Qualtrics served as the survey instrument system and disseminated all emails. Content of the email included the purpose of the study and a request for the principals to forward the email to their faculty members. The email also contained a hyperlink to the informed consent and survey.

The survey remained active for 28 days. The questionnaire totaled 28 items and included three from prior research and survey instruments used by Kotrlik and Redmann (2009) and Coley et al. (2015). The initial part of the survey consisted of nine items related to teachers perceived level of satisfaction with student and teacher access to technology and administrative support. The next section featured 19 items and investigated frequency of use and perception of effectiveness of software programs and web-based applications. For each construct, Likert Scale responses were employed. In this section, teachers also identified barriers to usage and sources of knowledge acquisition. The final portion featured demographics such as age, gender, years of full-time teaching experience, grade levels taught, and content areas. A panel of teachers in the field established content validity. To establish reliability, 20 public school teachers took the survey and responses were recorded. Two weeks later, these participants retook the same survey to ensure responses were similar. These respondents were not eligible to take the final survey which included the data presented in this article.

Participants

The questionnaire resulted in volunteer responses of 937 K-12 teachers employed in a rural public school system. A dropout rate of 9% resulted in 860 usable responses. Females comprised 68% (*N*=584) of responses compared to 32% males (*N*=276). The average age of respondents was 42 years old and employed as a full-time teacher an average of 13 years. All grade levels were represented in the data. Middle grades had the highest number of respondents (*N*=439; 51%), followed by grades K-4 (*N*=396 46%), and 9-12 teachers (*N*=310; 36%). Middle grades and 9-12 teachers identified which subjects they taught. Math teachers (*N*=206; 24%) had the highest frequency of responses, then English (*N*=189; 22%), Social Studies (*N*=163; 19%), Special Education (*N*=120, 14%), and Science (*N*=43; 5%).

Findings

Respondents identified the processes in which they acquired new information and skills of educational technology. For this study, a descriptive statistical analysis was employed comparing mean scores and standard deviation of responses. Rural teachers selected personal trial and error as the best method (*N*=520; 64%) of acquisition. Other faculty and staff served as the second most likely source, followed by Internet searches. Teachers were more likely to learn new technologies from students (*N*=228; 28%) than in-service professional development or workshops (*N*=154; 19%). Undergraduate or graduate coursework (*N*=495; 61%) and online training modules (*N*=447; 55%) were never or rarely used for technology acquisition. Most (*N*=552; 68%) never used social media communities such as Facebook, compared to 11% (*N*=89) who did so often or always (Table 1).

Table 1
Sources of Technology Acquisition

Source	*N*	*M*	*SD*
Personal trial and error	812	3.41	1.02
Other faculty/staff	814	2.86	1.13
Internet searches	812	2.82	1.08
Students	813	2.02	1.23
In-services or workshops	810	1.96	0.98
Undergraduate/Graduate coursework	813	1.58	1.04
Online training modules	811	1.46	1.01
Social media communities/groups	812	1.40	1.07

Notes: 1=never, 2=rarely, 3=sometimes, 4=often, 5=always.

Table 2

Comparison of Rural Teacher Technology Usage Frequency

Technology Usage	*N*	*M*	*SD*
Incorporate technology into lesson plans	860	3.08	0.94
Access web-based technologies to conduct class	853	3.04	0.99
Require students to access Internet in classroom	857	2.37	1.02
Communicate with parents of students outside school hours	857	2.37	0.89
Assign classwork that requires web-based technologies	860	2.21	1.02
Communicate with students outside school hours	861	1.65	0.91
Assign out-of-class work on web-based technologies	859	1.47	0.79

Notes: 1=never, 2=1–2 times a week, 3=3–4 times a week, 4=daily

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The third objective explored usage frequencies of web-based learning technologies. Teachers revealed document creation programs, such as Google Docs, as most likely (*N*=505; 62%) to be used at least once per week, followed by class websites (*N*=350; 43%), video sharing (*N*=293; 36%) and asynchronous communication (*N*=253; 31%). Formative and summative assessment technologies produced the highest standard deviation of responses. The majority (*N*=529; 65%) utilized assessment programs at least once a month. However, only 13% (*N*=106) employed assessment tools on a weekly basis. Podcasts (*N*=716; 88%) were least likely to ever be used (Table 3).

Table 3

Comparison of Technology Usage Frequency of Web-Based Technologies

Technology Type	*N*	*M*	*SD*
Create/edit/share documents	814	3.86	1.93
Class/teacher website	813	3.44	2.08
Video sharing	813	3.30	1.76
Asynchronous communication	815	2.70	2.02
Online classroom calendar	813	2.48	1.99
Formative or summative assessment	814	2.44	1.67
Learning management system	814	2.10	1.83
Photo sharing	810	1.48	1.08
Social networks	815	1.43	1.11
Microblogging	813	1.19	0.67
Podcasts	814	1.12	0.98

Notes: 1=never, 2=a few times a year, 3=a few times a semester, 4=monthly, 5=weekly, 6=daily.

Table 4

Comparison of Rural Teacher Perceived Effectiveness of Web-Based Technologies

Technology Type	***N***	***M***	***SD***
Create/edit/share documents	807	3.91	1.25
Class/teacher website	805	3.65	1.25
Video sharing	804	3.43	1.27
Formative or summative assessment	799	3.42	1.34
Asynchronous communication	802	3.38	1.37
Learning management system	800	3.01	1.35
Photo sharing	796	2.65	1.22
Microblogging	798	2.53	1.21
Social networks	803	2.28	1.25
Podcasts	798	2.16	1.32

Notes: 1=not at all, 2=slightly, 3=neutral, 4=moderately, 5=extremely.

Respondents then assessed perceived effectiveness of web-based technologies. Document creation was viewed most positively, as 43% (*N*=351) viewed it as extremely effective. compared to just 9% (*N*=69) who felt it was not effective at all. Class or teacher websites (*N*=410; 51%), video sharing (*N*=438, 54%), assessment tools (*N*=436; 55%), and asynchronous communication (*N*=424; 53%) were also viewed as either moderately or extremely successful by the majority of teachers (Table 4). Respondents perceived learning management systems (e.g. Google Classroom, Schoology) as a neutral (*N*=263; 33%) educational technology. While 37% (*N*=299) perceived LMS as either moderately or extremely effective, 22% (*N*=179) perceived LMS as “not at all” effective. Most teachers perceived social networks to be either not at all (*N*=359; 45%) or slightly (*N*=152; 19%) effective. Podcasts were not perceived positively, as only 22% (*N*=176) viewed it as moderately or extremely effective.

The fifth research interest evaluated usage frequency and perception of instructional software (Table 5). On average, only internet browsers (e.g. Google Chrome, Mozilla Firefox) were used weekly or daily by the majority of teachers (*N*=713; 86%). Other software used at least once a month by over half of respondents were word processors (*N*=678; 81%), presentation programs (*N*=602; 72%), and educational games (*N*=546; 66%). Photo (*N*=476; 57%) and video editing (*N*=560; 68%) were most likely to never be incorporated.

Next, teachers disclosed attitudes related to the effectiveness of the same software programs. Internet browser (*N*=746; 90%), word processing (*N* = 672; 81%), presentation programs (*N* = 676; 82%) and educational games (*N* = 640; 77%) were viewed by the majority as either moderately or extremely effective. Photo and video editing reported the lowest usage frequencies and perception mean responses. Although respondents viewed photo (*N*=322; 40%) and video editing (*N*=329; 41%) as either slightly or not at all effective, 51% (*N*=416) perceived audio/video players as moderately or extremely effective (Table 6).

Table 5

Comparison of Technology Usage Frequency of Software Programs

Technology Type	*N*	*M*	*SD*
Internet browser	833	5.38	1.16
Word processing	833	4.78	1.65
Presentation programs	833	4.29	1.66
Educational Games	832	3.95	1.61
Video/audio player	830	3.12	1.81
Spreadsheets	830	2.95	1.70
Photo editing	830	1.97	1.38
Video editing	827	1.60	1.06

Notes: 1=never, 2=a few times a year, 3=a few times a semester, 4=monthly, 5=weekly, 6=daily.

Table 6

Comparison of Rural Teacher Perceived Effectiveness of Software Programs

Technology Type	*N*	*M*	*SD*
Internet browser	832	4.50	0.83
Word processing	828	4.23	1.08
Presentation programs	824	4.20	1.02
Educational Games	832	4.00	1.08
Video/audio player	817	3.34	1.31
Spreadsheets	818	3.16	1.34
Photo editing	814	2.67	1.27
Video editing	811	2.64	1.27

Notes: 1 = not at all, 2 = slightly, 3 = neutral, 4 = moderately, 5 = extremely.

The final research area assessed rural teacher perceptions of severity of selected barriers in the technology integration process. Respondents identified financial cost as most significant, as 33% (*N*=268) felt it was a moderate barrier, while 39% (*N*=316) labeled money an extreme barrier. Teachers perceived time to incorporate technology into lesson plans to be the second largest barrier. Two out of three respondents (N=536; 66%) felt time was either a moderate or extreme barrier, compared to only 9% (*N*=76) who stated it was no barrier at all. The findings suggest teachers lack technology not because of an absence of knowledge or need, but rather the requisite time to create lesson plans which incorporate technology. Student access to the internet at home was found to be the third most significant barrier. Student interest in technology was viewed as the smallest barrier. Specifically, 68% (*N*=553) had no barrier at all, while only 24% (*N*=191) viewed it as somewhat of a barrier. With appropriate levels of interest and knowledge, students are more likely to use technology during the learning process in an effective manner. Additionally, teacher interest, administrative support, and student knowledge of technology were perceived as minimal barriers (Table 7).

Table 7

Rural Teacher Perceptions of Technology Integration Barriers

Barrier	*N*	*M*	*SD*
Financial cost	812	3.04	0.94
Time to incorporate technologies into lesson plan	812	2.83	0.93
Student access to Internet at home	812	2.70	0.89
Class time for students to utilize technology	810	2.60	1.00
Student access to technology at school	814	2.43	1.07
Lack of training	814	2.37	1.00
Teacher access to technology	813	2.15	1.05
My knowledge of technology	814	2.00	0.87
Student knowledge of technology	813	1.82	0.80
Administrative support	814	1.76	0.90
My interest in technology	814	1.51	0.74
Student interest in technology	811	1.41	0.70

Notes: 1 = not a barrier, 2 = somewhat of a barrier, 3 = moderate barrier, 4 = extreme barrier.

Discussion

Limitations

Study participants were limited to rural K-12 public school teachers in a Mid-Atlantic state. A second limitation occurred when the researcher was unable to contact participants directly and relied on voluntary responses. The researcher contacted building principals via email, who then forwarded the survey to their faculty members.

Conclusion and Implications

The findings extend the literature related to knowledge and skills acquisition, usage, and perceived effectiveness of various educational technologies used by rural teachers. From the results, it was evident rural teachers utilized a variety of methods to acquire technology knowledge and skills. However, results indicated teacher usage and perceptions varied widely. Through a more developed understanding of how rural teachers use and view technology, researchers and administrators may develop approaches which focus on incorporation and innovation. An additional contribution is identification of barriers rural teachers face related to technology. More specifically, responses offer a chance for researchers to develop new strategies to alleviate challenges such as financial support and lack of student internet access at home. A focus on rural teachers, rather than educators as a whole, presented a more distinct glimpse of technology usage within these schools.

Differences existed between respondents' perspectives of technology availability in and out of the classroom. Findings revealed approval of teacher and student access to technology at school. Prior research indicated teachers and students in rural schools were less likely to have computer access and slower Internet speed than suburban and urban students (Fowler et al., 2013; Handal et al., 2018). Additionally, a shortage of appropriate technology only further discourages teachers from acquiring and learning new and existing technologies (Blanchard et al., 2016). Student access to technology influences the capability and effectiveness of instructional strategies during and after class time. Teachers revealed student access to internet access at home as the third largest barrier. This may suggest continued lack of access for rural students based upon geographic constraints. One potential solution may be training and implementation of smartphone-friendly technologies. Though internet connections may be spotty or non-existent at home, students may use smartphone data plans to perform school-related work if available. Also, the purchase of tablets may provide students with digital resources outside of school via download capabilities (Croft & Moore, 2019). If teachers use smartphones effectively, they may communicate with students outside of school hours. Prior research found mobile applications can promote accountability and provide a channel for students to ask questions they may not in the classroom (Marshall, 2016).

Respondents considered financial cost as the most significant barrier. One way to work around budget restraints may be the usage of free or low-cost education software or mobile apps. District and building technology administrators should design professional development workshops and in-service training on specific platforms which are compatible with a variety of devices. Many financially strapped rural schools may be incapable of providing teacher stipends for subscription-based technology. This further demonstrates the importance of teachers to integrate technologies that permit stakeholders—including students and parents—to use at no cost. In particular, this may be of significant relevance to school districts geographically located in economically depressed communities.

Analysis suggested rural teachers were most likely to obtain innovative skills and adopt new technologies through personal trial and error. Additionally, fellow faculty and staff served as an important acquisition resource, as the majority of teachers revealed they often or always acquired new abilities through conversations with colleagues, which is consistent with Edwards' (2016) assertion that dialogue with coworkers related to technology facilitated improved excitement and efficiency. Applying these findings to the classroom, rural school administrators may create shared planning periods to examine and model technologies, promoting consistency and helping new faculty. For example, professional learning committees (PLCs) may be incorporated into the course schedule to foster cooperation by grade level or content area. Formation of faculty social media communities designed with the purpose to share and examine technology in an asynchronous, school-monitored setting may provide additional support for teachers outside of school hours (Jones & Dexter, 2018).

Differences existed between usage and perceptions of effectiveness of formative and summative assessment tools; although participants viewed them positively, many teachers did not employ them on a regular basis. Playposit and Quizlet, for example, provide student or teacher-created measurements of learning in low and high stakes settings. In the classroom, these platforms permit teachers to collect student thoughts on school policies, create an interactive environment, and evaluate learning during instruction (Marshall, 2016). Furthermore, by creating a collaborative classroom, rural teachers can replace drill and practice instruction and introduce higher order thinking skills (Ryan & Bagley, 2015).

Results showed document creation, class websites, and video sharing received the highest perceptions of effectiveness. Rural teachers used these technologies on a more frequent basis than prior findings from a national study of public-school teachers (Gray et al., 2010). These new findings highlight the need for continued professional development of technologies, such as Google's G-Suite for Education, which promotes Universal Design for Learning principles to offer students a chance to demonstrate mastery in a medium of their liking (Weiss, 2019). When utilized properly, these tools foster student collaboration and increase cognitive ability. Learners engrossed in cooperative-based activities are more liable to partake in group discussion, encourage shared formation of knowledge, report higher achievement levels, and foster increased enthusiasm than students who work independently (Eppley, 2017). Video sharing technology, such as YouTube, allows for delivery of content through multiple media, rather than paper-based textbooks or documents. Typically, rural school districts feature higher levels of students learning English who may prefer to use visual learning, in addition to subtitles, to develop understanding (Yentes & Gaskill, 2015).

Results showed most teachers rarely utilized learning management systems (e.g. Google Classroom). However, despite lack of use, respondents perceived the technology to be effective. Based on responses, it appears low usage frequencies are more likely to be attributed to an absence of financial resources necessary to purchase district-wide access rights across rural districts than lack of teacher interest. The findings were comparable to prior research which suggested school districts located in lower socioeconomic communities were less likely to use LMS (Blau & Hameiri, 2017). Conversely, rural schools, which may feature high rates of learning disabled and transient students, may particularly benefit from LMS (Ryan & Bagley, 2015).

Findings of this study revealed rural schools utilized and perceived technology to be effective, however a number of obstacles to successful integration exist. It is imperative teachers are trained and provided an opportunity to familiarize themselves with various technologies, their benefits, and integration strategies by their school administration (Jones & Dexter, 2018). For rural schools, the following recommendations may be used to guide the adoption and implementation process:

1. Develop goals and objectives for technology adoption and implementation early in the adoption process.
2. Clearly articulate the purpose, goals, and objectives of technology integration at building and district-wide levels through multiple communication channels.
3. Address barriers to technology usage promptly and thoroughly.
4. Develop and provide multiple, continuous professional development opportunities for faculty.
5. Create a faculty mentoring system, especially for first-year teachers, for sustained support.
6. Provide numerous avenues for training, such as video tutorials, in-person trainings, and opportunities for one-on-one assistance.
7. Develop a plan in the early stages of adoption to ensure teachers have sufficient time to hear about new technology and support systems to integrate these tools into their teaching practices.
8. Utilize teachers within each building as leaders to provide support for peers in formal and informal training.
9. Consistently highlight benefits of educational technologies for all stakeholders, including parents. Furthermore, develop a showcase of effective use across the district.
10. Recognize many students may not have regular internet access and develop a plan to ensure alternative methods of content delivery are available for this population.
11. Regularly evaluate the technology integration process and use data-driven decisions to build upon strengths and address barriers to implementation.

Future Research

Results provide multiple areas for the continuance of scholarship. Although the study analyzed usage frequencies and perceptions of various technology programs and barriers, respondents provided a foundation for further research and practice. Further investigations may be implemented in other American communities based upon socioeconomic status, as well as foreign countries. Classroom observations and focus groups composed of teachers from a more diverse set of backgrounds may provide additional understanding of expectancies of technology usage. Additionally, interviews with district administrators may help examine ways in which school districts adopt new technology and evaluate overall effectiveness.

These findings can lead to the development of resources to provide opportunities for teachers to learn technologies at their own pace. More specifically, districts should develop multiple ways to familiarize and train faculty on technologies offered within the school. In addition, schools should adopt a research-based implementation process which provides adequate time to effectively integrate technology. It is also imperative that districts create a transparent accountability mechanism to hold teachers and administrators responsible for utilization of specific technologies. Through an emphasis on continuous improvement, administrators can nominate teacher-leaders to direct training sessions and model innovative techniques. By placing a value on faculty mentors, teachers may effectively use their time to collaborate and foster a shared learning environment, including the creation of a resource bank to share and showcase ways to use technology to maximize student learning.

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College Enrollment and STEM Major Choice in a Rural State: A Statewide Examination of Recent High School Cohorts

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Rural students account for almost 20% of the US K-12 students, but rural context varies from state to state. This study uses a statewide longitudinal sample (N = 3,119) to analyze college enrollment and STEM major choice patterns of Montana's public high school graduates in the academic years of 2013-2017. The binary logistic regressions showed that Montanan graduates are more likely to enroll into a four-year institution than a two-year institution. Also, graduates enrolled at a four-year institution are more likely to consider STEM majors than students at a two-year institution. Although high school GPA and ACT STEM scores are strong predictors for both college enrollment and STEM major choice, findings for race/ethnicity, gender, and free or reduced-price lunch status varied across the two outcomes. Specifically, race/ethnicity contributes to variation in college enrollment, but not STEM major choice. Similarly, free or reduced-price lunch status in high school is predictive of college enrollment, but not STEM major choice. Although there was no difference in college enrollment type for gender, male students are more likely to select a STEM major, and this trend occurs at a rate of three times higher at a four-year institution versus a two-year institution. Our findings provide additional nuances of rural graduates, contributing to the understanding of their college enrollment and STEM major choices in the context of Montana - a large geographic, low populous state - which has received less attention than urban and high-density states.

***Keywords*: rural education, college access, college choice, STEM major choice, statewide longitudinal study**

It is critical to understand college enrollment patterns and major choice for rural high school students in the United States (US) because they make up almost 20% of all K-12 students (Showalter et al., 2017). National trends indicate that compared to their peers from city, suburban, and town locales, college enrollment rates for students from rural areas are the lowest (Burke et al., 2015; Tieken, 2016). Despite a large national sample of rural students, findings of rural patterns in college enrollment are often difficult to generalize to the entire US rural student population because samples do not include students from all US states or rural communities (Byun et al., 2017). Thus, this study aims to extend our understanding of rural students' college enrollment patterns and disparities in Science, Technology, Engineering, and Mathematics (STEM) major choice in Montana, where 74% of public schools are classified as rural (Eccher, 2019). In Montana, educational attainment is an essential factor in the state's economic growth and appears to have a stronger relationship with employment growth than either population or transportation infrastructure (Wagner, 2017).

Using national data sets, Byun et al. (2017) and Koricich et al. (2018) found that rural high school graduates more frequently enrolled in a two-year institution as opposed to a four-year institution. In a state-level sample, Burke et al. (2015) reported that rural students in Indiana enrolled in a two-year institution at higher rates than non-rural students. Furthermore, rural students are more likely than non-rural students to be undermatched to colleges when considering their level of presumptive eligibility either at a state level or national sample (Burke et al., 2015; Lee et al., 2017).

Rural students and students from lower socioeconomic status (SES) levels generally earn lower standardized test scores than their non-rural and affluent peers (Burke et al., 2015). The gap in access to ACT/SAT test preparation courses between urban and rural students is widening and serves as a barrier for admission for many rural high school students (Whitaker, 2016). Additionally, there are documented gender and racial/ethnic disparities in college enrollment. Female students are less likely than male students to attend a two-year institution rather than a four-year institution (Burke et al., 2015), but gender is not a predictor for rural youths' postsecondary enrollment patterns (Byun et al., 2017). Although race/ethnicity is related to college enrollment among a sample of rural nationally representative students (Byun et al., 2017), it was not predictive for students in the state of Indiana (Burke et al., 2015). Thus, national data masks important state-level variability in two-year versus four-year institution enrollment patterns (Burke et al., 2015). Also, within rural areas, one study found that White, Black, and Latinx high school youths in rural areas had comparable levels of educational aspirations, but American Indian students in their sample had the lowest aspirations (Irvin et al., 2016).

In addition to differential patterns of college enrollment, there are disparities in college major choice. Rural students have significantly less access to Advanced Program (AP) or International Baccalaureate (IB) math and science courses than non-rural students, but research indicates that taking advanced courses may be beneficial for academic outcomes such as test performance and college enrollment, especially for female students. Female students taking fewer advanced courses than males were less likely to choose STEM majors in college (Irvin et al., 2016; Jewett, 2019; Jiang et al., 2020). At the supply side, urban schools offered significantly more advanced and AP science courses than suburban, town, or rural schools (Jewett, 2019). Moreover, race/ethnicity is a significant predictor of college major. The odds of Asian students selecting a STEM major are 82% higher than the odds of White students, but Black and Latinx freshman students were equally likely to choose a STEM major as White students (Jewett, 2019; Moakler & Kim, 2014).

The current study extends previous research on rural students and postsecondary education patterns by incorporating two variables that represent space/place (Burke et al., 2015; Byun et al., 2017; Irvin et al., 2016; Kryst et al., 2018; Westrick et al., 2015), operationalized by both school district class (e.g., student population) and school district locale (e.g., urban, suburban, rural, etc.). Additionally, we include the racial/ethnic group of American Indian, which is often not included in research due to small sample sizes. This is problematic according to Brown (2017), as American Indian students have the highest dropout rates, lowest college enrollment rates, and lowest percentage distribution of degrees conferred of any minoritized population in the US. Moreover, to more precisely measure the differences of college enrollment and STEM major choice in both gender (female/male) and race/ethnicity (White, American Indian/Alaska Native, Latinx, and others), high school grade point average (HS GPA) and ACT subject scores were included as covariates instead of ACT composite scores in isolation (Allensworth & Clark, 2019; Jiang et al., 2018).

The following research questions guide this study:

(1) What is the likelihood that Montana high school graduates enroll in a four-year institution?

a. How do student-level characteristics, high school academic achievements, and school space/place contribute to the likelihood that a Montana high school graduate enrolls in a four-year institution?

(2) What is the likelihood that Montana high school graduates choose a STEM major?

a. What student-level characteristics, high school academic achievements, and enrolled institution type contribute to variation in a STEM major choice?

Review of Literature

Rural High School Contexts

Context of space and place, particularly of rural places, is an important consideration for research whose aim is to identify college enrollment patterns and college major choices (Kryst et al., 2018; Schmitt-Wilson & Downey, 2018). Variations within the rural context are associated with student outcomes and their access to postsecondary education. Research has identified the important contextual contributions of rural schools-based specific environments and socially just instructional methods as “this student in this context” (Eppley et al., 2018, p. 37). Moreover, other factors influence college attendance issues, such as rural “brain-drain” in which college educated youths leave rural community and do not return after graduation (Kryst et al., 2018; Tieken & San Antonio, 2016), local job prospects for students with only a high school degree (Jiang et al., 2018), and a state-wide Early College program for high school students (Allen & Roberts, 2019). Since 2002, the Early College Initiative has provided high school students with opportunities to obtain college-level learning while they are in the last two years of high school with the aim to potentially decrease the financial burden of college for underserved students. The program, operating in 28 states, allows high school students to graduate with both a high school certificate and an associate degree or up to two years of college credit toward a bachelor’s degree (Allen & Roberts, 2019). Allen and Roberts’ (2019) study found that school location matters for how state programs and policies, such as the Early College program, are implemented in Ohio. The available resources, opportunities, and constraints lead to variation in how schools can support students, such as long distance to other school districts and lack of easy transportation access to college partners. In addition to the school context, the community context, characterized by the concept that a “tight-knit social ecosystem can be a force driving students toward achievement in rural schools,” demonstrates importance, as students received appreciation and support from the community members in their small towns (Eccher, 2019, p. 13).

The effects of high school location and school type (conventionally operationalized as urban, suburban, town, and rural for location, and private vs. public for school type) are implicated in students’ college matching (Lee et al., 2017). Using the national data set ELS:2002, Lee et al. (2017) found that nearly half of rural public-school students were undermatching and rural students had undermatched disadvantages due to fewer AP/IB courses. Furthermore, rural high school contexts play an important role for rural students’ postsecondary attainment (Schmitt-Wilson & Downey, 2018; Tieken & San Antonio, 2016), particularly in Montana where educational attainment and employment growth are associated (Wagner, 2017). Our present study contributes to the understanding of college enrollment among Montanan public high school graduates, while controlling for student characteristics and pre-college scores.

Rural Students’ College Enrollment

According to the “Why Rural Matters 2015-2016” report, 87% of high school students in rural areas graduate within four years, but college preparation remains a major issue (Showalter et al., 2017). School contextual characteristics, such as college preparation program, academic achievement, grade attention, academic self-concept, and high school culture affect educational aspirations in rural communities (Corley, 2018; Irvin et al., 2016; Tieken & San Antonio, 2016). Rural high school students are less likely to attend postsecondary education than non-rural students, but when examining institution types, rural students are almost 20% more likely to attend a two-year institution versus a four-year institution (Koricich et al., 2018). Furthermore, Koricich and colleagues (2018) found that geographic proximity to institutions is a driving factor in the choice of rural students to attend a two-year institution, whereas socioeconomic effects boosted rural students' likelihood of attending a highly selective institution.

HS GPA and ACT/SAT scores are often used as predictors of college match as academic merit factors (Lee et al., 2017), college enrollment, and college graduation (Allensworth & Clark, 2019). Undermatching occurs when highly-prepared students, measured with better high school GPA and ACT/SAT scores, choose to both apply to and attend less selective colleges – particularly low-income and/or first-generation students (Lee et al., 2017; Ovink et al., 2018). College undermatching is more common among rural students although they have similar academic qualifications measured by HS GPA and standardized test scores compared with students at urban, public schools (Eccher, 2019; Lee et al., 2017). Rural students and students with a lower SES generally tend to earn lower standardized scores than their non-rural and more affluent peers and enrolled in four-year institutions at lower rates than their higher-SES peers (Burke et al., 2015). Higher-SES students tend to have higher chances of attending academically matched colleges and universities than their low-income counterparts (Lee et al., 2017).

AP/IB courses help increase the probability of college match (Lee et al., 2017). However, students in rural areas have less academic preparation for college opportunities due to fewer AP/IB offerings, remote location, and limited SAT/ACT preparation offers (Kryst et al., 2018; Whitaker et al., 2018). Using the population data of Civil Rights Data Collection in two school years (2011-12 and 2013-14) from public high schools in the US, Price (2020) investigated whether districts and schools offer AP or IB courses as college prep curricula, who enrolled in these courses are offered, and who acquired mastery level once enrolled in AP or IB courses. Price found that, on average, 7 out of 100 high school students attend districts that do not offer AP/IB courses. Moreover, among districts offering AP/IB courses, only 30% of American students attend schools that offer AP or IB courses. Comparing with White students, less than 24% of American Indian, 27% of Latinx, and 30% of Black students attend schools that offer AP/IB. Notably, rural schools are the least likely to equalize access to AP/IB availability against suburban schools, but students attending rural schools experience less disparity in mastery (in the case of AP exams, passing three or more college credits) among racial/ethnic disproportionality versus suburban peers.

Poverty Level: Free-Lunch High-School Student Participation

Over 48% of rural K-12 students are eligible for free or reduced-price lunch (FRL) in the US, which is often used as a proxy for low-income status (Burke et al., 2015; Eccher, 2019). In Montana specifically, many American Indian students are low-income adult learners (Brown, 2017). Food insecurity is a barrier to academic achievement and retention among college students in the US (Camelo & Elliott, 2019; Khosla et al., 2020; Payne-Sturges et al., 2018). At the college level, national data indicate that approximately 13% of two-year college students and 11% of four-year college students came from food-insecure families in 2015 (Blagg et al., 2017). Studies in 2015 and 2016 reported at least 20% of two-year college students have very low levels of food security, and two-year college students are more likely to have food security challenges than four-year students (Broton & Goldrick-Rab, 2018).

Gender, Race/Ethnicity, and STEM Major

Gill and Leigh (2000) documented the shift in the gender gap in college enrollment from 1970 to 1993. In 1970, the majority of two-year and four-year enrollments in the US were male students. Conversely, in 2018, 56% of students that enrolled in post-secondary institutions were female (U.S. Department of Education, 2021). Based on an American Community Survey data set, the fraction of humanities, social sciences, and education undergraduate/college major choice declined significantly for birth cohorts during the period of 1940-1993, with much of the increase in business and economics degrees and some in STEM (Patnaik et al., 2020). The gender trends in major choice have sizeable differences in these three major categories. There is a gender gap in STEM major choice due to women's comparative advantage in verbal skills – a proxy in university enrollment – than math skills, lower male university attendance, differences in high school course choices, and preferences for STEM (Patnaik et al., 2020). The number of female STEM bachelor's degree graduates in 2015-2016 nationally was lower than male peers (36% vs. 64%) across all racial/ethnic groups (de Brey et al., 2019). Additionally, there is a racial gap of bachelor's degree in science and engineering as underrepresented minority students received 22% of all science and engineering bachelor's degrees in 2016 (National Center for Science and Engineering Statistics, 2019). High school offerings such as engineering and engineering technology courses are important factors in students' decision to enroll in a STEM major at a four-year institution (Phelps et al., 2018).

Focusing on gifted high school students in Nebraska, ACT/SAT scores, race/ethnicity, school type (public/private), and living condition (urban, suburban, and rural) in relation to choice of STEM majors or non-STEM majors, the majority of gifted students are more likely to choose STEM majors (71%) when they enter college (Vu et al., 2019). Gender was a significant predictor in STEM major choice among these gifted students with the odds ratio of STEM majors for males being 5.124 times that of females, but race/ethnicity was not an important factor of gifted students' STEM major choice. For first-generation college students, female students are less likely to choose male-dominated majors (Wright, 2019) and to persist in STEM major completion (Mau, 2016). Weeden et al. (2020) used a national longitudinal data set and found substantial gender differences in STEM major completion. Specifically, among 2004 high school graduates who enrolled in college in the following fall, 18% of male graduates majored in the STEM/biomed field compared to 7.9% of female graduates. Interestingly, while in college, female students take more advanced courses in all major categories except STEM (Shewach et al., 2019).

Labor market data show that the set of core cognitive knowledge, skills, and abilities relating to a STEM education are now in demand – not only in traditional STEM occupations, but in nearly all job sectors and position types (U.S. Department of Education & American Institutes for Research, 2015). A study of rural students in the Appalachian area shows that students who plan to pursue STEMM – Science, Technology, Engineering, Mathematics, and Medical – careers had higher college enrollment than those who did not have a plan to pursue STEMM (Rosecrance, 2017). In Montana, only 23% of high school graduates were interested in STEM fields compared to 43% of graduates nationally (ACT, 2019). Location of residence also impacts major choice. A longitudinal study in Canada found that rural students are less likely to enroll in both STEM and non-STEM four-year programs compared with STEM and non-STEM programs at two-year institutions (Hango et al., 2019).

Montana Context

Montana is the fourth largest state geographically in the US yet ranks 44th for population with just over a million residents as of July 2019 (U.S. Census Bureau, 2019), or 6.8 people per square mile. The population is largely White (88.9%), while 6.7% identify as American Indian or Alaska Native, and 4.1% as Hispanic or Latino (U.S. Census Bureau, 2019). The vast majority, or 96%, of school districts are considered rural (Versland et al., 2020). Additionally, more than 200 schools in Montana have less than 200 students within an attendant community and are located in a county with five or fewer people per square mile (Versland et al., 2020). Smaller school sizes have been associated with more positive educational outcomes, particularly for students at risk for underachievement due to economic disadvantage, minority status, or academic abilities (Byun et al., 2017). Thus, understanding distinct and influential features of rural education is important to meet the local community's needs, such as the teacher shortage in Montana (Versland et al., 2020) or for innovative solutions that do "not simply use a one-size-fits-all approach" (Schuler, 2020, p. 4).

The Montana University System is composed of two flagship universities, three community colleges, seven tribal colleges, and three private institutions which collectively enroll around 40,000 students. In the fall 2020 semester, Montana freshman enrollment in a four-year institution accounted for 78% of all postsecondary enrollment and 60% were in-state students (Montana University System, 2020). In the academic year 2017-2018, the overall high school graduation rate was 86.4% in Montana, but the rate was 67.6% for American Indian students (The Monana Office of Public Instruction, 2019). Furthermore, the college enrollment rate of American Indian students to the Montana University System (excluding tribal colleges) was 25% in the academic year 2016-2017 compared to 46% of White students (The Montana Office of Public Instruction, 2018).

In response to these disparities, Montana has created programs to increase postsecondary access, particularly for historically underrepresented groups. For example, Montana provides a program (https://www.reachhighermontana.org) to support both high school students and parents in planning their future, such as accumulating college credits, creating a learning plan for after high school, and reference tools to prepare for college finances. Also, students in Montana between 16 and 19 years of age and/or in their junior or senior year of high school can participate in the dual enrollment program, which connects secondary and postsecondary institutions (Montana University System & Office of the Commissioner of Higher Education, 2020). Dual enrollment offers two delivery models: students can attend the Early College or the concurrent enrollment that offers college courses taught by a college-approved, state-licensed high school teacher at a high school. Furthermore, there are different support programs in Montana. For example, the BRIDGES program provides: (a) support to American Indian students wanting to transfer from four tribal colleges to a public, doctoral-granting institution; (b) the Montana Indian Student fee waivers (Brown, 2017); or other types of support such as (c) scholarships to enhance American Indian undergraduate/graduate access through National Science Foundation grants.

Method

Sample

This study uses a statewide longitudinal data set of 54,634 students in the Growth and Enhancement of Montana Students (GEMS) Data Warehouse provided by the Montana Office of Public Instruction (OPI) and the Office of Commissioner of Higher Education. The study sample are Montana youths who graduated from high school between 2013-2017 and attended a postsecondary institution in Montana. Each academic year sample includes 2,000 participants randomly selected for a total sample of approximately 10,000 students over five years for this study. In Montana, more than 50% of high school graduates did not enroll to a two-year or four-year institution in the Montana University/College System within 3-16 months of high school graduation during the academic years 2016-2018. Of the 10,000 students in the data set, 6,548 were missing data for institution type and/or freshman major choice and were excluded from the analysis. Additionally, 333 students were excluded from analysis due to missing data for ACT scores and/or HS GPA. Thus, the final sample consists of 3,119 students.

Measures

Outcome Variables

We investigated two dichotomous outcome variables: (1) enrollment at a four-year versus two-year institution and (2) selection of a STEM major versus non-STEM major. We utilized the six-digit Classification of Instructional Program Codes developed by the Department of Education (Douglas & Salzman, 2019) - to create two major groups (STEM or non-STEM) similar to previous studies (Jones et al., 2019; Mau, 2016; Wiswall et al., 2014). Specifically, STEM majors include agriculture, computer science, engineering, biology, mathematics and statistics, interdisciplinary studies, health professions, and physical sciences. Non-STEM majors include professional fields such as business/management/marketing, social sciences, humanities and art, education, and vocational. STEM major analysis of participants attending two-year and four-year institutions is based on the institution type at enrollment.

Explanatory Variables

Demographic variables include categorical variables of students' gender (female coded 0 vs. male coded 1), race/ethnicity (American Indian or Alaska Native – AI/AN, Latinx, White – reference group, and others), student-level National School Lunch Program (NSLP) status (full price vs. free or reduced-price lunch, or FRL), school district class (AA, A, B, or C) and school district locale (rural, town, or city). School district class is determined by the schools' Montana High School Sports Classification, which is a school-level variable dependent on high school student enrollment. Class AA includes schools with 779 or more students, class A includes schools with 307-778 students, class B includes schools with 108-306 students, and class C includes schools with 107 or fewer students.

According to the U.S. Department of Education (National Center for Education Statistics, 2006), rural schools were defined using the urban-centric locale codes developed by the U.S. Census Bureau. These codes involved schools' geographic proximity to an urbanized area as well as population size and density. There are three subcategories of each major locale category (city, suburban, town, and rural), including large, midsize, and small for both city and suburban; and fringe, distant, and remote for both town and rural. Schools in this study have the following locale codes: city – large, city – midsize, town – fringe, town – remote, rural – fringe, rural – distant, and rural – remote.

Continuous variables include students' high school GPA and ACT subject scores (STEM, reading, and English). The ACT STEM score (i.e., the average of students' ACT math and science scores) provided greater explanatory power and improved model fit than using both ACT math and ACT science scores. ACT STEM score represents students' combined performance on the ACT math and science tests and was introduced in the ACT STEM College Readiness Benchmark in 2015 (ACT, 2015). Additionally, HS GPA was transformed using the natural logarithm, as the original HS GPA values violated the logistic regression assumption of linearity of the logit. In the logistic regression models, all continuous predictors have been centered according to the grand mean.

Data Analysis

As students are nested in communities, we first investigated the need for multilevel modeling using a combination of school district class and locale, as well as using each of these variables individually. Although it would have been methodologically sound to nest students within their high schools, these data are not available in the GEMS data set. There was very little variation by school district class and/or locale, thus, multilevel modeling was statistically unnecessary. Therefore, we used logistic regression statistical analysis to estimate a series of models as our outcomes were binary (Agresti, 2017) to investigate what factors contribute to enrollment at a two-year versus four-year institution and STEM major choice while controlling for additional student-level characteristics, high school academic achievements, and school space/place.

Since school district class and locale explained little to none of the variation in the outcomes, likely due to the largely rural nature of the state, we excluded these variables from the analyses and began by examining student-level characteristics (gender, NSLP status, and race/ethnicity). We then examined high school academic achievement (HS GPA, ACT math score, ACT science score, ACT reading score, ACT English score, ACT STEM score, and ACT composite score) in multiple models and found that the best fit model was provided by HS GPA, ACT STEM score, ACT reading score, and ACT English score. Next, we examined school space/place for the second research question by including institution type as a predictor of STEM major choice. Lastly, we analyzed the interactions between significant predictors in the final model of each analysis, but none were found to be statistically significant predictors of either institution type or STEM major choice.

In this study, we present two models for the first research question and three models for the second research question. The first model in each analysis included student-level characteristics. Subsequently, the second model in each analysis added HS GPA and ACT subject scores. The third model for the second research question included the school space/place predictor of institution type. We examined Akaike information criterion (AIC) values to assess overall model fit and report findings for the best-fitting model, indicated by the lowest AIC value. In addition, we report pseudo-R^2 values for each model and use log-likelihood ratio chi-square tests (LRT) to determine whether the model with additional predictors fits the data significantly better than the model with fewer predictors. All assumptions of logistic regression were examined and confirmed in each model.

Results

Descriptive Analysis

The sample was 52.9% female, 5.1% American Indian/Alaska Native, 3.5% Latinx, and 88.0% White. Less than a quarter, or just 21% of students were eligible for free or reduced-price lunch. Students from rural areas accounted for 35% of all students, 79.6% of the sample enrolled in a four-year institution, and 22.3% of students chose a STEM major (Table 1).

Table 1

Descriptive Statistics

Factor	**Institution Type Analysis**		**Major Choice Analysis**	
	n	**%**	**n**	**%**
Institution type				
two-year	635	20.4	632	20.3
four-year	2,484	79.6	2,484	79.7
Major choice				
Non-STEM			2,422	77.7
STEM			694	22.3
Gender				
Female	1,649	52.9	1,646	52.8
Male	1,470	47.1	1,470	47.2
NSLP status				
Free/reduced-price	656	21.0	654	21.0
Full price	2,463	79.0	2,462	79.0
Race/ethnicity				
AI/AN	158	5.1	158	5.1
Latinx	110	3.5	110	3.5
Other	106	3.4	106	3.4
White	2,745	88.0	2,742	88.0
School district class				
>778 students	1,599	51.3	1,598	51.3
307-778 students	612	19.6	612	19.6
108-306 students	496	15.9	495	15.9
<108 students	412	13.2	411	13.2
School district locale				
City	800	25.7	799	25.6
Town	1,227	39.3	1,227	39.4
Rural	1,092	35.0	1,090	35.0
Total	3,119	**100.0**	**3,116**	**100.0**

Factor	Mean	Standard Deviation	Range
HS GPA	3.30	.55	(.65, 4.48)
ACT STEM score	21.61	4.19	(11, 36)
ACT reading score	22.18	5.67	(6, 36)
ACT English score	20.30	5.38	(4, 36)

Research Question 1

Logistic regression results for the first research question (How do student-level characteristics, high school academic achievements, and school space/place contribute to the likelihood that a Montana high school graduate enrolls in a four-year institution?) can be found in Table 2. The first model in the analysis of college type includes gender, NSLP status, and race/ethnicity as explanatory variables. Pseudo-R^2 values show that model 1 explains about 1% of the variance in students' decision to attend a four-year institution (McFadden = .009, Cox & Snell = .009, Nagelkerke = .014). Gender and race/ethnicity are not significant predictors of attending a four-year institution when controlling for all other factors in this model. However, NSLP status is a significant predictor of attending a four-year institution [β = .56, $p < .001$, CI = (1.42, 2.15)], as students who are not eligible for free or reduced priced lunch are predicted to be 75% more likely to attend a four-year institution when compared to students with free or reduced-price lunch (Odds Ratio/OR = 1.75).

The second model adds HS GPA, ACT STEM score, ACT reading score, and ACT English score to model 1. Model 2 fits the data significantly better than model 1 as the null hypothesis of the LRT is rejected, $\chi^2(4) = 394.53$, $p < .001$. Pseudo-R^2 values show that model 2 explains about 13% – 20% of the variance in student's decision to attend a four-year institution (McFadden = .134, Cox & Snell = .127, Nagelkerke = .199). NSLP status is a significant predictor of attending a four-year institution [β = .24, $p < .05$, CI = (1.01, 1.59)], as students from more affluent families are predicted to be 27% more likely to attend a four-year institution when compared to students with free or reduced-price lunch (OR = 1.27). Race/ethnicity (AI/AN) is a significant predictor of attending a four-year institution [β = 1.16, $p < .001$, CI = (2.02, 5.17)], as AI/AN students are about 3.2 times as likely to attend a four-year institution when compared to White students (OR = 3.19). Additionally, HS GPA is a significant predictor of attending a four-year institution [β = 2.02, $p < .001$, CI = (4.34, 13.04)]. Since the natural logarithm of HS GPA was used as a predictor in this model, the odds ratio (OR = 7.50) represents a HS GPA increase of *e* or 2.72 points above the grand mean. Thus, a more useful interpretation of OR/*e* shows that students with a HS GPA one point above the grand mean are predicted to be about 2.8 times as likely to attend a four-year institution (OR/*e* = 2.76). In addition to HS GPA, ACT STEM score is a significant predictor of attending a four-year institution [β = .12, $p < .001$, CI = (1.08, 1.17)], as each one-point increase above the grand mean for ACT STEM score is estimated to increase students' odds of attending a four-year institution by 13% (OR = 1.13). Also, ACT English score is a significant predictor of attending a four-year institution [β = .04, $p < .05$, CI = (1.01, 1.07)], as each one-point increase above the grand mean for ACT English score is estimated to increase students' odds of attending a four-year institution by 4% (OR = 1.04). Exploratory models indicated that neither school district class nor locale were significant predictors or attending a four-year institution and worsened model fit.

Research Question 2

Logistic regression results for the second research question (What student-level characteristics, high school academic achievements, and enrolled institution type contribute to variation in a STEM major choice?) can be found in Table 3. The first model in the analysis of major choice includes gender, NSLP status, and race/ethnicity as explanatory variables. Pseudo-R^2 values show that model 1 explains about 5% – 8% of the variance in students' selection of a STEM major (McFadden = .051, Cox & Snell = .052, Nagelkerke = .081). NSLP status and race/ethnicity are not significant predictors of selecting a STEM major when controlling for all other factors in this model. However, gender is a significant predictor of selecting a STEM major [β = 1.11, $p < .001$, CI = (2.55, 3.66)], as males are predicted to be about three times as likely to major in a STEM field when compared to females (OR = 3.05).

Table 2

Logistic Regression Models for Institution Type Analysis

Factor	Model 1		Model 2	
	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)
Constant	.93‡ (.10)	2.54‡ (2.08, 3.12)	1.35‡ (.12)	3.84‡ (3.06, 4.85)
Male	-.06 (.09)	.94 (.79, 1.13)	.03 (.10)	1.03 (.84, 1.26)
Full price lunch	.56‡ (.11)	1.75‡ (1.42, 2.15)	.24* (.12)	1.27* (1.01, 1.59)
AI/AN	.43 (.22)	1.53 (1.01, 2.40)	1.16‡ (.24)	3.19‡ (2.02, 5.17)
Latinx	.04 (.24)	1.04 (.67, 1.69)	.29 (.26)	1.33 (.82, 2.25)
Other	.27 (.26)	1.31 (.81, 2.24)	.45 (.28)	1.57 (.93, 2.78)
HS GPA (ln)			2.02‡ (.28)	7.50‡ (4.34, 13.04)
ACT STEM			.12‡ (.02)	1.13‡ (1.08, 1.17)
ACT reading			.02 (.01)	1.02 (.99, 1.05)
ACT English			.04* (.02)	1.04* (1.01, 1.07)
AIC	3,135.63		2,749.10	

Note. * = p < .05, † = p < .01, ‡ = p < .001

The second model adds HS GPA, ACT STEM score, ACT reading score, and ACT English score to model 1. Model 2 fits the data significantly better than model 1 as the null hypothesis of the LRT is rejected, $\chi^2(4) = 344.28$, $p < .001$. Pseudo-R^2 values show that model 2 explains about 15% – 23% of the variance in a student's selection of a STEM major (McFadden = .155, Cox & Snell = .151, Nagelkerke = .232). NSLP status, race/ethnicity, ACT reading score, and ACT English score are not significant predictors of selecting a STEM major when controlling for all other factors in this model. Males are predicted to be about 3.2 (OR = 3.17) times as likely to major in a STEM field when compared to females ([β = 1.15, $p < .001$, CI = (2.59, 3.89)]. Additionally, HS GPA is a significant predictor of selecting a STEM major [β = 1.93, $p < .001$, CI = (3.40, 14.47)]. Again, since the natural logarithm of GPA was used as a predictor, the odds ratio (OR = 6.92) is best interpreted with OR/*e*. This shows that students with a HS GPA one point above the grand mean is predicted to be about 2.5 times as likely to select a STEM major (OR/*e* = 2.54). Of all the ACT subject scores included, only ACT STEM score is a significant predictor of selecting a STEM major [β = .18, $p < .001$, CI = (1.15, 1.24)], as each one-point increase above the grand mean for ACT STEM score is estimated to increase students' odds of majoring in a STEM field by 19% (OR = 1.19).

The third model adds institution type to model 2. Model 3 fits the data significantly better than model 2, as the null hypothesis of the LRT is rejected, $\chi^2(1) = 48.14$, $p < .001$. Pseudo-R^2 values show that model 3 explains about 17% – 25% of the variance in a student's selection of a STEM major (McFadden = .170, Cox & Snell = .165, Nagelkerke = .252). NSLP status, race/ethnicity, ACT reading score, and ACT English score are not significant predictors of selecting a STEM major when controlling for all other factors in this model. Gender is still a significant predictor of selecting a STEM major [β = 1.16, $p < .001$, CI = (2.60, 3.91)] as males are predicted to be about 3.2 times as likely to major in a STEM field when compared to females (OR = 3.19). HS GPA is a significant predictor of selecting a STEM major [β = 1.61, $p < .001$, CI = (2.44, 10.55)], as a one-point increase above the grand mean for HS GPA is estimated to increase students' odds of selecting a STEM major by 84% (OR/*e* = 1.84). ACT STEM score is a significant predictor of selecting a STEM major [β = .17, $p < .001$, CI = (1.14, 1.23)], as each point increase above the grand mean for ACT STEM score is estimated to increase students' odds of majoring in a STEM field by 18% (OR = 1.18). Institution type is a significant predictor of selecting a STEM major [β = 1.12, $p < .001$, CI = (2.19, 4.42)], as students attending four-year institutions are predicted to be just about three times as likely to major in a STEM field when compared to students attending two-year institutions (OR = 3.07).

When examining interactions between significant predictors in the best-fitting model (model 3), an interaction between gender and institution type was found to be a significant predictor of STEM major choice (see Table 4 in appendix). Upon further examination, three observations had standardized deviance residuals that were more than three standard deviations away from the mean. After removing these outliers, we conducted a sensitivity analysis. Interestingly, the interaction between gender and institution type was no longer significant, but the findings of models 1, 2, and 3 remained very similar. Thus, these three observations were removed from the analysis of major choice for all models.

Although findings for the two outcomes varied, there were also similarities – especially in regard to high school academic achievement. Both HS GPA and ACT STEM score were statistically significant predictors of both four-year institution enrollment and STEM major selection. ACT English was a significant predictor of enrolling in a four-year institution but was not useful in predicting students' major. Whereas gender was not a significant predictor in institution type, it predicted students' selection of a STEM major. Additionally, both race/ethnicity (AI/AN) and NSLP status were significant predictors only in four-year institution enrollment while enrollment at a four-year institution was a significant predictor of selecting a STEM major.

Discussion

This study builds upon the limited knowledge about college choice and STEM major choice of Montanan students, a largely rural state. The majority of students in Montana enrolled into a four-year institution in this sample compared to a two-year institution, approximately 80% vs. 20% respectively, which contrasts to previous rural-context studies either at the national level or other states (Burke et al., 2015; Byun et al., 2017; Koricich et al., 2018). Findings indicate that although enrolling in either a two-year or four-year institution in Montana did not differ between males and females, race/ethnicity is a strong predictor of the likelihood that students enroll in a four-year, in-state institution. More specifically, among students who do not leave the state for postsecondary education, American Indian/Alaska Native students in Montana are more likely to enroll to a four-year institution than White students, but there is no statistical significance between Latinx and White students. This aligns with Lee and colleagues' (2017) recent study showing no college-matching gap for American Indian students compared to White students when academic qualifications and other background conditions are held equal. Notably, NSLP status is strongly predictive for public high school students in Montana to enroll into a four-year institution as students not eligible for free or reduced-price lunch are predicted to be 27% more likely than their free or reduced-price lunch counterparts.

Table 3

Logistic Regression Models for Major Choice Analysis

Factor	Model 1		Model 2		Model 3	
	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)
Constant	-2.03‡ (.12)	.13‡ (.10, .17)	-2.02‡ (.13)	.13‡ (.10, .17)	-2.93‡ (.21)	.05‡ (.03, .08)
Male	1.12‡ (.09)	3.05‡ (2.55, 3.66)	1.15‡ (.10)	3.17‡ (2.59, 3.89)	1.16‡ (.10)	3.19‡ (2.60, 3.91)
Full price lunch	.23 (.12)	1.25 (.998, 1.58)	-.10 (.13)	.91 (.71, 1.17)	-.14 (.13)	.87 (.68, 1.12)
AI/AN	-.40 (.24)	.67 (.41, 1.05)	.16 (.26)	1.17 (.70, 1.90)	.05 (.26)	1.05 (.62, 1.71)
Latinx	.03 (.24)	1.03 (.63, 1.63)	.20 (.26)	1.22 (.72, 2.00)	.16 (.26)	1.18 (.70, 1.93)
Other	-.02 (.24)	.98 (.60, 1.54)	.06 (.26)	1.06 (.63, 1.74)	.04 (.26)	1.04 (.62, 1.71)
HS GPA (ln)			1.93‡ (.37)	6.92‡ (3.40, 14.47)	1.61‡ (.37)	5.00‡ (2.44, 10.55)
ACT STEM			.18‡ (.02)	1.19‡ (1.15, 1.24)	.17‡ (.02)	1.18‡ (1.14, 1.23)
ACT reading			.01 (.01)	1.01 (.98, 1.03)	.01 (.01)	1.01 (.98, 1.03)
ACT English			-.02 (.02)	.98 (.95, 1.01)	-.03 (.02)	.97 (.95, 1.003)
Four-year institution					1.12‡ (.18)	3.07‡ (2.19, 4.42)
AIC	3,148.51		2,812.23		2,766.09	

Note. * = p < .05, † = p < .01, ‡ = p < .001.

As Koricich et al. (2018) found, the higher the SES of students, the greater the odds of attending postsecondary education and a four-year institution. In other words, SES has a strong, statistically significant relationship with postsecondary educational decisions. Higher-SES students also tended to have significantly higher chances of attending academically matched colleges and universities than did their lower-SES peers (Lee et al., 2017). As NSLP status is a proxy for SES, this may explain the lower college enrollment rate of this group. The findings that HS GPA, ACT STEM and ACT English scores are predictors for student enrollment in a four-year institution (Allensworth & Clark, 2019; Lee et al., 2017), particularly in a four-year institution in Montana, may be indicative of rural students considering college as increasingly necessary for occupational prospects (Tieken, 2016; Tieken & San Antonio, 2016). Although NSLP status matters for college enrollment, it does not for STEM major choice.

There are many factors that may affect students' choice of STEM majors such as intrinsic and extrinsic motivation, after-school programs, self-efficacy, gender, interest in STEM, family background, and race/ethnicity (Vu et al., 2019). Similar with previous studies (Mau, 2016; Vu et al., 2019), gender was statistically significant in students' choice for STEM majors. Male students are about three times as likely to choose a STEM major compared to their female counterparts in this study, while the odds of male gifted students are five times higher than female gifted students in Nebraska (Vu et al., 2019). This is similar to the pattern of gender differences in STEM major enrollment found using a national longitudinal data set (Jiang et al., 2020). High-school age is a critical stage to consider future occupations and college enrollment as well as college major choice, so the gender differences in STEM achievements at the high school level may lead to STEM major choice gaps during postsecondary education even though female students outperformed male students in STEM courses. However, race/ethnicity did not predict differences in the major choice for Montanan students like gifted Nebraska high school students. Notably, we found that the odds of selecting a STEM major at a four-year institution is three times higher than doing so at a two-year institution in this study, which is opposite to rural students in Canada as they are less likely to enroll in both STEM and non-STEM four-year programs compared with STEM and non-STEM at two-year institutions (Hango et al., 2019).

Study Limitations and Future Research

The present study has several limitations in examining high school graduates' college enrollment and STEM major choice in Montana. First, academic experiences and external factors such as teachers' expectations, advanced course-taking such as AP/IB, parental education, household incomes, school district ID are predictive for college enrollment (Byun et al., 2017; Corley, 2018; Kryst et al., 2018), but these variables are not available in this data set. Second, prior research showed that the farther rural graduates' high schools were from colleges, the more likely rural graduates were to enroll in a two-year institution or undermatch with a college (Burke et al., 2015). However, this study does not have specific information of students' high school distance to an enrolled college. Third, there is not available information about Montanan students' occupational plan in STEM fields to examine in relation to their college enrollment (Rosecrance, 2017). Fourth, we also were not able to examine students who either did not enroll in postsecondary education or enrolled in a different state, as we only have data on graduates who enrolled at an institution in Montana. Therefore, there may be ecological fallacies concerning the findings for race/ethnicity, as more White students may be leaving Montana for college than American Indian students. Prior research supports the likelihood of an ecological fallacy in this study, as "minority students are less likely than Whites to send scores (i.e., ACT or SAT) to and attend an out-of-state institution" (Niu, 2015, p. 342). Finally, we only knew students' initial major consideration at the enrolled college, not their graduated majors.

As NSLP status is a strong predictor of college enrollment in Montana, it is important to understand how to support Montanan students participating in the NSLP to increase their postsecondary access when food insecurity is currently a major concern for college students (Camelo & Elliott, 2019; Khosla et al., 2020). Also, considering that American Indian students are more likely to enroll into a four-year institution compared to White students, it is imperative to provide support programs, such as a structured college preparatory instruction designed for American Indian students, as graduation for this group is lower than Whites (National Center for Education Statistics, 2019). Additionally, we recommend that policies at the state and institution levels aim to increase the enrollment of American Indian students in postsecondary education, as nationally this group has the lowest college enrollment rate (Brown, 2017).

As only 20% of all US high school graduates and 2% of underrepresented minority students met the ACT STEM Readiness Benchmark in 2018 (Committee on STEM Education of the National Science and Technology Council, 2018) and only 23% of Montana high school students reported interest in STEM fields (ACT, 2019), understanding the motivations and conditions necessary to increase Montanan students' interest in STEM and obtain STEM college readiness warrants further research. For example, researchers could investigate available professional development for STEM teachers to be role models or what STEM labor information in Montana is available for high school students to increase their STEM interest and college readiness (Kryst et al., 2018; Lee et al., 2017). Furthermore, our study indicates a striking gender disparity in STEM major choice in Montana. Therefore, future research should investigate what factors attract and engage female students to STEM majors, such as student counseling in high school or college-level advanced course-taking (Shewach et al., 2019). Also, future studies should use data that include students' high schools to assess how Montana contextual location contributes to students' STEM major choice. Qualitative research could examine students' occupational intentions and motivations to stay or mobilize for their jobs after graduation (Hango et al., 2019) to meet the future STEM workforce in Montana or the available labor demands.

Conclusion

The findings from this study are highly relevant, as the data set included recent high school graduates from the 2013-2017 academic years. As rural context varies from state to state, this study provides a more complete picture of college enrollment patterns and major selection among students from a largely rural state who enrolled in a Montana postsecondary institution. Although our findings about gender and free or reduced-price lunch are consistent with prior research, importantly, our findings complicate trends provided in national data concerning postsecondary enrollment patterns and STEM major selection of American Indian students.

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Appendix
Logistic Regression Models for Major Choice Analysis Including Outliers

Factor	Model 1		Model 2		Model 3		Model 4	
	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)	β (SE)	OR (95% CI)
Constant	-2.00‡ (.12)	.14‡ (.11, .17)	-1.98‡ (.13)	.14‡ (.11, .18)	-2.83‡ (.20)	.06‡ (.04, .09)	-4.49‡ (.59)	.01‡ (.003, .04)
Male	1.10‡ (.09)	3.01‡ (2.52, 3.60)	1.14‡ (.10)	3.11‡ (2.55, 3.82)	1.14‡ (.10)	3.12‡ (2.55, 3.83)	2.90‡ (.61)	18.20‡ (6.46, 76.21)
Full price lunch	.21 (.12)	1.23 (.98, 1.55)	-.12 (.13)	.89 (.70, 1.14)	-.16 (.13)	.85 (.67, 1.10)	-.16 (.13)	.85 (.67, 1.10)
AI/AN	-.42 (.24)	.66 (.40, 1.03)	.14 (.25)	1.15 (.68, 1.86)	.03 (.26)	1.03 (.61, 1.67)	.03 (.26)	1.03 (.61, 1.67)
Latinx	.02 (.24)	1.02 (.63, 1.61)	.18 (.26)	1.20 (.71, 1.97)	.15 (.26)	1.16 (.69, 1.90)	.14 (.26)	1.15 (.68, 1.89)
Other	-.03 (.24)	.97 (.60, 1.53)	.05 (.26)	1.05 (.63, 1.72)	.03 (.26)	1.03 (.61, 1.70)	.03 (.26)	1.03 (.61, 1.68)
HS GPA (ln)			1.88‡ (.37)	6.56‡ (3.24, 13.64)	1.57‡ (.37)	4.81‡ (2.36, 10.09)	1.58‡ (.37)	4.84‡ (2.37, 10.13)
ACT STEM			.18‡ (.02)	1.19‡ (1.15, 1.24)	.17‡ (.02)	1.18‡ (1.14, 1.23)	.17‡ (.02)	1.18‡ (1.14, 1.23)
ACT reading			.01 (.01)	1.01 (.98, 1.03)	.005 (.01)	1.00 (.98, 1.03)	.01 (.01)	1.01 (.98, 1.03)
ACT English			-.02 (.02)	.98 (.95, 1.01)	-.03 (.02)	.98 (.95, 1.004)	-.03 (.02)	.97 (.95, 1.003)
Four-year institution					1.05‡ (.17)	2.85‡ (2.05, 4.06)	2.56‡ (.59)	12.88‡ (4.83, 52.47)
Male × four-year institution							-1.86† (.61)	.16† (.04, .45)
AIC	3,160.95		2,830.14		2,788.64		2,776.28	

Note. * = $p < .05$, † = $p < .01$, ‡ = $p < .001$.

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Defining Rural: The Impact of Rural Definitions on College Student Success Outcomes

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Rural students have unique characteristics that necessitate further exploration when analyzing assessment and student success data. From assessment, programming, and policy standpoints, intentionality in selection of a definition of rural is critical to prevent making inappropriate or inaccurate decisions. In this study, we sought to compare three definitions of rurality to better help understand this issue and to select a definition that we believe is most appropriate for use at a large research institution in a largely rural state.

***Keywords*: higher education, rural, student success outcomes, retention, graduation**

Southern University (pseudonym) is a large, public, land-grant research institution in a predominately rural state (regardless of the definition of rural). To support students' academic success, this institution tracks and evaluates multiple measures of student success research, including metrics for academic performance, retention, and graduation. In recent years, a strategic approach to measuring student success outcomes for students from rural areas has been implemented at Southern University. Rural students have unique characteristics that necessitate further exploration when analyzing assessment and student success data. This is particularly important when considering retention rates and graduation rates, common metrics at the university and system level for student success and institutional effectiveness, as rural students have lower attendance and graduation rates (National Student Clearinghouse, 2019).

Before arriving to college, students from rural areas are likely to face significant challenges that their suburban and urban peers may not have encountered. Rural students are more likely to have lived in poverty and to have attended a low-resource school (Brown & Swanson, 2003; Provasnik et al., 2007) with less emphasis on college readiness (Ardoin, 2017; Ditillo, 2019; Lichter et al., 2003) and fewer high-quality teachers (Demi et al., 2010; Monk, 2007). Students from rural areas are less likely than their suburban or urban counterparts to have attended a school that offered Advanced Placement courses (Gagno & Mattingly, 2016; Gibbs, 2003; Provasnik et al., 2007), to have had access to guidance counselors (Griffin et al., 2011; Provasnik et al., 2007, Wimberly & Brickman, 2014), and to have a parent (or known an adult) who attended college (Demi et al., 2010; Provasnik et al., 2007). Americans from rural areas are less likely to hold a college degree than peers from suburban or urban areas, and additionally, fewer young adults from rural areas enroll in college than peers in suburban areas (National Student Clearinghouse, 2019; Provasnik et al., 2007). These pre-college challenges may impact academic success, including retention and graduation rates, for rural students as they continue their education in college.

A number of other factors influence student success as well in addition to a student's geographic origin. When exploring student success outcomes, educational researchers often factor in academic success proxies such as SAT/ACT scores, effort proxies such as high school GPA, first term GPA in college, and personal characteristics such as gender, race/ethnicity, socioeconomic status, and first-generation college student status. A body of literature in higher education research suggests that these elements influence student success, and students' place of geographic origin may as well.

For several years Southern University has made efforts to systematically define, identify, and study students from rural areas for focus in student learning outcomes assessment and institutional student success research using a county-level rurality definition (Isserman, 2005) that we believed most accurately captures the rural character of the state. However, there are competing, and sometimes conflicting definitions of rurality (Cromartie & Bucholtz, 2008), and selection of one particular definition over another may impact outcome analysis and subsequent decisions made using the data.

Increasing student success outcomes for rural students in the state recently became a system-wide strategic planning goal for the university system in which Southern University is a part. Prior to the university system's decision to select a definition for rurality, Southern University had informally adopted a rurality definition and used it to analyze assessment data for several years. Upon implementation of the new system-wide definition and knowing that definitions of rurality can vary, we considered the importance of comparing several definitions of rurality to assess the influence each definition had on student success analyses. We believed it was important to select a definition of rurality that most accurately captured the essence of the state and student population. Hawley et al. (2016) note, "failure to clearly label and define a key theoretical construct such as rurality invites misinterpretation, which threatens the validity of inferences one may generalize from the study" (p. 4).

To effectively and accurately measure outcomes for rural college students, we must be able to define rurality. From assessment, programming, and policy standpoints, intentionality in selection of a definition of rurality is critical to prevent making inappropriate or inaccurate decisions. In this study, we compare three definitions of rurality to better understand how they can affect what we report, whom we serve, and decisions we make as a campus. It is noteworthy that although the three definitions may differ in how they parameterize rurality, their underlying philosophy is fundamentally similar. All three schemes view rurality through the lens of socio-geographic locality, a perspective embraced by a majority of policymakers and social science researchers (Boix-Tomàs et al., 2015; Brown & Schafft, 2011; Burton et al., 2013; Nelson, 2016). Despite acknowledging and even incorporating social, economic, and cultural factors that shape rurality, classifications that subscribe to rurality as locality naturally overemphasize the roles of geographic place and population size and density. Thus, as a social construct, rurality is defined not by the physical space but by the people who occupy it and the social, moral, and cultural values and community affiliation they view at the crux of being rural (Brown & Schafft, 2011). While recognizing the value of the social constructivist approach, it is important to note the definitions used in this study focus on rurality as a quantifiable place rather than social construct.

Defining Rural: Issues and Selected Definitions

Researchers generally agree that the extant literature has failed to establish and apply a consistent definition that accurately depicts the rural context (Isserman, 2005; Nugent et al., 2017). Instead, rural education studies typically default to commonly used rurality classification codes often with little consideration for their inherent assumptions and limitations. Faulty representations of what is rural preclude us from accurately assessing and understanding the issues rural individuals face. The consequences may be misguided policies and decisions that fail to effectively fund and support rural people and communities. In this section we provide a table comparing the criteria for each of the three

Table 1
Comparison of Rurality Definitions Used in Study

Rurality definition	Definition description
Rural–Urban Density Typology (Isserman, 2005)	• "Rural county: (1) The county's population density is less than 500 people per square mile, and (2) 90 percent of the county population is in rural areas or the county has no urban area with a population of 10,000 or more. The density requirement is the same used to distinguish urban and rural census blocks, and the urban area threshold mimics the urban cluster requirement that defines micropolitan core areas. The 90 percent requirement screens out low-density counties with substantial urban populations, but it has no official precedent or standing. • Urban county: (1) The county's population density is at least 500 people per square mile, (2) 90 percent of the county population lives in urban areas, and (3) the county's population in urbanized areas is at least 50,000 or 90 percent of the county population. The density and the 90 percent requirement serve as above, and 50,000 is the urbanized area threshold for the nucleus of a metropolitan county. The second part of the third criterion is only necessary because independent Virginia cities are treated as counties statistically; it designates as urban counties some independent cities that have fewer than 50,000 residents but are entirely or almost entirely within larger urbanized areas that spill over their borders. • Mixed rural county: (1) The county meets neither the urban nor the rural county criteria, and (2) its population density is less than 320 people per square mile. That density is two acres per person; it has no official standing but seems reasonable. • Mixed urban county: (1) The county meets neither the urban nor the rural county criteria, and (2) its population density is at least 320 people per square mile. Thus, mixed urban counties are almost two-thirds of the way from no population to the urban density threshold of 500 people per square mile." (p. 475)
USDA ERS Rural Urban Continuum Code	Metropolitan counties 1. Counties in metro areas of 1 million population or more 2. Counties in metro areas of 250,000 to 1 million population 3. Counties in metro areas of fewer than 250,000 population Nonmetropolitan counties 1. Urban population of 20,000 or more, adjacent to a metro area 2. Urban population of 20,000 or more, not adjacent to a metro area 3. Urban population of 2,500 to 19,999, adjacent to a metro area 4. Urban population of 2,500 to 19,999, not adjacent to a metro area 5. Completely rural or less than 2,500 urban population, adjacent to a metro area 6. Completely rural or less than 2,500 urban population, not adjacent to a metro area (USDA, 2013).

University System Class definition	This definition groups counties in the state into 3 classes in terms of level of economic distress. Class One counties are the 40 counties with the highest annual distress ranking (using metrics from the below criteria), Class Two counties are the next highest 40 ranking counties, and Class Three counties are the 20 counties with the lowest level ranking. Criteria used to determine Class status: • Average unemployment rate for the most recent twelve months for which data are available (October 2016–September 2017, Department of Commerce). • Median household income for the most recent twelve months for which data are available (2015, U.S. Census, Small Area Income & Poverty Estimates). • Percentage growth in population for the most recent 36 months for which data are available (July 2013–July 2016, Office of State Budget & Management). • Adjusted property tax base per capita for the most recent taxable year (FY 2016–17, Department of Public Instruction). Automatic qualifying criteria for Class One and Class Two status: • A county with a population of less than 50,000 people Automatic qualify criteria for a Class One county • A county must be Class One for at least two consecutive years • A county with less than 12,000 people • A county with a population less than 50,000 people AND a poverty rate of 19% or greater

definitions of rurality we applied to this study: The USDA ERS Rural Urban Continuum Codes, abbreviated as USDA ERS RUCC (U.S. Department of Agriculture, 2013), the Rural–Urban Density Typology (Isserman, 2005), and the new university system Class definition. We then briefly describe the benefits and drawbacks of each.

The Rural–Urban continuum codes of the USDA ERS are the classification most frequently applied in rural education studies (Nugent et al., 2017). At the core of the USDA ERS coding lies the county-level classification of the Office of Management and Budget (OMB). Using counties as the smallest geographic unit, the OMB designates metropolitan and micropolitan areas that pivot around urbanized areas of 50,000 or more people, and urban clusters of 10,000 to 49,000 people (OMB, 2013). Together, metropolitan and micropolitan areas form core based statistical areas, and the remaining counties make up the outside core. Contiguous counties may join core areas based on employment measures. Building on OMB's metropolitan and micropolitan designations, the USDA ERS refines the classification by further dividing metropolitan areas into three metro categories according to population size (i.e., 1 million or more, 250,000 to 1 million, fewer than 250,000) (USDA, 2013). Additionally, the USDA ERS labels micropolitan and outside core areas as non-metro areas. These non-metro areas are classified into six categories based on population size (i.e., 20,000 or more, 2,500 to 19,999, and less than 2,500) and contiguity to metro areas. A benefit of these codes is that unlike some county-level definitions, they provide a higher level of population specific information per county. However, rural/urban mixture within a county is often still lost as proximity to the metro core areas can suppress a true measure of rurality in those counties as is the case in many counties in the state in which Southern University is located. In the case of many counties flagged as any of the three metro types (46%), an informed policymaker and most citizens would agree that qualitatively and practically these counties house a multitude of communities that are not metropolitan or influenced by metropolitan areas in the county. There are often cases of rural "overbounding" or "inclusion of large rural expanses not intimately related to a metropolitan core" (Morrill et al., 1999, p. 730). Another drawback is the practical use of the nine levels of classification. In our case, working with educational data even at a large institution across multiple cohort years, there are too few students from many of the levels for statistical analysis. Thus, to have enough students per cell for analysis, we must conflate the levels, resulting in a Rural–Urban dichotomy, one which does not allow us to look at a mixture by county with a number of counties that are perhaps rural in character being pulled into the urban block.

The next definition we consider is the university system definition recently adopted by the university system of which Southern University is a part. This definition was developed by the state's department of commerce. Using rankings based on four economic indicators (unemployment rate, median household income, population growth, and adjusted property tax base per capita), the department of commerce classifies its counties into one of three classes to indicate the level of economic distress. Class One counties represent the most economically distressed counties whereas Class Three counties are the least distressed. A state statute establishes how counties are distributed across Class, with 40 counties allocated to Class One, 40 to Class Two, and 20 to Class Three. The university system's adaptation of this definition considers students as rural if they are from counties that were classified as Class One and Class Two counties in the year 2016. This definition relies on the relationship between economic development and population density to classify rurality as it was not specifically developed to be a rurality definition but rather an economic distress indicator. Given the statute requiring counties to be divided into Class Three, Class Two, and Class One in groups of 40/40/20, respectively (i.e., there must be 40 Class Three, 40 Class Two, and 20 Class One counties), rurality for many counties will be artificially constructed and limited. This definition also does not account for mixture within a county. Nonetheless, given the relationship between economic development and population density in the state, the Class One and Class Two counties are mostly (that is, fairly often but not entirely) defined as most rural by other definitions as well. However, there are a roughly a dozen Class Three counties that have a significant number of towns with small populations and/or population density that by this definition are considered urban.

To overcome the limitations inherent in federal urban–rural classifications, some researchers developed alternative coding schemes. Isserman's (2005) Rural–Urban Density Typology builds on OMB's urban core and census density standards to also recognize spaces where urban and rural blend. The Rural–Urban Density Typology makes classifications at the county level by creating distinctions for when counties are predominately urban, predominately rural, or a blend of the two: mixed rural or mixed urban. According to Isserman's typology, counties can be rural (fewer than 500 persons per square mile and 90% of population residing in rural places), urban (minimum 500 persons per square mile and 90% of population residing in urban places), mixed rural (fewer than 320 persons per square mile but does not meet rural county criteria), or mixed urban (minimum 320 persons per square mile but does not meet urban county criteria). Using the Rural–Urban density typology attributes 85% of the nation's 55 million rural people, as defined by the U.S. Census, to rural and mixed rural counties and only 5% to urban counties. In contrast, integrating both the Rural–Urban typology and metro/non-metro distinction places 36% of the rural population in metropolitan counties that are rural or mixed rural. Thus, a benefit of the Rural–Urban typology definition is that counties are not homogenous, and this definition accounts for admixture within counties. This helps derive a sense of the rural character of an area given the number of small towns/communities outside the influence or commuting vicinity of urban centers. However, this definition, like all, is not without flaws. Waldorf & Kim (2015) note that while the tail ends of urban and rural are well-defined (and many of those that fall in the mixed categories), there is still the issue that in many cases, "groups of counties that do not meet either the rural or urban thresholds are only differentiated by a population density threshold of above versus below 320 persons per square mile" (p. 6), and that Isserman's threshold of 320 (like any of the threshold cutoffs for any given definition) is somewhat "arbitrary."

Nonetheless when we look at the county breakdown of the state in which Southern University is located using the Rural–Urban Density Typology and considering insider knowledge of local economies, commuting patterns, and influence of urban centers, the researchers originally believed that this definition most accurately captured the rural nature of more of the state's counties. However, with this definition, one can also encounter similar issues as the USDA ERS Rural Urban Continuum Codes—depending on the population of interest for analysis, one may not have enough observations per level, in which case conflation is necessary. In most cases for analyses at Southern University, this does not present an issue. However, for the purpose of this study (as described in more detail in subsequent sections) we conflated the four-category Rural–Urban Density Typology into a rural/urban binary so that we could make a consistent rural/urban comparison across all three definitions (as noted, USDA ERS RUCC also had too few observations from each of the nine categories and the decision was made to conflate into rural/urban).

In Table 2, we offer a county-level comparison of three rurality definitions (as binary definitions) and classification of rurality. It is important to note that there is variation in the amount of overlap between all three definitions in terms of which counties are considered rural. When comparing the university system Class definition to the Rural–Urban Density Typology definition, we see that the university system Class definition classifies 15 counties as non-rural that are considered rural by the Rural–Urban Density Typology. The Rural–Urban Density Typology lists five counties as non-rural that are considered rural by the university system Class definition. The university system Class definition and Rural–Urban Density Typology have the greatest amount of classification overlap relative to the USDA ERS RUCC classification.

Table 2

State County-Level Classification by Rurality Definitions

Rurality Classification by County	University System Class definition		Rural–Urban Density Typology (Isserman, 2005)		USDA Rural Urban Continuum Codes	
	N	%	N	%	N	%
Non-Rural County	**20**	**20.0%**	**10**	**10.0%**	**46**	**46.0%**
Rural County	**80**	**80.0%**	**90**	**90.0%**	**54**	**54.0%**

Table 3

Comparison of County Classification of University System Class definition and Rural–Urban Density Typology

University System Class Definition	Rural–Urban Density Typology	
	Number of Non-Rural Counties	Number of Rural Counties
Number of Non-Rural Counties	5	15
Number of Rural Counties	5	75

Comparing the university system Class definition to the USDA ERS RUCC classification, we find that the USDA classifies 30 counties as non-rural that are classified as rural by the university system definition. The university system definition only classifies four counties as non-rural that are considered rural by the USDA definition. The USDA ERS RUCC definition classifies the most counties as non-rural (falling into one of the "metro" categories) out of all three definitions. All 10 counties considered non-rural under the Rural–Urban Density Typology are also considered non-rural by the USDA definition. There are only five counties that are considered urban by all three definitions. These counties are home to four of the state's major urban centers. There are 50 counties (1/2 of the counties in the state) that are considered rural by all three definitions.

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Research Question

Our study centered on the following question: How do findings for college student success measures vary by the definition of rurality applied?

Methods

To answer our research question, we conducted logistic regression for success outcomes (second-year retention and six-year graduation) for Southern University students using three different definitions of rural: Rural–Urban Density Typology, USDA ERS Rural Urban Continuum Codes, and the university system Class definition.

The data used to answer these questions are from historical student records from in-state, full-time, first-time undergraduate students from three incoming freshmen cohorts at the institution: 2009, 2010, and 2011. Student record data included 12,079 observations from the three cohorts combined.

Table 4

Comparison of County Classification of USDA ERS RUCC and University System Class Definitions

	USDA ERS RUCC Definition	
University System Class Definition	Number of Non-Rural Counties	Number of Rural Counties
Number of Non-Rural Counties	16	4
Number of Rural Counties	30	50

In this article, we focus on findings for comparison of definitions and outcomes for second-year retention and six-year graduation as those are student success outcomes identified for improvement at the study institution. Using each definition, we constructed logistic regression models using second-year retention and six-year graduation as response variables. The response variable for retention was classified as either *retained* or *not retained* with a dummy variable value of one or zero, respectively. Similarly, six-year graduation was recorded as a value of one if the student graduated in six years and zero if not.

The logistic regression models included student demographics as well as a term to index a student's rural or urban background using one of the three definitions as covariate. The rurality covariate was derived from the county of residence provided on each student's initial application to the university. As previously noted, a number of student background characteristics and academic success and performance (effort) have been noted to influence retention and graduation in higher education literature. The control variables we included in retention and graduation models were gender, first generation college student status[i], and race/ethnicity using Integrated Postsecondary Education Data System (IPEDS) classifications along with Southern University's definition of underrepresented minority (Black or African American, Hispanic, American Indian or Alaska Native, Hawaiian or Other Pacific Islander) to create a variable underrepresented minority (URM or non-URM). In this study, we used Pell status as a proxy for low income (Cahalan & Perna, 2015) and included a variable indicating whether or not the student received a Pell grant. We also controlled for college (the first college the student entered at Southern University grouped by Science, Technology, Engineering and Math (STEM) vs. non-STEM colleges) because some colleges at the study institution, particularly STEM majors, may have slightly longer time to degree. We also included SAT score (math and verbal) as we have previously found higher SAT scores to be associated with higher rates of retention and graduation on this campus and high school GPA to represent effort/academic performance. We also included a variable for total test credits brought into Southern University. Specific to the institution, we included variables for the number of credit hours passed in the first term at Southern University and cumulative first term GPA at Southern University. There is evidence that the number of credits taken during the first semester of college can potentially impact graduation (Attewell & Monaghan, 2016), and at the study institution, internal studies have suggested that a higher number of credit hours attempted and passed in the first term is correlated with higher likelihood of graduating in less than six years. Additionally, at Southern University, student outcome analyses consistently suggest that a student's first term GPA is a strong predictor of their final GPA.

For this analysis, as noted, we made all the definitions binary for comparison. The necessity of collapsing rural categories as such when modeling using threshold definitions is a noted limitation (Waldorf & Kim, 2015). For the Rural–Urban Density Typology, we conflated rural and mixed rural into a single rural category and urban and mixed urban in to a single urban category. Similarly, for USDA ERS Rural Urban Continuum Code, we combined all six nonmetropolitan classifications into a single rural category, and all three metropolitan classifications into a single urban category. For the university system definition, following university system guidelines, Class One and Class Two counties were considered rural and Class Three counties were considered urban.

All variables listed above were initially included in models for second-year retention and six-year graduation, and a backward selection process was used to remove nonsignificant covariates in order to achieve more parsimonious models. Initial models were run without inclusion of interaction terms for variables of interest, and subsequent models included interactions between rural typology variables and other variables of interest to explore potential interactions between variables such as rurality and first-generation status, SES, etc. We compared the adjusted R2 and AIC of the models (with and without interactions) along with concordant pairs to determine the best fitting models.

Table 5

Population Captured as "Rural" in Each Definition, 2009–2011 Cohorts Combined

Rurality Definition	% of Incoming First Year Students 2009–2011 at Southern University Considered Rural (In-state students only)
USDA ERS RUCC	15% (N=1829)
University System Class Definition	34% (N=4049)
Rural–Urban Density Typology	45% (N=5468)

Findings

As demonstrated in Table 5, the number of students considered rural varies greatly by definition used, ranging from 15% of the incoming student population from 2009–2011 being considered rural with the USDA ERS RUUC non-metro category, up to 45% using the Rural–Urban Density Typology.

Using the three definitions, we compared retention and graduation outcomes for second-year retention and six-year graduation. Despite differences in the populations captured by definition, the retention and graduation rates for rural students were fairly similar across all three definitions (Table 6).

Regression Models

For second-year retention, models using the three distinct definitions tell a similar story (Table 7). In all three models, rural students, however defined, are less likely to be retained after their second year than students from non-rural areas. Additionally, all three models suggest that first generation college students are less likely to be retained, but there were no significant interactions in any of the models between first generation status and rurality. A higher first term GPA, higher number of test credits brought in, and receiving a Pell grant predicted higher likelihood of returning after the second year. Notably, across all three definitions, rural students posted a lower first term GPA, which has historically been a strong predictor of retention and graduation at the study institution.

Table 6

Second-Year Retention and Six-Year Graduation Rates by Rurality Definition, 2009–2011, First Year Cohorts Combined, Southern University

Rurality Definition	2nd-Year Retention Rural Students	2nd-Year Retention Urban Students	6-Year Graduation Rural Students	6-Year Graduation Urban Students
USDA ERS RUCC	81.5% (N=1492)	86.7% (N=8893)	62.3% (N=1141)	68.2% (N=6990)
University System Class Definition	82.7% (N=3351)	87.6% (N=7034)	63.1% (N=2556)	69.4% (N=5575)
Rural–Urban Density Typology	83.6% (N=4574)	87.9% (N=5811)	64.5% (N=3535)	69.5% (N=4596)

Table 7

Second-year retention for 2009–2011 First Year Cohorts Combined, Southern University by Rurality Definition

Variable	Estimate	Rural–Urban Density Typology	University System Class Definition	USDA ERS RUCC
Intercept	B	0.4795	0.4687	0.448
	SE	0.2676	0.2685	0.2654
	OR		.	
Total Test Credits from High School	B	0.0225	0.0221	0.0221
	SE	0.00549	0.00551	0.00548
	OR	1.023	1.022	1.022
First Term GPA	B	1.0613	1.0603	1.0649
	SE	0.0336	0.0337	0.0336
	OR	2.89	2.887	2.901
Hours Passed First Term	B	x	x	x
	SE	x	x	x
	OR	x	x	x
Rural Variable*	B	-0.1704	-0.144	-0.269
	SE	0.0588	0.0613	0.0746
	OR	0.843	0.866	0.764
Student's First College**	B	-0.1547	-0.1534	-0.15
	SE	0.0589	0.059	0.0588
	OR	0.857	0.858	0.861
SAT Verbal Score	B	-0.00262	-0.00264	-0.003
	SE	0.00045	0.000449	0.00045
	OR	0.997	0.997	0.997
SAT Math Score	B	x	x	x
	SE	x	x	x
	OR	x	x	x
First Generation Status***(First gen)	B	-0.2497	-0.2482	-0.244
	SE	0.1003	0.1003	0.1003
	OR	0.779	0.78	0.783
First Generation Status (FG Status Unknown)	B	-0.2803	-0.2858	-0.287
	SE	0.0688	0.0688	0.0685
	OR	0.756	0.751	0.751

Variable	Estimate	Rural–Urban Density Typology	University System Class Definition	USDA ERS RUCC
Pell Grant Recipient ****	B	0.1661	0.165	0.1647
	SE	0.0658	0.0659	0.0659
	OR	1.181	1.179	1.179
High School GPA	B	x	x	x
	SE	x	x	x
	OR	x	x	x
Race (Non-URM is reference group)	B	x	x	x
	SE	x	x	x
	OR	x	x	x
Gender (Male is reference group)	B	x	x	x
	SE	x	x	x
	OR	x	x	x

*Different definition for each model; rural is the reference group
**Student's first college in a STEM college is the reference group
***Non-first-generation college student is the reference group
****Non-Pell Grant recipients are the reference group

Looking at six-year graduation (Table 8), we see a slightly different trend when comparing definitions. Comparing the most parsimonious models (again, those that did not include interactions between any of the variables), both the Rural–Urban Density Typology and the USDA ERS RUCC definition models include rurality as a significant factor influencing six-year graduation (rural students are less likely to graduate in six years than urban peers). The university system Class definition model does not include rurality as a significant variable. Additionally, the university system Class definition model includes Pell recipient status as a significant variable, with students who receive Pell less likely to graduate in six years than those who do not. However, despite these differences in the models, they do pattern similarly in that all three predict higher odds of graduating with more test credits brought in, higher first term GPA, higher number of hours passed first term, being female, and first college being non-STEM. All three models again suggest higher SAT verbal score as being a negative predictor of graduation in six years.

Discussion and Conclusions

All three definitions tend to capture the most rural counties in the state well. It is evident that students from the most rural counties (which are also often the most economically challenged) are not retained and do not graduate at the same rates as their peers (National Student Clearinghouse, 2019). However, some definitions, like the university system Class definition and the USDA ERS RUCC, may fail to include rural students in mixed rural/urban counties. This is notable as Isserman (2005) suggests that most counties in the U.S. have a heterogeneous mixture of rural and urban. This potential imprecision matters because students who live in small towns and rural communities in counties that contain an urban center often face similar challenges as students who lives in small towns and rural communities in counties without an urban center. For example, they might have the same feelings of being academically underprepared (Ditillo, 2019) and face challenges navigating a new environment (Ditillo, 2019; Stone, 2017). As such, we might expect similar outcomes for them in college.

Table 8.

Six-Year Graduation for 2009–2011 First Year Cohorts Combined, Southern University by Rurality Definition

Variable	Estimate	Rural–Urban Density Typology	University System Class Definition (No interactions)	USDA ERS RUCC
Intercept	B	-1.1981	-1.3613	-1.207
	SE	0.1938	0.1887	0.1913
	OR	x	x	x
Total Test Credits from High School	B	x	x	x
	SE	x	x	x
	OR	x	x	x
First Term GPA	B	0.8744	0.8777	0.8761
	SE	0.0307	0.0306	0.0306
	OR	2.398	2.405	2.402
Hours Passed First Term	B	0.0216	0.0215	0.0216
	SE	0.0024	0.00241	0.0024
	OR	1.022	1.022	1.022
Rural Variable*	B	-0.087	x	-0.162
	SE	0.0435	x	0.0581
	OR	0.917	x	0.85
Students' First College **	B	0.1552	0.1583	0.157
	SE	0.0439	0.0438	0.0439
	OR	1.168	1.172	1.17
SAT Verbal Score	B	-0.0019	-0.0019	-0.002
	SE	0.0003	0.00032	0.0003
	OR	0.998	0.998	0.998
SAT Math Score	B	x	x	x
	SE	x	x	x
	OR	x	x	x
First Generation Status*** (First gen)	B	-0.2332	-0.2219	-0.236
	SE	0.0502	0.0516	0.0498
	OR	0.792	0.801	0.79
	B	-0.1843	-0.1717	-0.183

Variable	Estimate	Rural–Urban Density Typology	University System Class Definition (No interactions)	USDA ERS RUCC
First Generation Status*** (First gen status unknown)	SE	0.076	0.0763	0.076
	OR	0.832	0.842	0.833
Pell Grant Recipient****	B	x	-0.0976	x
	SE	x	0.0493	x
	OR	x	0.907	x
High School GPA	B	x	x	x
	SE	x	x	x
	OR	x	x	x
Gender (Male is reference group)	B	0.2628	0.2653	0.263
	SE	0.0438	0.0438	0.0438
	OR	1.301	1.304	1.301
Race (Non-URM is reference group)	B	-0.2806	0.1219	-0.276
	SE	0.0534	0.0272	0.0532
	OR	0.755	1.276	0.759

*Different definition for each model; rural is reference group
**Student's first college in a STEM college is the reference group
***Non-first-generation college student is the reference group
****Non-Pell Grant recipients are the reference group

While second-year retention models performed similarly, the six-year graduation model using the university system Class definition suggested that *rurality is not a significant predictor of student performance*. Further exploring this finding is critical. The results generated from the Class definition may be misleading due to the fact that a number of counties with a significant number of rural communities are considered Class Three (urban) and thus are excluded from being considered rural. While the Class status might capture economic indicators for the county *at large*, it may not accurately capture the rural character of the county. This finding presents a possible issue as we assess performance indicators and make decisions about programming and interventions to support rural students. As a university level metric, the Class definitions yield graduation rates for rural students that appear higher given the omission of several key counties. However, knowing that rural students face challenges that urban students do not, by using this definition we miss out on identifying rural students for interventions. These students who then might not be targeted for interventions are still captured in the university's overall graduation rates (for example, the previously listed counties account for 12% of the population in this study; N=1432).

As previously noted, rural scholars suggest that rurality is not just about metrics; it is multidimensional and sociocultural. As Hawley et al. (2016) note, "a one-size fits all definition ranks somewhere between dictatorial and chimerical" (p. 4). Therefore, for practitioners in higher education, it may be important to use multiple measures, context, and judgment when making decisions about rural students and what definition is applied.

Considering rurality from multiple lens or definitions can more holistically assess how this element can shape both students' pre-college experiences and postsecondary education success. Definitions should be sensitive to state, county, and community knowledge. This means that any one definition will inevitably miscategorize some students who perhaps then do not receive the appropriate services and be at a higher risk for not completing.

Across definitions, our analyses suggest that outcomes are generally lower for rural students. However, as we noted, the university system Class definition's exclusion of several counties with rural populations may mask some issues tied to graduation rates and student support. The results of these analyses suggest that as we continue analyzing student success data, we must systematically identify rural students and evaluate outcomes for this population. We must also continue to be thoughtful and intentional about how we define rural and whom we might be including or excluding depending on our definition. As researchers and practitioners, we must balance efficiency and practicality when making distinctions such as defining rurality and continually reflect upon and leverage the state, county, and community level knowledge that our campus and community stakeholders can provide to develop the most accurate ways of operationalizing rurality. As the push to support rural college student access and success increases nationally, this study (although institutionally specific) may serve to spur critical thought and action among both assessment/institutional research practitioners in higher education as well as researchers as they consider how they approach defining rural students on their campuses.

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End Notes

[i] In this study we use the Federal TRIO definition: "(A) an individual both of whose parents did not complete a baccalaureate degree; or (B) in the case of any individual who regularly resided with and received support from only one parent, an individual whose only such parent did not complete a baccalaureate degree."

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High School Sport Participation Intensity and Breadth: Relationships with Academic Achievement in a Rural Midwestern High School

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The purpose of this study was to address the gap in research related to whether measures of participation (intensity and breadth) demonstrated a relationship with academic achievement for 11th grade student athletes (*N*=128) in a rural Midwestern high school. Anonymous athletic participation and achievement data from 2015-2017 was obtained from the school's archive and analyzed by correlation, hierarchical regression, and one-way ANOVA. Data derived from statistical analyses demonstrated two outcomes regarding sport participation, ACT, and GPA: (a) Intensity demonstrated no statistical significance to student achievement measured by ACT, however intensity demonstrated a statistically significant relationship to cumulative GPA ($p < .05$), and (b) ANOVA analysis demonstrated statistically significant differences in breadth and GPA ($p < .01$) between one sport athletes and three sport athletes. Three sport athletes had statistically significantly higher GPAs than one sport athletes and significantly higher GPAs than two sport athletes. The research was limited to one cross-sectional heterogeneous rural high school population of participants over a three-year period. Furthermore, the study was limited to school-specific athletic participation data as school non-athletic activity and out-of-school activity participation was not available. Results from this study suggest programming and potential practice recommendations for rural school leaders. Future research on ESA sport, activity, and non-school activity participation intensity and breadth related to academic outcomes is justified.

***Keywords*: multisport, academic achievement, social bonds, extracurricular school activities (ESAs), athletic participation**

From 1989-2018 overall participation in interscholastic athletics in the United States experienced an increase for 29 consecutive years (Niehoff, 2020). During the same time, participation in out-of-school structured activities for students ages 12-17 also experienced an overall increase in participation (Moore et al., 2014). This increase, while beneficial for socialization, development, and overall health, can come at the expense of other positive undertakings, such as academic achievement (Coleman, 1961; Marsh, 1992; Marsh & Kleitman, 2002). For example, a student who participates in a non-school select gymnastics team, which travels extensively for much of the school year, may miss out on days of instruction in the school setting, opportunities for instructional feedback, and opportunities to participate in a breadth of school activity offerings. Further complicating the matter, the demand of time, rigor, and pressure related to high school academics has also increased for students (Tavani & Losh, 2003). How does a 21st century student experience positive social and developmental outcomes from activity participation without detracting from the necessary time required to be successful academically?

Extracurricular school activities (ESAs), a construct popularized by Marsh and Kleitman (2002), have been of specific research interest due to growing popularity of school activity participation as compared to non-school leisure activities. The extant literature review regarding what researchers and practitioners defined as "extra," "curricular," or "school-related" is often ambiguous and nuanced, thus it is critical for researchers to define the term clearly to assess implications (Bartkus et al., 2012; Marsh & Kleitman, 2002). The dichotomy of organized sport in the United States for high school students is increasingly intertwined between non-school opportunities and ESAs. On one hand, schools urge students to participate in as many activities (including sports) as possible to provide the most holistic developmental learning experience possible, while on the other hand, societal pressures exist to specialize in specific activities in order to win championships, garner elite status, and earn athletic and academic college scholarships (Bell et al., 2016; Feeley et al, 2016; Luthar & Sexton, 2004). A recent poll by National Public Radio (NPR) revealed that 26% of parents believed that their high school student athlete would be a professional athlete at some point in the future (Kelto, 2016). In U.S. men's basketball for example, the National College Athletic Association (2020) found 3.5% of high school players go on to play NCAA basketball, with only 1.2% of those players advancing to play professionally. This discrepancy between fact and fallacy helped to recognize the myths associated with sports specialization in the United States that undergird school sport activity participation.

As the trend of sport specialization became prevalent so did a decrease in the intensity and breadth of school activities participation (Baker et al., 2009; Coakley, 2010; Jayanthi et al., 2013). Intensity of participation is defined by the total time spent in activities for a duration of time (typically in hours) (Bohnert et al., 2010). Breadth of participation is often measured by the variety of participation either by activity category or continuum number of activities (Busseri et al., 2006; Eccles & Barber, 1999; Sharp et al., 2015). The ramifications of lesser school participation are particularly relevant to rural school leaders and PK-20 experts as the bulk of research in activities participation and academic achievement represented significant positive relationships (see e.g., Broh, 2002; Cooper et al, 1999; Holland & Andre, 1987; Marsh & Kleitman, 2002; Melnick et al., 1992). For an increasing number of United States students, in order to placate pressures, which include a rigorous academic schedule, students participate in less varied activities or specialize in one activity (Haddix, 2016). High school athletes from the 2000s and beyond have grown up with youth prodigies specializing to reach elite status as amateurs. Tiger Woods in golf, Michael Phelps in swimming, and Venus and Serena Williams in tennis, were examples who changed the success equation for high school athletes in the 21st century (Coakley, 2010; Myer et al., 2015; Smith, 2015). Therefore, for this study the researchers hypothesized decreases in multisport participation would be problematic for rural school students due to lack of sport opportunities present outside the school context, and reduced school peer and adult social interactions. Furthermore, reduced rural ESA participation linked to specialization is likely to exhibit deleterious effects (Lang, 2021; Showalter et al., 2017). For example, since rural schools require a higher percentage of participation from their students to fill rosters, an increase in students who specialize in out-of-school activities over ESAs, often leaves schools with no choice but to eliminate ESAs with dwindling participation (Feldman & Matjasko, 2005). Consequently, the reduction in rural school ESA opportunities disproportionately affects lower-socioeconomic status (SES) students who cannot afford to participate in out-of-school structured activities, such as club or specialized sports teams. In addition, because rural schools are frequently located in scarce proximity to recreation opportunities, students of lower-SES demographics have reduced opportunities for physical exercise in absence of ESA offerings (Bell et al., 2018).

Literature Review

The gap in knowledge regarding rural participation in ESA athletics and academic achievement was whether intensity and/or breadth of ESA sport participation demonstrated relationships to academic achievement. If so, to what extent was the relationship linear and did participation exhibit any threshold significance? Little research has been conducted on activities intensity beyond the work of Busseri et al., (2006); Denault et al., (2009) and Fredricks (2012); particularly within the lens of multisport participation, in the United States. This study contributed to previous evidence which posited ESA participation versus non-participation resulted in positive relationships to academic achievement (Shulruf, 2010). To build upon that premise, was more participation better? Does an increase in participation intensity and/or breadth in ESA athletics per school year share a relationship with incremental improvement in measures of academic achievement (Feldman & Matjasko, 2005)? Extant literature on defining breadth included contextualization from categories of organized school and non-school activities to within school definitions of school activities which included athletics (Eccles & Barber, 1999; Rose-Krasnor et al., 2006; Sharp et al., 2015).

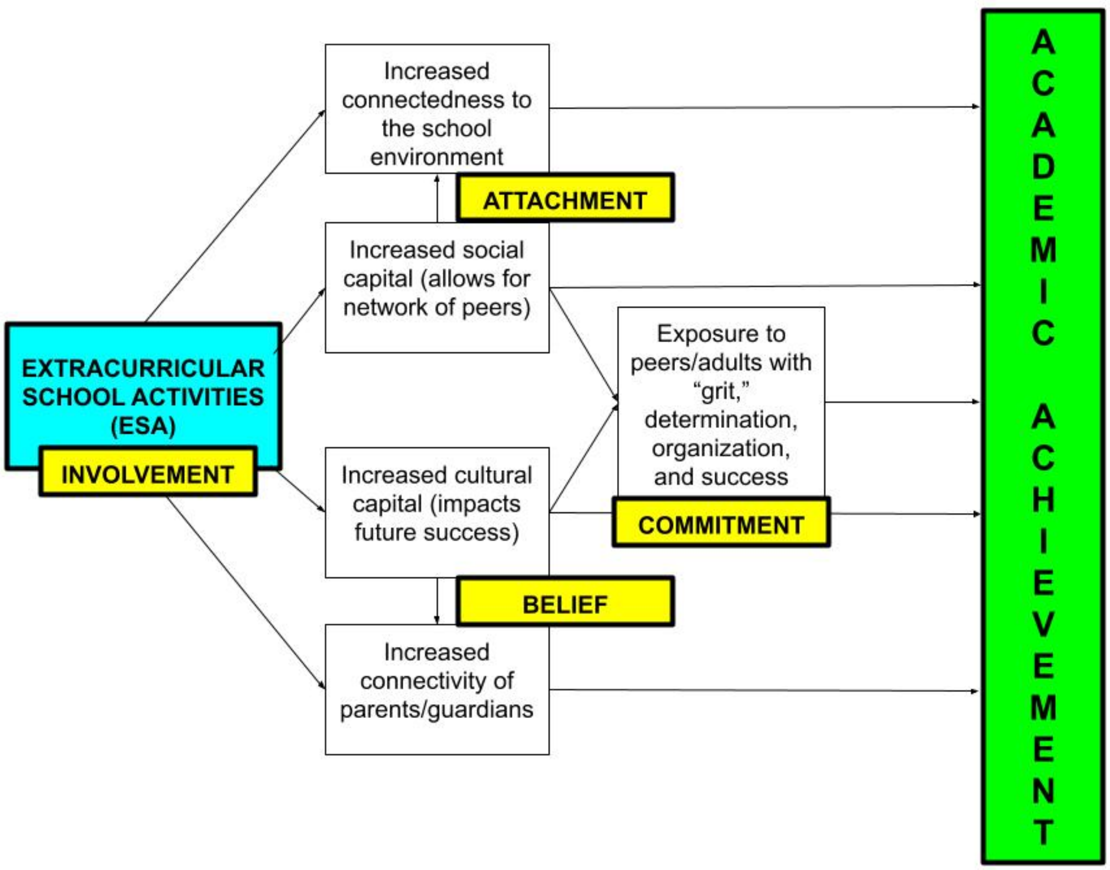
Nearly six decades of research regarding participation versus non-participation in ESAs has produced a litany of cross-sectional and longitudinal data to suggest a positive relationship for academic achievement existed for ESA participants (Broh, 2002; Camp, 1990; Eccles & Barber, 1999; Fredricks & Eccles, 2005; Melnick et al., 1992). It was hypothesized that because rural students were more bonded (socially) through increased participation, measured by both intensity and breadth, non-cognitive benefits would exhibit linear associations with academic achievement. The study utilized demographic data including gender, previous academic ability (GPA & ACT), minority status, and free/reduced lunch status to control for confounding variables related to academic achievement and better tease out the relationship between participation and achievement (Camp, 1990: Covay & Carbonaro, 2010; Feldman & Matjasko, 2005).

Theoretical Frameworks in ESA Sport Research

ESA participation and related outcomes have been viewed by researchers through a variety of frameworks such as social and cultural capital models, developmental models, and the social bond theory. The social bond theory, introduced by Hirschi in *Causes of Delinquency* (1969), is centered on the concept of social bonds individuals form within institutions, such as schools. The social bonds are categorized into four primary dimensions: (a) attachment, (b) commitment, (c) involvement, and (d) belief (Neely & Vaquera, 2017; Peguero et al., 2015). The social bond theory best identified how ESA sports could be viewed in relationship to the effects of participation intensity and academic achievement. Social capital models, as explained by Broh (2002), illustrate how individuals acquire benefits from those around them. The nexus of school and ESA sports intensify acquiring social capital by peers and their families within the school and ESA sport contexts (Hansen et al., 2003; Stearns & Glennie, 2010). Similarly, cultural and social capital models focused on access to networks of peers and adults which were often associated with positive outcomes for students involved in ESAs (Adler & Adler, 1994; DiMaggio, 1982; Shulruf, 2010). For example, a high school student who participates in three sports with three different school coaching staffs is exposed to numerous adult role models exhibiting goal setting, prioritizing, communicating, and problem solving. Additionally, since cultural and social capital largely mirror the SES of students, access to diverse adults (coaches/directors) who have demonstrated success navigating career success broadens student participant horizons and narrows potential gaps related to achievement inequities Gerber (1996) found stronger positive associations related to academic achievement for activities associated with schools versus that of non-school activities. The context of school was central to ESA participant effects as it provided an academic setting where student-athletes maintained contact with the school environment and coaches, unlike some out-of-school opportunities (Darling et al., 2005; Finn, 1989; Marsh & Kleitman, 2002). Furthermore, sponsors of rural ESAs tend to be the same adults that students interact with during the school day, increasing the likelihood of enhanced relationships and access to those with aligned academic practices and values (Assouline et al., 2017). Students who were more involved in an activity setting were better supervised, had deeper interactions with adults and peers, and were less likely to be involved in negative developmental experiences (Bohnert et al., 2010; Fredricks & Eccles, 2005; Osgood et al., 1996).

Figure 1

Theorized Application of the Social Bond Theory to ESA Sport Participation and Academic Achievement.



Note. The four elements of Hirschi's social bond theory (involvement, attachment, belief, and commitment) integrated with elements of social capital and cultural capital frameworks.

Research Questions

The study aimed to address the following research questions:

1. What is the correlation between ESA high school sports participation intensity and ACT achievement at Lanlaur High School (pseudonym) from 2015-2017?
2. What is the correlation between ESA high school sports participation intensity and GPA at Lanlaur High School from 2015-2017?
3. Is there a relationship between ESA high school sport participation intensity and GPA at Lanlaur High School from 2015-2017 when previous academic ability is used as a covariate?
4. Is there a difference between ESA high school sport participation breadth and GPA at Lanlaur High School from 2015-2017?

The research questions were designed to align with developmental theory and social bond theory while incorporating literature from social and capital models within schools (Broh, 2002; Eccles & Gootman, 2002; Feldman & Matjasko, 2005; Marsh & Kleitman, 2002).

Methodology

Participants

The participants of the study were three sets of 11th grade students at Lanlaur High School, a rural Midwestern high school, from 2015-2017. The total student population for the 11th grade students over the three-year cross-section was 298 students; however, the population who participated in high school athletics for this study was 128 students (*N*=128). The percent of high school students eligible for free and reduced lunch (FRL) rates under the National School Lunch Act were 14% free and 6% reduced (U.S. News & World Report, 2017). FRL status was used as a proxy for SES in this study because of availability of demographic data and for its demonstrated relationship with poverty (Nicholson et al., 2014). Gender classification breakdown varied annually during the three-year cross-section ranging between 48-52% male and 48-52% female from 2015-2017. The high school was considered homogenous in race/ethnicity as 97% of students were White non-Hispanic students (National Center for Education Statistics, 2020).

Eleventh grade students were chosen for this study for two reasons. First, by the end of the 11th grade in high school, all 11th graders in this Midwestern state from 2015-2017 had one or more recorded ACT composite score(s) unless it was determined as not required under disability conditions set forth by the state's Department of Elementary and Secondary Education. Second, the 11th grade year is a critical year for planning, preparing, and applying for post-high school career plans making success by this year paramount in pursuing future plans (Barnett, 2016; Feller, 2003). Additionally, previous research in multisport participation indicated specialization was more prevalent as students progressed through high school (Post et al., 2017).

Measures

Demographics

Gender, previous academic ability as measured by GPA, minority status, and FRL status were collected and utilized to control for other confounding variables to academic achievement and to better isolate the relationship of intensity and breadth of sports activities and the dependent variable, academic achievement results (Camp, 1990: Covay & Carbonaro, 2010; Feldman & Matjasko, 2005; Fredricks, 2012; Mahoney & Cairns, 1997; Marchetti et al., 2015; Whitley, 1999; Yeung, 2015). Additionally, these variables were utilized to attempt to better tease out the self-selection effects often associated with interscholastic sport participation and academic outcomes (Crosnoe, 2002). The confounding variables became covariates and produced data to identify how statistically significant their contributions were to academic achievement, both individually and as a group.

Measuring Participation

Participation in extracurricular activities is typically measured through intensity and breadth (Denault et al., 2009). While both intensity and breadth are common measures utilized in research, rarely are they both studied simultaneously (Rose-Krasnor et al., 2006). Since intensity and breadth are highly correlated, this study opted to utilize both measures of participation measurement to test for differences in student achievement outcomes (Knifsend & Graham, 2012; Neely & Vaquera, 2017; Rose-Krasnor et al., 2006). Busseri et al. (2006) recognized that involvement in a variety of types of extracurricular activities may have differing developmental outcomes for students and therefore the researcher inquired to apply similar logic to academic outcomes.

Intensity. Intensity was operationalized by calculating the total hours in sport for each academic school year resulting in a composite time spent figure. For example, if in a given year "Student A" participated in football, basketball, and boys' golf the researcher would add the archived season participation hours for each sport and compute a final intensity (in hours) index figure. Table 1 denotes an example of how a participation intensity index figure was operationalized and calculated. The range hours of intensity for a Lanlaur High School athlete participating as an 11th grader from 2015-2017 was 112 to 640 total hours (*M* = 315.3, *SD* = 148.22). The operationalization of intensity was consistent with the design of Denault et al. (2009) in which researchers utilized a composite index in hours for each participant's total participation each year.

Breadth. Gerber (1996) contextualized breadth of participation by the total number of sports participated in each year (Eccles & Barber, 1999; Neely & Vaquera, 2017; Rose-Krasnor et al., 2006). Since this study was an inquiry related to multisport participation each year at Lanlaur High School, the range of breadth was from one to three. Sport participation measured by breadth at Lanlaur High School for 11th grade athletes from 2015-2017 is: 38.3% (*n* = 49) participated in one sport, 45.3% in two sports (*n* = 58), and 16.4 % (*n* = 21) in three sports.

Measuring Academic Achievement

Extant research has utilized GPA as a primary measure in evaluating the relationship between ESA participation and academic outcomes (Sitkowski, 2008; Watkins, 2004). However, modern critiques regarding the inconsistency of methods in determining academic viability from only one source, such as GPA, led the researcher to utilize two methods; GPA and ACT composite results (Moriana et al., 2006). The utilization of both a localized derived student achievement measure (i.e., GPA) coupled with analysis of a nationally normed standardized test (i.e., ACT) was more holistic and appropriate as differing measures of student achievement can explain different student characteristics (Kelepolo, 2011). GPA is a more subjective multidimensional achievement measure that includes a variety of student and teacher variables such as personality and motivation (Dickinson & Adelson, 2015; Jaramillo & Spector, 2004). The ACT aims to take a more objective approach by providing insight on college readiness and content knowledge (Marchetti et al., 2015).

The ACT exam. The ACT has been considered a quality measure of college readiness and academic achievement and therefore served as an independent proxy of academic achievement (Bettinger et al., 2013). In this Midwestern state, all 11th graders starting in the 2014-2015 school year, as part of a required state statute, take the ACT exam in April of each school year (Helwig, 2014). Numerous students, including each year's cohort of 11th graders, had taken the ACT prior to their 11th grade year or thereafter. This study identified the highest composite score for each student in a given cohort year because the highest ACT score is what was reported for school, scholarship, and post-high school purposes. The utilization of the ACT versus other measures of academic achievement, such as GPA, was unique because ACT was not a component of participation eligibility for this Midwestern state's high school activities association's sports by-laws. In choosing ACT, the researcher aimed to avoid self-selection biases that have hindered past studies on ESA participation and academic achievement (Bohnert et al., 2010: Feldman & Matjasko, 2005; McNeal, 1995; Neely & Vaquera, 2017).

Table 1

Excerpt Sample of Operationalized Student Participation Intensity Data

Student ID #	Sport	Hours[a]	Sport	Hours[a]	Sport	Hours[a]	Total[b]
145654	**Football**	**241**	**Basketball**	**262**	**Boys Golf**	**148**	**651**

Note: Hours[a =] represents total hours participating per season.
Total[b] = represents total cumulative sports participation hours per student per academic year.

The ACT exam is a national assessment administered to high school students to evaluate their readiness for college (Marchetti et al., 2015). While the test consists of four components, English, Mathematics, Reading, and Science, the results are reported through a composite score ranging from 1-36. Colleges and universities traditionally utilize ACT results as a way of evaluating admission as well as the awarding of scholarships. The popularity of the ACT has grown beyond its Midwestern origin and now rivals the SAT throughout the nation for college readiness evaluation and admissions (Farrell, 2006). The credibility of the ACT has grown to the extent in which states, including the study's rural Midwestern state, have adopted the ACT as a component of the official battery of state assessments for evaluating school accountability.

GPA (Grade Point Average). GPA is the primary way for K-12 high schools to demonstrate individual student achievement and is one of the most studied variables in education (Kuncel et al., 2004). It is a cumulative way to represent achievement in grading periods such as quarters or semesters as well as an overall career representation. Lanlaur High School utilized a weighted GPA system in which certain college preparatory classes were weighted more significantly than the remainder of high school courses. In other words, students could enroll in courses that resulted in an A = 5 points, B = 4 points, C = 3 points, D = 2 points, and F = 1 point versus the non-weighted coursework where A = 4 points, B = 3 points, C = 2 points, D = 1 point, and F = 0 points. The weighted GPA system created an opportunity to garner a cumulative GPA greater than the traditional top of the range (4.0), and was utilized to determine class rank, valedictorian, and salutatorian for graduation purposes. The prior GPA for the sample ranged from 1.20 to 4.33 (M = 3.43, SD = 0.725).

Procedure

The researcher acquired archival student data from Lanlaur High School administration and counseling department after confirmation from a university institutional review board regarding the threshold of human subject research was not met and therefore use of secondary anonymous school data was permitted.

In order to maximize anonymity and utilize ethical data practices for research involving individual student assessment data, achievement data, and extracurricular participation the researcher relied upon anonymization by the school counselor to convert student names to student identification numbers prior to export to the researcher (Punch, 2014).

Data Analysis

The tools utilized to collect the data were Microsoft Excel and Statistical Package for the Social Sciences (SPSS, Version 23). The analysis of data was examined by correlation, hierarchical regression, and one-way analysis of variance (ANOVA) analyses (Creswell, 2014; Field, 2013). The researcher analyzed this data with SPSS to generate descriptive statistics and quantitative results by way of correlation, hierarchical regression, and one-way ANOVA (Field, 2013).

Descriptive statistics were compiled and displayed for minority status, gender, cumulative participation hours (intensity), ACT composite results, GPA, and post-11th grade cumulative GPA. The first analysis, a correlation, was conducted between participation intensity (cumulative hours per school year) and ACT composite results. The Pearson product-moment correlation coefficient was examined for both statistical significance and strength of positive/negative correlation. The second analysis, a correlation, was conducted between participation intensity and cumulative GPA. Like the first correlation, the Pearson product-moment correlation coefficient was examined for both statistical significance and strength of positive/negative correlation.

Next, a hierarchical regression was deployed in an effort to determine whether a relationship existed between participation intensity and GPA when controlling for previous academic ability. The researcher utilized this analysis because measuring academic achievement and developmental outcomes involved many different interactions, including ESA sport participation (Bryk & Raudenbush, 1992; Feldman & Matjasko, 2005). In addition, recent research, such as Neely and Vaquera (2017), called for future studies examining ESA sport participation and the social bond theory utilizing advanced hierarchical models. After checking for multicollinearity between independent variables, the variables were entered in two models of hierarchy. In the first model, a regression was conducted examining gender, FRL status, student identified as a minority, and prior academic achievement as independent variables and post-GPA as the dependent variable. In the second model, the previous independent variables were controlled for and ESA sport participation intensity was added. In doing so, the framework conducted two regression analyses and attempted to isolate the significance of ESA sport participation intensity.

For the final research question, the researcher utilized a one-way ANOVA to determine if a difference existed between breadth of sport participation and mean group GPA at Lanlaur High School from 2015-2017. Kelepolo (2011) and Lumpkin and Favor (2012) utilized similar one-way ANOVA analyses when examining GPA differences and extracurricular participation data. Tukey post-hoc analysis was utilized to further examine significant interaction effects (Hill, 2010). The *a priori* significance level for all analyses was set up at the $p = .05$ level.

Results

The disaggregated gender of the sample (N=128) was 77 males and 51 females. Free/reduced lunch status (FRL) included 112 non-FRL students and 16 FRL students. The race/ethnicity breakdown of the sample included 122 students who identified as White non-Hispanic and six students who identified as a minority student. Previous academic ability (measured by previous 11th grade GPA) for the sample ranged from 1.20 to 4.33 ($M = 3.43$, $SD = 0.725$).

The academic achievement variable outcomes were analyzed for both ACT and GPA. The ACT composite range for the 2015-2017 Lanlaur High School 11th grade athlete participants sample was 10-33 ($M = 21.1$, $SD = 4.90$). When broken down by gender, males in the sample averaged 20.0 ($SD = 5.48$) and females averaged 21.9 ($SD = 3.77$) on the ACT exam, respectively. When analyzed by FRL status, those who did not qualify for FRL averaged 21.3 ($SD = 5.05$) while those students in the sample who did qualify for FRL averaged 20.0 ($SD = 3.63$) on the ACT. When ACT was analyzed by minority status within the sample, non-minority students averaged 21.2 ($SD = 4.98$) while minority students averaged 19.8 ($SD = 2.48$).

The post-11th grade cumulative GPA for the sample ranged from 1.42-4.33 ($M = 3.47$, $SD = 0.711$). When broken down by gender, males in the sample averaged 3.32 ($SD = 0.753$) and females averaged 3.70 ($SD = 0.578$) for post-11th grade GPA. The group mean difference between gender and GPA was 0.38 and statistically significant ($p = .002$). When analyzed by FRL status, those who did not qualify for FRL averaged 3.48 ($SD = 0.719$) while those students in the sample who did qualify for FRL averaged 3.37 ($SD = 0.578$) for their respective post-11th grade GPAs. When post-11th grade GPA was analyzed by minority status within the sample non-minority students averaged 3.50 ($SD = 0.719$) while minority students averaged 3.37 ($SD = 0.586$).

Results from the first correlation between participation intensity and ACT composite were not statistically significant, Pearson's $r(126) = .098$, $p = .270$. There was no statistically significant correlation between ESA sport participation intensity and ACT for 11th grade athletes at Lanlaur High School from 2015-2017. Results from the second correlation between participation intensity and post-11th grade GPA were statistically significant ($p < .05$), Pearson's $r(126) = .195$, $p = .027$. The coefficient of determination ($r^2 = .038$) meant participation intensity accounted for 3.8% of the variance in cumulative post-11th grade GPA at Lanlaur High School from 2015-2017. Results from this analysis fell within the typical one to four percent variance sports participation explains of academic outcomes in extant literature (Hanks & Eckland, 1976; Spreitzer & Snyder, 1976). In summation, there was a statistical significance between participation intensity and post-11th grade athletes' GPA at the high school from 2015-2017.

Results from the hierarchical regression analysis were not statistically or practically significant ($p > .05$) between participation intensity and post-11th grade GPA when holding constant for other known contributing factors to academic achievement which included previous academic ability, gender, minority status, and FRL status. Tests for multicollinearity indicated a very low level of multicollinearity was present (*VIF* = 1.080 for gender, 1.080 for previous academic ability, 1.078 for FRL status, and 1.075 for minority status). Beta coefficients for model 1 results were: previous academic ability (β = 0.986, *t* = 70.463, *p* = .000), FRL status (β = -.14, *t* = -.987, *p* = .326), minority status (β = .23, *t* = 1.656, *p* = .100), and gender (β = 0.009, *t* = 0.628, *p* = .531). Addition of participation intensity in model 2 did not change the statistical significance of the prediction (R^2 change = .000. *F* = .457, *p* = .501) (R^2 Change = .10; *F* (1, 122) = .040, *p* = .842). The null hypothesis was accepted.

Results from the one-way ANOVA between breadth of sport participation and post-11th grade GPA were statistically significant. There was a statistically significant difference between participation breadth and GPA at the *p* <.01 level for Lanlaur High School 11th grade athletes from 2015-2017 [*F* (2, 125) = 4.76, *p* = .010]. Post hoc comparisons using the Tukey HSD test indicated a mean score for a breadth of one sport (*M* = 3.29, *SD* = .821) was significantly different than a breadth of three sports (*M* = 3.84, *SD* = .470), but a breadth of two sports (*M* = 3.51, *SD* = .636) was not statistically significant different from breadths of one sport and three sports.

Discussion

The purpose of this study was to address the gap in research related to whether measures of participation (intensity and breadth) in ESA sports activities demonstrated a relationship with academic achievement for 11th grade student athletes in a rural Midwestern high school. The findings identified by the researchers demonstrated two themes associated with sport participation measurement and academic achievement. Intensity of participation (total hours participated in athletics per school year) demonstrated a weak, but statistically significant relationship to GPA (*p* = .027) and no relationship to ACT achievement. Since ACT is a standardized assessment and can be prepared for on single occasions, it perhaps captures differing academic elements of rural athletes' academic prowess. GPA in comparison, when analyzed in a cumulative fashion, tends to represent a more holistic overall academic tenacity within the high school setting. Neither intensity nor breadth demonstrated curvilinear effects to academic achievement previously noted by researchers of the "overscheduling" hypothesis (Mahoney et al., 2006). The student athletes in the study did not exhibit a threshold of participation related to decreasing academic achievement.

Table 2

ANOVA Comparisons of a Rural Midwestern High School 11th Grade Athlete Breadth and GPA 2015-2017

				Tukey's HSD Comparisons		
Group	*n*	Mean	*SD*	Breadth 1	Breadth 2	Breadth 3
Breadth 1	49	3.29	.820		.254	.008**
Breadth 2	58	3.50	.636	.254		.137
Breadth 3	21	3.84	.470	.008**	.137	

**p*<.05, ***p*<.01, ****p*<.001

Breadth (number of sports) participated in per year demonstrated statistically significant ($p < .01$) results when analyzing differences between one, two, and three sport athletes and their respective post-11th grade GPAs. Female athletes demonstrated the largest group mean differences in GPA when categorized by breadth compared to their male counterparts.

Students who do well in school academically and behaviorally are often more likely to be motivated to participate in extracurricular activities (Fejgin, 1994; Fredricks & Eccles, 2005; McNeal, 1998; Rees & Sabia, 2010; Shulruf, 2010). Critics of positive associations between athletic participation and academic achievement propose athletics equally draws individuals who are high-achieving, determined, and goal-oriented to athletics (Spreitzer, 1994; Videon, 2002). Others argue athletics should be credited with enhancing academic achievement. Most of these arguments have lauded the non-cognitive benefits of sports, not only that it builds character, but that sports can build self-esteem, confidence, and motivation transferable to academic success (Bradley & Conway, 2016; Ferris & Finster, 2004; Olszewski-Kublius & Lee, 2004; Rishe, 2003). The researchers utilized socio-demographic factors to attempt to control for self-selection factors like Denault et al. (2009), Stevenson (2010), and Videon (2002). It should be noted that longitudinal studies are more influential than cross-sectional studies for limiting the effects of selection bias and establishing causation (Broh, 2002).

Results from this study suggest programming and potential policy recommendations for rural school leaders. First, results from this study demonstrated no observable threshold or diminishing return related to athletic participation and academic achievement measured by GPA. In fact, as breadth of sport participation increased cumulative GPA also increased. Furthermore, the linear relationship at Lanlaur High School between breadth and GPA was more apparent for females versus their male counterparts. These results suggest consideration for increased school athletic offerings for females in rural school settings.

Second, no evidence was found for increased athletic participation (measured by intensity or breadth) as being detrimental to academic achievement. Therefore, budget considerations by school districts related to academic achievement that include a reduction in athletic offerings or funding are not recommended. A reduction in athletic offerings due to financial considerations is particularly problematic in rural settings where extracurricular opportunities are less prevalent outside of the school environment. Weininger et al. (2015) found that community type affected participation by: (a) supply of opportunities, and (b) costs to participate. Covay and Carbonaro (2010) and Snellman et al. (2015) confirmed extant literature regarding inequities within athletic participation as recent findings indicated athletic participation was still largely stratified by socioeconomic factors. Schools have a history of offering school sports to help mitigate the impact of parent resources (Bennett et al., 2012). Marsh and Kleitman (2002) found when considering demographic variables and academic achievement, socioeconomic factors were the most consistent interactions; thus, highlighting a prioritized necessity for rural schools to maintain and promote ESA opportunities. ESA opportunities to support students' mental and physical health, academic achievement, and social and cultural capital when contextually other such supports may be more isolated in availability (Edwards et al., 2013).

Lastly, benefits for ESA school sport participation have evolved beyond original notions related to positive associations noted by Coleman (1961) and later by Jordan and Nettles (1999) where ESA sport participation served as a structured activity placeholder in lieu of unstructured and/or unsupervised time. A shift in contemporary research versus the classical deficit-reduction paradigm is known as the positive youth development (PYD) paradigm (Bradley & Conway, 2016; Forneris et al., 2015). ESA sport participation has demonstrated developmental and academic gains through the acquisition of social and cultural capital provided by peers, coaches, teachers, and other extra-familial adults' association with ESA sports (Broh, 2002; Mahoney et al., 2006; Marsh & Kleitman, 2002; McNeal, 1995).

Limitations of this study were particularly related to the anecdotal nature of a cross-section study (Broh, 2002). Results from this study cannot be conflated to any other rural school district in the Midwest or the United States. The demographics of the rural Midwestern high school were homogenous in both SES and racial identity. A final limitation of this study was associated with self-selection, or selection bias, related to the voluntary nature of students choosing to participate in interscholastic athletics. Interscholastic athletes are not a random cross-section of the average high school student (Yeung, 2015). Additionally, in order to be eligible to participate in interscholastic athletics, Lanlaur High School students would need to be considered a bona fide student by the eligibility guidelines set forth by the state athletic association and the high school. State athletic association eligibility guidelines were set forth requiring students to meet minimum academic, behavioral, and residency guidelines to participate in interscholastic activities under the auspices of the state association. The study was delimited to ESA sports versus all school-sanctioned activities, clubs, and organizations. Lanlaur High School co-curricular activities such as band and chorus were not included in this study because they were: (a) not confined to a "season" thus skewing intensity, and (b) not congruent because part of their participation is tied to instruction and required attendance during the school day.

Implications for Future Research and Practice

Research

The results of this study indicated that ESA sports share a statistically significant relationship with academic achievement when measured by breadth and GPA in a rural Midwestern high school setting. Implications for secondary rural school academic and student participation were noted. Future research is recommended to assess gender differences related to multisport participation and academic achievement in varied rural school contexts. In addition, a qualitative inquiry is recommended to test the application of the social bond theory to the breadth of sports participation and academic achievement outcomes. Additionally, a mixed-methods analysis to examine the combined effects of ESA and out-of-school athletic participation differences related to participation and academic achievement (Cooper et al., 1999).

Practice

Rural school leaders should seek to provide diverse ESA offerings where possible to mitigate inequities of participation related to SES (Lang, 2021). ESAs offer low costs for participation, less time commitments, and reduced needs for privatized transportation than their out-of-school activity counterparts (Glover, 1999; Guèvremont et al., 2014). In addition, when budgetary decisions threaten the vitality of the diversity of rural ESA offerings school leaders should consider community or regional partnerships, including cooperatives, to maintain ESA opportunities (Kellstedt, 2021; Lang, 2021; Porter, 2016). In conjunction with maintaining diverse ESA offerings school leaders should also consider traditional barriers to participation not frequently examined related to regional norms, culture, and race/ethnicity. The theme of high school students working a job while attending school is a common inhibitor for rural ESA participation. Many high school students are compelled to work outside of school hours to supplement family income stemming from financial hardships or ramifications related to the COVID-19 pandemic (Coulangeon, 2018; White & Gager, 2007). Further complicating rural ESA participation and out-of-school employment are cultural norms. Cuadros (2006) highlighted in *A Home on The Field*, how Latino families in rural North Carolina emphasized securing employment defined who a person was and thus created cultural dilemmas for high schools and potential participants in rural ESAs. Assessing rural school ESA offerings which could be modified to accommodate the localized needs of students to maintain or increase participation is a worthy endeavor for 21st century rural school leaders.

School leaders have an opportunity to utilize innovate hiring practices to consider how to attract, retain, and compensate teachers who can not only excel in the classroom, but apply their instructional and relationship strengths to ESA opportunities. Considering United States teacher shortages, rural schools should aim to highlight the strengths of teaching and sponsoring ESA activities in rural schools. Furthermore, rural schools should provide innovative professional development for teachers which promotes and incentivizes multi-faceted school roles, including ESA sponsorship (Aragon, 2016; Tran et al., 2020).

School leaders are presented with ample justification for heightened focus on ESAs and academic achievement considering the extant benefits rural ESAs provide rural students through the accumulation of social and cultural capital by the solidification of social bonds. Customizing the ESA program for the localized rural context, maximizing collaborative opportunities for ESA sustainability, and hiring and retaining quality teachers and ESA sponsors, are both feasible and imperative for the continued legacy of ESAs in rural school communities.

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Professional Development for Secondary School Teachers and Educational Professionals in STEM Fields

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Rural communities are geographically isolated and have limited access to specialized services and ongoing support from content educational experts. As a result, rural school districts across the nation face many challenges related to the recruitment, retention, and professional development for their teachers. Studies have reported that rural school districts experience a shortage of specialized teachers and it is likely that rural school teachers will teach in content areas outside of their area of expertise. Finding mathematics and science teachers is a constant challenge. In response, we developed the Professional Development for Secondary School Teachers and Educational Professionals (PD-STEP) into STEM Fields Model, which utilizes research-based lessons aligned with curriculum standards and purposefully centered on (a) agricultural mathematics, science, and technology knowledge and skills; (b) specific needs of English language learners; and (c) indigenous, authentic agricultural topics through field-based experiences for teachers. The PD-STEP into STEM Fields Model encompasses the development of a lesson plan template and lesson topics that incorporate teachers' professional development training on food, agriculture, natural resources, and human sciences. These professional development activities explore opportunities available in the career paths described by the United States Department of Agriculture and engender resource-rich partnerships among university faculty and rural school teachers.

***Keywords*: rural education, professional development, STEM education**

This article is organized in three sections. First, we describe the recruitment of participants from five rural high schools located in South Texas. Second, we present the professional development model and a description of the PD-STEP into STEM Fields Lesson Plans (template and five lesson plans) that incorporate food, agriculture, natural resources, and human sciences (FANH) topics during the first year of the PD-STEP into STEM Fields grant (summer 2018). Third, we present the teachers' perceptions based on their first-year experiences in the PD-STEP into STEM Fields professional development sessions.

Rural School District Challenges

Numerous studies have investigated the factors contributing to rural school challenges. Rural students encompass more than 18.7% of the nation's public school enrollment yet receive less federal funding than urban schools (Showalter et al., 2019; Showalter et al., 2017). Documented studies of rural communities verify that rural schools are geographically isolated and experience challenges in recruiting and hiring specialized content teachers (Hardré, 2011; Monk, 2007). Consequently, rural school teachers may be highly taxed when dealing with classroom situations that require them to teach outside of their content area (Fortney et al., 1999; Hammer et al., 2005; Henry, 2019; Jimmerson, 2004). In addition to geographic isolation, administrators in rural school districts are faced with economic challenges associated with loss of economic bases, lower school district budget revenue, and lack of political capital, leaving school districts with scarce resources to deal with the difficulties of recruiting, hiring, and retaining highly skilled professionals in the areas of mathematics and science (Hammer et al., 2005; Johnson & Zoellner, 2016; McHenry-Sorber, 2019; Monk, 2007; Williams & Grooms, 2016). In spite of these challenges, there are some advantages to teaching in rural school settings including smaller student-to-teacher ratios, which customarily means more time for teachers to individualize instructional time with students (Nagle et al., 2006; Tine, 2017). Smaller classes translate into a reduction in paperwork and record keeping, which gives rural school teachers more time to build stronger, instructionally meaningful relationships with rural students. Establishing meaningful relationships is important because rural schools are the focal points of rural communities (Nagel et al., 2006; Tine, 2017).

Researchers propose that rural school settings can serve as viable contexts for the creation of high-quality learning environments and can play a positive role in increasing student attendance and academic success (Chance & Segura, 2009; Hardré & Reeve, 2003). Some authors have also suggested that the demographics of rural districts are rapidly changing due to an increase in enrollment of English learners (Lauzon & Leahy, 2000; Lichter et al., 2016). Unfortunately, policymakers are not familiar with the academic needs of rural school students and the instructional challenges of rural teachers (Johnson et al., 2014; Lauzon & Leahy, 2000; Lichter et al., 2016). Previous studies emphasized that homegrown teachers familiar with rural students provide place-based-conscious learning and leadership by utilizing the close community relationships and cross-rural school district collaborations typical of the rural context to positively impact rural school students' academic outcomes (Henry, 2019; Johnson et al., 2009a; Johnson et al. 2009b).

A number of authors have recognized that rural school districts experience challenges in the recruitment and retention of specialized content area teachers—especially mathematics and science teachers (Levin et al., 2011; Monk, 2007). This challenge limits the access of students attending rural school districts to college readiness courses such as calculus, trigonometry, physics, and chemistry as well as curtailing the evaluation and servicing of special needs students (Johnson & Zoellner, 2016; Showalter et al., 2019). Relatedly, funding and justifying the hiring of a specialized teacher is problematic for rural school districts (Howley et al. 2012; Salamon, 2003). In fact, rural school districts prefer to hire teachers certified in multiple content areas like science, mathematics, or social sciences or grow their own teachers (Johnson & Zoellner, 2016). However, this choice is problematic because most rural school teachers need to prepare for multiple courses, and this could potentially lead to teacher burnout. For example, science teachers need to prepare to teach biology, physics, earth science, and chemistry daily (Johnson & Zoellner, 2016). In light of the documented research, rural school district leaders must appreciate the important role played by resource-rich partnerships that increase the content-based capacity and professional development training of rural school teachers (Henry, 2019).

Rural School Teacher Challenges

Rural school teachers play a critical role in motivating secondary students to pursue postsecondary education. Unfortunately, isolation from content-specific colleagues and lower salaries make rural school districts less attractive to cross-certified teachers (Johnson & Zoellner, 2016). Nevertheless, cross-certified teachers are highly sought after by rural school districts and are a challenge to find, hire, and retain (Johnson & Zoellner, 2016; Tine, 2017). In the rural school context, and given the challenges that rural school districts face in finding mathematics and science specialized teachers, teachers have multiple class preparations for various grade levels (Rhodes, 2014). According to Burt and Boyd (2015) the "ideal rural teacher is someone who is comfortable with the rural way of life and capable of wearing many hats" (p. 78); in other words, the rural teacher needs to be certified to teach multiple subjects or grade levels, prepared to supervise several extracurricular activities, and able to teach students of differing ability levels within a single classroom. Based on our review of the literature pertaining to the multifaceted demands experienced by secondary school rural school teachers, we applied for and were awarded the Professional Development for Secondary School Teachers and Educational Professionals (PD-STEP) in Science, Technology, Engineering and Mathematics (STEM) Fields grant to support five rural school districts by providing professional development that utilized research-based instructional lessons aligned and centered on agricultural mathematics, science, and technology knowledge and skills.

The PD-STEP into the STEM Field Model and Objectives

In 2018, the National Institute of Food and Agriculture of the U.S. Department of Agriculture awarded the PD-STEP into the STEM Fields (PD-STEP) Professional Development grant to a regional university in South Texas. The goal of PD-STEP was to develop rural high school teacher teams (STEM Field Teams) in mathematics, science, career, and technical education to implement an innovative, agricultural-based, hybrid professional development model to address both the Agriculture and Food Research Initiatives and the Education and Literacy Initiatives and make the services of these STEM Field Teams available to five rural school districts. The overarching goal of the PD-STEP Professional Development Grant was to identify, utilize, replicate, and disseminate instructional research-based best practices in an agricultural real-world context.

PD-STEP utilized research-based instructional lessons aligned to the curriculum standards prescribed by the Texas Education Agency (2020b)—known as the Texas Essential Knowledge and Skills (TEKS) standards—purposefully centered on field-based experiences in (a) agricultural mathematics, science, and technology knowledge and skills; (b) specific needs of English language learners; and (c) indigenous, authentic agricultural topics. In addition, based on the advice of the Agriculture & Food Research Initiative, PD-STEP focused on key problems of local importance that impact regional, national, and global sustainability of organic and urban agricultural systems such as:

- farm efficiency
- profitability
- sustainability
- ranchery
- bioenergy
- rural ecology
- aquaculture
- near communities
- human nutrition (National Institute of Food and Agriculture, 2021).

Recruitment Activities Summer 2018 (Year 1)

According to the National Center for Education Statistics (2013), Texas is characterized as having the largest rural student population in the nation (Johnson et al., 2014) with 459 rural school districts (Texas Education Agency, 2017). Texas Education Commissioner Morath launched the Texas Rural Schools Task Force in 2017 to bring rural school superintendents together to discuss the educational challenges faced by rural schools.

The authors of this article were the members of the PD-STEP project team. We carefully planned on-site visits to each of five Texas rural school districts. The school districts were identified, in large part, from the Texas Education Agency's Texas Academic Performance Reports (2020a) that indicated a low level of participation in Advanced Course/Dual Credit Completion, as well as their proximity to the university. The five school districts are located within an 85-mile radius, rendering the university the only four-year college readily accessible to these rural school districts. We anticipated that the students of the teachers participating in this project would also have access to faculty at the university, potentially encouraging students to consider attending college after graduation. We also anticipated that the participating students and teachers would collaborate closely with faculty and staff at the university. Our community outreach efforts aligned with the goal of the university to create a transdisciplinary and collaborative research environment to foster discovery and prepare a community of critical thinkers for leadership roles. Prior to submitting the PD-STEP grant proposal, the Principal Investigator (Viloria) scheduled face-to-face meetings with the superintendents of each of the five school districts to secure their support for the participation of mathematics, science, and career and technology high school teachers in the professional development sessions over the three years of the grant. The PI and a CoPI travelled to each of the school districts to deliver teacher applications and meet with district representatives. The fifteen participating teachers' demographic information and some details of the schools and districts are shown in Table 1. The teacher recruitment process took three months (April through June). With the support of the district superintendents and the principals of the respective high schools, 15 secondary teachers came on board, three from each of the participating school districts (see Table 1). According to the PD-STEP eligibility criteria, teachers were eligible to participate if they

(a) had fewer than five years of teaching experience (preferred but not required);

(b) were in a STEM field or seeking STEM field certification;

(c) were bicultural, bilingual, and/or biliterate (preferred but not required); and

(d) had prior experience in an agricultural area (preferred but not required).

It was challenging to convince some teachers to commit to a week-long summer professional development session. Due to the distance from their homes, we provided the option for participants to live on campus. Only five teachers opted to accept this offer while the rest used a district vehicle to commute daily. Table 2 shows the academic disciplines represented by the first-year PD-STEP rural school teachers.

Table 1

District Details and Teachers' Demographics

School District	Number of Teachers	Number of Schools	Community Population	Number of Teachers Selected	Participants' Demographics
Cotulla ISD	110	5	4,137	3	1 White female 1 Hispanic female 1 Hispanic male
Freer ISD	60	3	2,666	3	1 White male 1 Hispanic male 1 Hispanic female
Jim Hogg ISD	86	3	4,558	3	1 Hispanic male 2 Hispanic females
Webb County ISD	26	3	Bruni: 379 Oilton: 152	3	3 Hispanic males
Zapata ISD	227	6	14,179	3	2 Hispanic females 1 Hispanic male

Notes. Data from Texas Education Agency for 2018–2019 (2017, 2018–2019, 2020a) and U.S. Census, 2019. "ISD" is an abbreviation for "independent school district."

Table 2

Academic Disciplines Among the PD-STEP Teachers

Agricultural Science	Family & Consumer Science	Algebra 1, Computer Science, English 3 & 4	General Science	Biology, Pre-AP Biology	Chemistry & Environmental Science	Algebra 2, Pre-AP Algebra 2
1	1	1	2	3	2	5

The First Year PD-STEP Professional Development Activities

As previously mentioned, studies have found that rural school teacher professional development and training and support are important (Burt & Boyd, 2015; Johnson & Zoellner, 2016; Rhodes, 2014; Tine 2017). For the first year, the PD-STEP team focused, among other things, on garden-based learning (Desmond et al., 2004; Williams & Dixon, 2013) and field-based experiences that were conducted at a local ranch. As Williams and Dixon (2013) pointed out, garden-based education tends to be multidisciplinary, so the PD-STEP team used this idea to provide PD-STEP teachers with agricultural mathematics, science, and technology knowledge and skills via hands-on professional development. Furthermore, the PD-STEP lessons incorporated the specific needs of English language learners and the hands-on lessons served as the canvas on which to integrate multidisciplinary activities and active learning.

Garden-based education activities took place in different ways. The PD-STEP team partnered with the Texas A&M University Agrilife Extension Center, whose representatives presented the Learn, Grow, Eat, & Grow curriculum overview. The participating teachers received training in how to set up garden beds and were offered predesigned lesson plans from the 4-H curriculum that discussed topics such as pollination, nutrition, and growing rates. Teachers also observed a cooking demonstration that incorporated healthy eating habits and integrated topics in biology, chemistry, and algebra. The curriculum was intended to be modified by the teachers to cater for their students' needs, academic level, and age group. Another activity was a visit to the Laredo Center for Urban Agriculture and Sustainability that houses one of the major community gardens in the city. In addition, a Master Gardener shared best practices for developing and maintaining a school garden.

At the end of the week, through collaboration with the agriculture-related community, the PD-STEP teachers visited the East Foundation Ranch. During this visit, teachers explored authentic agricultural topics through field-based experiences at the ranch. For instance, they discussed structure/function and survival, biotic and abiotic ecosystems, and groundwater, surface water, and watersheds. Throughout the week, teachers attended multiple demonstrations of hands-on activities that incorporated agricultural mathematics, science, and technology knowledge and skills topics.

PD-STEP Lesson Plans

At the forefront of PD-STEP is the implementation of lessons with field-based experiences, situated learning (Korthagen, 2010), experiential methods (Steffe et al., 2000), and problem-based learning (Savery & Duffy, 1995) in the agricultural environment. A number of authors have recognized that effective lesson plans incorporate relevant, research-based, instructional best practices like cooperative learning (Johnson et al., 1994), culturally relevant pedagogies (Nieto, 2013), the Technical Language Acquisition and Retention Model (Mireles et al., 2019), the jigsaw strategy (Slavin, 1984), reciprocal teaching (Palinscar & Brown, 1984), and the 5E instructional model (Bybee, 2015). Typically, the model lessons begin in the classroom and then students are taken to the field to observe a real-life manifestation of the lesson (Mireles, 2017). This design innovatively inverts this curricular flow, resulting in authentic, real-life experiences that anchor conceptual understanding in a contextual fashion (Mireles, 2017). Another unique aspect of the proposed lessons involves incorporating the mathematics and science correlation model (Offer & Mireles, 2009) as well as adaptations for English language learners (Casey et al., 2018).

We developed pathways to identify and replicate best practices to engage youth in STEM within FANH through the PD-STEP professional development activities. We initiated the development of the PD-STEP Lesson Plan template and shared the first four STEM Field lessons, which were to be explained during the professional development session. These initial lesson plans were designed to be consistent with the STEM Field Model. For example, the PD-STEP topics in the lesson plans included "Beautiful Patterns." The "Beautiful Patterns" lesson is based on the Fibonacci sequence and how the shape of many naturally occurring biological organisms conforms with graphical representations of the Fibonacci sequence and its close relative, the golden ratio (Nematollahi et al., 2020). In this lesson, students are engaged in activities that include measuring the golden ratio relative to a given row-length of vegetables with at least 80% accuracy when growing their own plants. They then relate their findings to the golden ratio of the Fibonacci sequence and discuss how growth patterns in nature conform to graphical representations of algebraic, linear, quadratic, and exponential expressions. These topics align closely with TEKS as well as Next Generation Science Standards (2013).

PD-STEP Teachers' Activities

Each of the 15 teachers was asked to develop three STEM Field lesson plans and the lessons were uploaded to the PD-STEP digital repository. Over the first year, in addition to the four lessons developed by the PD-STEP team, 40 lessons were developed by the participating teachers. We anticipate uploading a further 45 lesson plans each year of the grant so that there will be a total of 109 lesson plans at the end of this grant. The PD-STEP digital repository can be accessed at https://www.tamiu.edu/coedu/pdstep.shtml#lesson . After the professional development week and through the end of the first year, all the teachers completed three individual agricultural STEM lesson plans. All lesson plans in the repository will be shared with participating school districts and school districts nationwide at the conclusion of the PD-STEP grant.

Finally, since one of the aims of the PD-STEP project was to provide agricultural math- and science-based experiential learning opportunities, teachers were also able to use the remainder of the school year (2018) to access the online Texas A&M Master Gardner training modules and continue to volunteer for a total of 50 hours of hands-on work related to agricultural STEM activities in their immediate communities.

Documenting PD-STEP Teacher Experiences

According to Burt and Boyd (2015), the ideal rural teacher is someone who is comfortable with the rural way of life and capable of wearing many hats: certified to teach multiple subjects or grade levels, prepared to supervise several extracurricular activities, and able to teach students of differing ability levels within a single classroom. The PD-STEP Model helped teachers develop the skills necessary for integrating FANH concepts in their classes, explore the opportunities available in the FANH career paths, and forge mentorships with professional and business leaders and Texas A&M International University faculty. Teachers participating in the PD-STEP Professional Development sessions completed pre- and post-surveys (see Appendices A and B). We analyze these data in the following section.

Data Analysis

The participants' survey responses were analyzed for recurring themes and educational gaps highlighted by the teachers. First, the pre- and post-participation surveys were read by all three of us individually (Bogdan & Biklen, 2007). Then we scheduled a follow-up session to discuss the findings and compare and contrast the participants' perceptions with our observations during the professional development sessions. Since the surveys included data to be compiled by tally and frequency, we documented these in journals and notes taken from our individual reading of the teachers' surveys and from our recurrent discussions. Then we created a coding system (Charmaz, 2006). In addition, some of the data that were more qualitative in nature, such as participants' interviews and observation data, were transcribed and analyzed for recurrent themes. We organized the data into patterns and themes (Merriam, 1998). Subsequently, the themes that we identified were (a) knowledge and skills, (b) students' academic needs, (c) field-based experiences, (d) post-professional development survey questions, and (e) effective professional development experiences. Overwhelmingly, the teachers's pre- and post-professional development surveys validated that they were self-motivated to participate in PD-STEP Professional Development sessions.

Knowledge and Skills

Teachers responded to the pre-professional development questions related to knowledge and skills, which we identified as Questions 3 and 5. The following are some examples: How many years of teaching experience do you have? What subject areas have you taught? What grades have you taught? (See Table 3). The rural teachers' expertise was strong, and this positive situation was also a call for action by district officials who needed to find and train novice teachers to fill the vacancies left by teachers who retired. In response to the following question: Please add any additional comments related to your experience in today's PD-STEM Teachers Professional Development (see Table 4). Participating teachers' dispositions to network with rural school teachers from nearby rural school districts were positive and strong.

Table 3

Responses Concerning Experience

Participant	Experience
Teacher 1	I have five years of teaching experience in subject areas of Principles of Agriculture, Advanced Animal Science, Equine Science, Livestock Production, Wildlife, and small animal management. All subjects include ninth through twelfth grade students.
Teacher 5	I have taught Grade 9 through 12 sciences for 24 years. I have taught Biology, Chemistry, Physics, IPC, Anatomy, & Physiology, Astronomy, Environmental Systems, and Medical Terminology.
Teacher 9	I have 31 years of teaching high school math and I am always looking for motivational experiences for my students.
Teacher 10	I have 18 years of experience teaching science, English, mathematics in both fifth grade and eighth grade.
Teacher 14	I have been teaching for 27 years—all at the high school level. I have taught Biology, but I am an Agricultural Science teacher now.
Teacher 15	I have been teaching for 22 years and presently teach Culinary Arts and Child Development for ninth through twelfth graders.

Table 4

Additional Comments

Participant	Comments
Teacher 1	I hope to gain more knowledge and personal growth from this program.
Teacher 9	I am very excited to be here and learn new things that I can apply in my classroom.
Teacher 10	I am very motivated to be here and learn new ideas for my classroom.
Teacher 12	I am extremely excited for what this week has to offer and taking this journey with this team for the next year!
Teacher 14	I hope to network with all the other teachers and have a positive experience.
Teacher 15	I hope this experience will open many more windows of opportunity to engage students in learning where food comes from.

Table 5

Expectations of Learning from Professional Development

Participant	Expectations of Learning
Teacher 1	To expect the unexpected. I hope to learn different aspects of this professional development to incorporate properly in the classroom and lessons.
Teacher 2	To be able to use mathematics into the STEM field and be able to get students involved in this program.
Teacher 5	To be able to use science lessons to teach everyday applications in the agricultural field.
Teacher 7	To be able to understand the nature of horticulture in this South Texas environment.
Teacher 9	I hope to learn more hands on activities that I can use in my classroom that relate to the environment.
Teacher 10	How to better prepare for my students' learning needs.
Teacher 11	I expect to learn how to incorporate gardening into my curriculum—helping to teach students life-skills.
Teacher 12	I hope to learn something new and different I can take back to my classroom to provide my kids with a hands-on experience.
Teacher 13	How to incorporate STEM into my daily lessons to keep the students engaged.
Teacher 14	I expect to be able to better serve our students by integrating/aligning mathematics and science to our agricultural science curriculum. I also expect to develop better lesson plans and teaching strategies to engage students.
Teacher 15	I expect to acquire knowledge in various agricultural aspects as they apply to the food chain.

Students' Academic Needs

We identified Question 1 of the pre-professional development survey as addressing the students' academic needs component: Can you please tell us what you expect to learn from this professional development experience? (See Table 5). PD-STEP participants' high levels of self-motivation increased our motivation to plan and execute an engaging professional development workshop. In fact, several studies have suggested that the efficacy of rural school teachers is related to job satisfaction and a positive school context in which professional ideas are shared and mutual trust thrives (Edinger & Edinger, 2018; Lacks & Watson, 2018). We focused on creating the professional network space for the participants to share and build professional relationships outside of their school districts.

Field-Based Experiences

We identified Question 2 from the pre-professional development survey as pertaining to the teacher participants' field-based experiences: Can you please explain your motivation to be part of this professional development experience? (See Table 6). Hadré (2008, 2011) explained that "what teachers do influences students' motivation and choices, and what students do influences teachers' motivation and practice" (2011, p. 214), especially in a rural school setting.

Table 6

Motivation to be Part of this Professional Development Experience

Participant	Motivation to Participate
Teacher 5	To help provide innovative field-based methods of instruction to fellow teachers and to learn to collaborate between STEM teachers and CATE* teachers.
Teacher 7	My degree in agriculture science gives me a natural development in this field and I would like to continue my development for this field in the form of student-centered lessons.
Teacher 9	The department chair at my school wants to grow a garden in the high school for our students to use. This would be a great experience for me to obtain the information and apply it.
Teacher 11	I teach biology, and I had my students grow plants this year just to expose them to the growing process. I wanted them to see seeds and watch them grow. However, I do not have any curriculum for this experience so this class is just what I needed.
Teacher 12	The opportunity to implement something new and unique in the classroom motivated me to be part of this professional development experience. I have also always wanted to begin a garden at school.
Teacher 14	Again, to be able to have more meaningful lessons and engage students so they can experience success and want to back to my class.
Teacher 15	My motivation is to become knowledgeable in different agricultural topics related to the food industry, i.e., food crops.

* CATE is an abbreviation for career and technical education.

Post-Professional Development Survey Questions

We grouped the post-professional development survey questions and the respective teacher participants' responses into three categories: effective professional development experiences, suggested activities, and instructional strategies and goals met.

Effective Professional Development Experiences

Were the activities/approaches used to facilitate the professional development experience effective? We asked participants to elaborate on the activities that they enjoyed the most and that they thought would be useful in their teaching (see Table 7). Participants enjoyed sharing their classroom experiences with rural school peers who could relate to the demographics, context, and challenges that rural school teachers face. We concluded that hands-on lessons were successful in motivating our rural school teachers' interest in incorporating the sample PD-STEP lessons.

Table 7
Activities Related to Teaching

Participant	Activities
Teacher 1	I believe that all the activities were helpful. I enjoyed the pattern lesson and the master gardening lessons to further enhance our class participation. Most of the lessons were mainly to the average student, GT; one modification would be to consider the special education students and how to involve them in the lessons we want to cover.
Teacher 2	The hands-on activities were the ones I enjoyed the most. In addition, going outside and enjoying nature was educational but relaxing. The short videos from Texas Wildlife Association (TWA) were also beneficial and will help students.
Teacher 4	I enjoyed the observations with Leopold. This will be very useful in the class because it make the students become more aware of nature and develop a sense of preservation.
Teacher 5	The sample lessons that were provided were useful to me as a science teacher. I will be able to incorporate this type of teaching and lesson planning this year. I will modify with different videos.
Teacher 6	Outdoor activities are always good because it provides a change for students. Community involvement will be important and can help to create unity.
Teacher 10	All the hand-on activities provided good opportunities for student engagement. I would like to see lesson plans developed using release STAAR questions content to make it more relevant to high school.
Teacher 11	Hands-on lessons were awesome. Limit the stand and deliver approach.
Teacher 12	Yes! All of the hands-on activities were very fun and engaging. I could see myself doing similar approaches.
Teacher 13	All activities were awesome! All were fun and interactive. Great job!
Teacher 14	All activities were great. Working hands-on labs @ LBV Bldg. was the best way to engage our learning.

Suggested Activities

We asked, "If you were to do this again, what additional activities and/or approaches would you suggest?" (See Table 8). Based on the participants' comments, we believe that our face-to-face professional development sessions for the participants were successful in addressing teacher self-efficacy and teacher well-being—which we hope will lead to reducing rural school teacher attrition.

We asked, "What suggestions do you have for improving this professional development experience?" (See Table 9). Since this was the first of a series of a three-year summer professional development opportunities for rural school teachers, their feedback was important for the planning of subsequent professional development activities. Therefore, the participants' feedback was well-received and incorporated in the second year's professional development sessions.

Table 8
Additional Activities and/or Approaches

Participant	Additional Activities
Teacher 1	I believe more of the technological basics and design. Our schools are wanting us to use computers and i-Pads to teach our students.
Teacher 2	Again, just being in the outdoors and getting your hands dirty are the best ways to run these professional developments.
Teacher 3	Additional cooking demonstrations with non-common vegetables.
Teacher 4	I am open to whatever else can be added to enhance the learning experience relating to understanding Texas wildlife.
Teacher 9	Secondary high school teachers need high school activities. Model high school activities in real world time constraints.
Teacher 12	I would try to apply different sciences (chemistry) to the lesson plans and present them at a higher level.
Teacher 13	I would just keep doing what you are doing. We have been to this professional development before and did not feel like it repeated. I also learned many new things.

Table 9
Suggestions for Improving the Professional Development Experience

Participant	Suggestions
Teacher 2	We covered a lot of information, we have to go back and digest all the info. So maybe condense the information but surely keep the hands-on activities.
Teacher 3	All aspects were wonderful. No improvement needed.
Teacher 4	It was a wonderful learning experience.
Teacher 10	Continue to work with local teachers to design lesson plans around TEKS-related activities.
Teacher 12	It was very fun and interesting. I really enjoyed all the activities.
Teacher 14	Keep the same group of people for year 2! It was an awesome experience! Looking forward to meeting again.

Instructional Strategies Learned and Goals Met

We asked, "To what extent do you feel the goals/objectives of PD-STEP were accomplished? Please explain." (See Table 10). We asked this question to gain insight into the extent to which the PD-STEP goal of integrating field-based experiences, situated learning (Korthagen, 2010), experiential methods (Steffe et al., 2000), and problem-based learning (Savery & Duffy, 1995) into lessons was achieved.

We asked, "What do you feel you have gotten out of your recent professional development experiences? How have they influenced your teaching practices?" (See Table 11). We believe that all teachers learn more effectively from hands-on professional development opportunities; and this group of 15 participants agreed that the interactive lessons were pertinent to their teaching assignments in rural schools.

Table 10

Goals/Objectives of PD-STEP

Participant	Accomplishment of goals and objectives
Teacher 1	They were mostly accomplished by involving all aspects of mathematics, science, engineering in agriculture.
Teacher 2	I felt the goals were accomplished, sometimes a bit rushed but there was just so much information to cover.
Teacher 3	I learned a great deal about the need for food in given areas and the lack of knowledge many of our students possess.
Teacher 4	All the goals/objectives were accomplished. The delivery of the lessons/activities were well constructed and flowed very efficiently, and they were fun and educational.
Teacher 5	I feel the goals were accomplished and received a lot of useful information and resources.
Teacher 6	PD-STEP provided the resources to create a community garden. We will also be able to get answers through the Agriculture Extension Office.
Teacher 8	By actually showing the garden – tied in with mathematics, health, science tied it all together.
Teacher 10	They were accomplished to some degree. I realize it is the 1st year of the program but we will need to work harder to connect topics in TEKS to the lesson plans presented

Table 11

Influence of Recent Professional Development on Teaching Practices

Participant	Benefits gained from this program
Teacher 1	More hands-on activities which will help develop better or more interactive lessons. I have a new approach and point of view.
Teacher 2	Yes, the hands-on activities influenced my teaching practice and I have actually learned a lot and will take these to my students. It was a refresher in a sense.
Teacher 3	Learned a great deal. I will incorporate more hands-on activities in my lessons and relate them cross curricular.
Teacher 4	A revelation to nature and wildlife. It will enhance my teaching practice by placing more emphasis on the preservation of our land.
Teacher 6	Recently, I have been attending more PD that emphasize constructivist learning. Emphasis is placed on kids doing activities and building knowledge through activities.
Teacher 7	I improved my science and math skills in master gardening.
Teacher 9	A fresh perspective for redesign lessons which has disciplines with real-world applications.
Teacher 10	I am learning with so many more resources and lots of knowledge about gardening and how it relates to environmental science.
Teacher 11	I'm inspired to complement my new knowledge, continue implementing hands-on lessons to inspire and reach my students.
Teacher 12	I feel very informed in the agricultural area. I'm able to see connections and how they can be implemented to math and science.
Teacher 13	I learned a lot more about land stewardship and have new, fresh ideas for the school year.

We asked, "What new strategies learned during the PD-STEP professional development experience have you tried lately that might benefit a student you are struggling with?" (See Table 12). We were pleased to read the participants' feedback because the rural school teachers' message was clear: They enjoyed the activities and were enthusiastic about trying the PD-STEP lessons in their classrooms.

Lessons Learned from First-Year Experience

Rural school districts have a shortage of specialized teachers and are challenged in finding mathematics, and science teachers (Levin et al., 2011). This challenge has serious consequences for rural students by limiting their access to courses that will get them college-ready such as calculus, physics, trigonometry (Johnson & Zoellner, 2016). Rural school districts prefer to hire teachers who are certified in multiple areas of science, mathematics, or social sciences or grow their own homegrown multidisciplinary teachers (Johnson & Zoellner, 2016). We believe that the agricultural mathematics, science, and technology skills field-based experiences that we designed helped develop rural school teachers' multidisciplinary knowledge and skills. Consequently, the goals of PD-STEP were to develop and provide a cadre of mathematics,

Table 12

New Strategies Learned during the PD-STEP Professional Development Experience

Participant	New strategies learned
Teacher 2	Short videos and hands-on activities will be my focus this year. Takes more planning and collection of activities/materials but will give you a better result.
Teacher 3	Planting a garden will give my students ownership and teach them how to care form something.
Teacher 4	Include more activities to spark interest in a topic or area of study for the students to learn about.
Teacher 6	I have tried utilizing activities to teach concepts to students who are struggling. I have given troubled students projects and extra responsibilities to try to bring ownership to their learning.
Teacher 8	The bottle effect of sand, silt, clay will help student envision how soil profiles work.
Teacher 9	Research and create applications to use in areas which are real world and connected to agriculture.
Teacher 12	There were different lessons that had different approaches to the topic, so it really varies. The different approaches were very helpful and I will try to implement them in my lessons.

science, CATE rural high school teacher teams (STEM Field Teams) from five rural districts in Texas with hands-on experiences and real world applications of the STEM fields during a week-long faculty development opportunity. The first year of PD-STEP, the STEM Field team focused on (a) recruiting teachers and establishing strategies for research-based instructional lessons aligned to agricultural mathematics, science, and technology knowledge and skills and (b) catering to the specific needs of English language learners by focusing on indigenous, authentic agricultural topics addressed through field-based experiences.

During the first year, we conducted on-site visits to each of the five participating school districts to recruit 15 teachers and conducted a four-day faculty development that included hands-on activities and the presentation of the PD-STEP lesson plan model to the teachers. This professional development opportunity provided rural school teachers from five South Texas school districts with the necessary tools to expand their multidisciplinary backgrounds and supported their development as the multidisciplinary instructional leaders that the school districts required. The teachers' perceptions of their first-year experience informed programmatic improvements associated with lesson planning and delivery. Each of the three years of the grant will build on the experiences of the professional development activities from the previous year. As a result of conversations with rural school districts and the external grant evaluator, we decided to extend the invitation to participate to the same teachers in order to build their professional skills and strengthen their rural school teachers' network.

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Appendix A

PD-STEP into the STEM Field

STEM Teachers Pre-Professional Development Survey

The goal of the STEM Field project is to develop and provide, to a cadre of mathematics, science, and career and technical education (CATE) rural high school teacher teams (STEM Field Teams), an innovative agricultural-based face-to-face and hybrid professional development. The Project Team is interested in capturing the participants' feedback to help them align and/or modify the STEM Field Model professional development activities. The Project Team will be utilizing research-based instructional strategies aligned to Texas Essential Knowledge and Skills (TEKS) curriculum standards that are purposefully centered on (1) agricultural mathematics, science, and technology knowledge and skills; (2) specific needs of English language learners; and (3) indigenous, authentic agricultural topics through field-based experiences first.

1. Please tell us what you expect to learn from this professional development experience.
2. Please explain your motivation to be part of this professional development experience.
3. How many years of teaching experience do you have? Which subject areas have you taught? What grades have you taught?
4. Have you recently been assigned to a different grade level? If yes, please let us know how this professional development experience can help you prepare for your new teaching assignment.
5. Please add any additional comments related to your experience in today's PD-STEM Teachers Professional Development.

Appendix B

PD-STEP into the STEM Field

STEM Teachers Post-Professional Development Survey & Reflections

The goal of the STEM Field project is to develop and provide, to a cadre of mathematics, science, and career and technical education (CATE) rural high school teacher teams (STEM Field Teams), an innovative agricultural-based face-to-face and hybrid professional development. The Project Team is interested in capturing the participants' feedback to help them align and/or modify the STEM Field Model professional development activities. The Project Team will be utilizing research-based instructional strategies aligned to Texas Essential Knowledge and Skills (TEKS) curriculum standards that are purposefully centered on (1) agricultural mathematics, science, and technology knowledge and skills; (2) specific needs of English language learners; and (3) indigenous, authentic agricultural topics through field-based experiences first.

1. Were the activities/approaches used to facilitate the professional development experience effective? Please elaborate on the activities that you enjoyed the most and will be useful in your teaching. Please elaborate on what needs to be modified or improved.
2. To what extent do you feel the goals/objectives of PD-STEP were accomplished? Please explain.
3. If you were to do this program again, what additional activities and/or approaches would you suggest?
4. What do you feel you have gotten out of your recent professional development experiences? How have they influenced your teaching practice?
5. What suggestions do you have for improving this professional development experience?
6. What new strategies learned during the PD-STEP professional development experience have I tried lately that might benefit a student I am struggling with?

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Modeling Conspicuous Collaboration for Preservice Teacher Candidates Enrolled in Higher Education Courses

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Preservice and inservice teachers in higher education should have the opportunity to observe conspicuous collaboration in action. When collaborative efforts are overt and used as teachable moments, the possibilities are clearer and the results more impactful for all participants. In this program description, we share benefits, challenges, structures, and implementation techniques for modeling conspicuous collaboration in higher education teacher preparation. To provide models of conspicuous collaboration, we collaborated in a project to co-teach general and special education teacher preparation courses at the undergraduate and graduate levels. We examined our own courses to design class activities and assignments that could be successfully co-taught. Each of us delivered our individual course, adding special collaborative learning activities and assignments that allowed students to experience interactive, collaborative learning while observing the purposeful collaboration of their instructors. Both of us—together with our preservice and inservice teachers—realized that optimal collaboration included clarifying roles and responsibilities, displaying respect toward the collaborative partner, holding one another accountable, setting aside time for planning and debriefing, and considering ways to combine classroom assignments and learning activities that met the requirements of both courses.

***Keywords*: collaboration, higher education, co-teaching, special education, general education**

"Collaboration" "Inclusion" "Individual Needs" Whether considered individually or in combination, these contemporary expectations bombard administrators and teachers in rural schools with benefits, challenges, and expectations. With the chronic shortage of special education teachers nationwide (Robinson et al., 2019), especially in rural areas (Schulte & Justeson, 2019), administrators in rural schools must maximize the skills and talents of all teachers. Faced with limited resources and spaces, administrators in rural schools must work to provide the best possible education for all students while accommodating students' diverse backgrounds and varied developmental needs. When collaborating to meet the needs of all students, special education and general education teachers together face the challenges of inadequate resources and instructional options in their schools.

A key principle of inclusive schooling is collaboration (Hedegaard-Soerensen et al., 2017), conducted both formally and informally on a daily basis (i.e., co-teaching; consultation; transdisciplinary teams; and models involving families, students, and school staff). As with all teachers, rural education teachers are responsible for educating students with diverse abilities and needs. They often have limited contact with outside service professionals for support and program planning, thus increasing their sense of professional isolation and heightening the need for collaboration (Pugach et al., 2012).

Although collaboration is identified as a best practice in education, preservice teachers typically do not experience these approaches in their higher education training (Lock et al., 2017).

Teachers at all levels of education are increasingly asked to draw on their collaborative skills to meet the needs of today's P-12 learners. It is not unusual for public school teachers to work together with grade or content level colleagues, special educators, and paraprofessionals to implement curriculum and to meet individual student needs. While implicit in most teacher preparation programs, many teacher education leaders do not explicitly teach the skills necessary for successful collaboration (Bacharach et al., 2008, p. 9).

Brinkmann and Twiford (2012) urged teacher education leaders to demonstrate collaboration between general special education teachers and adaptive special education teachers so those they teach can better understand diagnostic testing, lesson planning, differentiating, and collecting data. Weiss et al. (2017) insisted that collaborative processes and strategies should be a fundamental component of teacher preparation.

Literature Review

Definitions of Collaboration

Collaboration is defined as "the act of working collectively with other individuals for an agreed upon mission. The collaborative individual seeks to not only work toward individual goals, but toward mutual goals" (Kemp, 2013, p. 4). Collaboration in K-12 education is clarified as "a systematic process in which teachers work together to analyze and improve their classroom practice" (Riveros, 2012, p. 604). Collaborative teaching in higher education is further delineated as "any academic experience in which two professors work together in designing and teaching a course that itself uses group learning techniques" (Robinson & Schaible, 1995, p. 57). Faculty collaboration is further defined as "a cooperative endeavor that involves common goals, coordinated effort, and outcomes or products for which the collaborators share responsibility and credit" (Austin & Baldwin, 1991, p. 2).

Working collaboratively has long been the goal for educators at all levels; however, the reality of educational practices often prohibits it. Challenges that educators face with collaboration include time constraints, individual responsibilities, limited access to colleagues, and dissimilar goals/objectives. The fact that collaborative planning, teaching, and evaluation all require additional work, focus, and determination adds a major challenge when attempting to incorporate collaboration. Collaborative delivery helps ensure those learning to teach are provided with genuine opportunities to apply special education knowledge, principles, and practices in classroom settings. Such a cohesive experience for those learning to teach can yield opportunities for meaningful discussions and increased learning and effectively enhance the learning experience of both the instructors their students (Harper & Sadler, 2002).

We have coined the term "conspicuous collaboration" as the intentional modeling of overt collaboration since obtaining the requisite knowledge and skills of effective collaboration is not an intuitive process. Arthaud et al. (2007) overtly modeled collaboration for preservice teachers in their teaching practices in higher education. Fuhrman & Streim (2008) stated that in order for collaboration to occur, individual responsibilities should be clearly articulated with an open discussion of possible solutions by all team members. Elements of conspicuous collaboration include open communication, common planning time, and mutual respect.

Rationale and Benefits of Collaboration in Higher Education

The shift to more inclusive educational practices in American schools has created a climate where collaboration is viewed as an essential practice for the education of students with special needs. In fact, researchers have asserted that effective collaboration between special education and general education professionals has moved to the forefront of crucial skills for special educators (Carter et al., 2009). The language of the *21st*

Century Goals for Education further accentuated the importance of collaboration and extended to include society as a whole (Darling-Hammond & Oakes, 2019). According to Nevin et al. (2009), K-12 reform efforts of inclusion of students with disabilities in schools encouraged teacher educators to collaborate across disciplines. In order to prepare future teachers to meet the needs of a diverse student population, such collaboration is considered imperative. Unfortunately, many teacher preparation programs do not include explicit training on collaboration; resulting in minimal opportunities for joint, collective practice (Friend & Cook, 2013). Modeling conspicuous collaboration enables both general education and special education preservice teachers to recognize the symbiotic relationship that exists throughout the education enterprise. As educators connect with other professionals outside their respective disciplines, the core concepts and values of true collaboration and diversity can be realized.

Given the nature of higher education, college faculty experience professional isolation (Kariuki & Jarvis, 2017). Teacher educators must provide an emphasis on preparing general and special education personnel in collaborative ways, especially in places where their training has previously occurred separately (Nevin et al., 2009). While this collaboration may be present in some settings, Fogg (2006) insisted there was a need for collaboration over autonomy, noting that in particular, junior faculty preferred opportunities to collaborate with senior faculty.

Teacher educators can make collaborative efforts conspicuous to those they teach so they can internalize the importance of collaboration and embrace collaboration in their own settings. Modeling collaboration is an important component of the process (Nevin et al., 2009) and is a key element in conspicuous collaboration. The benefits of organizational collaboration include improved efficiency, effectiveness, increased instructor confidence, acquisition of new teaching methods, and enhanced student learning (Burns & Mintzberg, 2019). Articulating learning objectives for their courses enables collaborators to plan more effectively (Shibley, 2009). Additional reasons to collaborate include increasing productivity, maximizing resources, improving teaching and research, maintaining motivation, and encouraging creativity and risk taking (Creamer, 2003). Furthermore, when higher education faculty members model methods of collaboration in higher education, they allow preservice teachers to benefit from their experiences and expertise and afford a real life example of what the preservice teachers may have only read about in textbooks. Using joint planning, co-taught lectures, group activities and discussions, and shared responses to student questions, faculty members can present different theoretical perspectives to students (Artesani et al., 1998). Instructors also benefit from collaboration as they share a sense of responsibility for each other, plan high-quality course content in advance, and maximize resources with two instructors being better than one (Minett-Smith & Davis, 2019). When a teacher educator connects with a colleague outside their discipline, there is an opportunity for them to complement each other's strengths and overcome limitations in their individual knowledge or experience.

Barriers to Collaboration in Higher Education

According to Bennett and Fisch (2013), the lack of preservice teacher training in collaboration is partially due to the segregation of general education preservice teacher candidates and special education teacher candidates in the higher education setting. Jorgenson et al. (2011) cited challenges for collaborative teaching in higher education including transportation, technology access, financial compensation, support personnel roles, and university policies. All of these obstacles must be addressed before beginning collaboration so as to not disrupt the collaborative process. Lester and Evans (2009) reported that lack of team teaching in higher education may be due to traditions, insufficient time, a dearth of creativity, and the often-held perception that teaching should be an isolated activity.

Modeling Conspicuous Collaboration in Higher Education

Effective collaboration with a variety of partners is essential for all teachers, especially in rural areas. One powerful way to instill this understanding is for teacher educators to model effective collaboration at all levels of the teaching profession. Given the need for conspicuous collaboration in higher education, we collaborated in courses at both the graduate and undergraduate levels to prepare qualified rural education teachers. Each of us incorporated collaborative concepts and practices and selected activities and assignments that highlighted collaborative practices. Our collaboration occurred on various projects and during mutual class periods but did not occur during all class sessions or lessons.

We made overt efforts to implement and assess the use of conspicuous collaboration to help students to value, identify, and understand the collaborative process. To ensure that conspicuous collaboration was implemented with fidelity, we co-planned the collaborative projects, co-taught some aspects of them, co-evaluated the resulting student products, and co-reflected on the instructional process to determine if our collaborative and course goals were met. In addition, all collaborative projects included student assessment and a range of ways of soliciting student feedback on the collaborative process (e.g., exit tickets, open-ended assessment questions, class discussions). The following sections describe the conspicuous collaboration strategies we utilized in the teacher preparation program located in a rural region of the southeastern United States.

Collaborative Assignments and Class Sessions

Shadowing/Assessment Project

One conspicuous collaboration project with which we engaged was designed to make our collaborative efforts conspicuous to those we were teaching so they could internalize the importance of collaboration and embrace collaboration in their future classroom settings. One facet of this project was oriented to general elementary education majors and another to special education majors. We modeled collaboration during general education and special education graduate classes to a cohort of students in a conspicuous, overt, and intentional way. We designed the project to support the requirements of two graduate courses and we made explicit connections between coursework and assignments in the two courses with members of both courses completing the same assignments and assuming comparable responsibilities. This effort modeled conspicuous collaboration while concomitantly providing quality instruction in each class. The authentic learning of conspicuous collaboration processes was accentuated our commitment to help students make connections between the two graduate courses.

Our conspicuous collaborative project met the objectives for both graduate courses (TCHR 6030: Literacy Development in the Content Area Classroom and SPED 6000: Exceptional Children in the Regular Classroom). The focus in TCHR 6030 was determining the learner’s approximate general reading level and motivation to learn as well as their ability to use specialized skills/abilities to process materials in a particular content area. The SPED 6000 course emphasized observing a student with a disability and comparing that student’s actions, activities, and expectations against those of their peers. Students enrolled in SPED 6000 took part in a shadowing experience in a rural K-12 school and conducted an assessment component for TCHR 6030 to address areas of interest for reading and learning, define general reading levels in comprehension and recognition, identify motivation to use reading for content learning, and conduct a writing inventory. Students were required to work in partner groups and write an overall report, including an overall description of shadowing in the rural K-12 school, how technology was used to collect information, the use of assessment instruments and the resulting data, and a reflection about the collaborative experience. Each partner group made a class presentation to a combined class session to share their experiences and the knowledge they gained. We required groups to incorporate the use of technology, such as VoiceThread, Prezi, and/or the Smartboard. We evaluated the partner groups using the same rubric.

Based on assessment feedback received from students, we noted that the general education preservice teachers commented more often on learning more differentiated instructional strategies for individual learners. Conversely, the special education preservice teachers remarked that they gained knowledge about instructional approaches for large class sizes involving diverse student populations.

Universal Design for Learning (UDL) Lesson Plan

Masters of Arts in Teaching graduate students, who were not special education majors, were simultaneously enrolled in two graduate courses. We are higher education faculty members, one of us an elementary education instructor and the other a special education instructor. We modeled conspicuous collaboration and critical aspects of teaching beneficial to K-12 rural school settings. We tasked our graduate students with creating a lesson plan for the content area and grade level they planned to teach incorporating Universal Design for Learning (UDL) accommodations in TCHR 6030. We required our students to then extend that lesson plan to provide modified instructional activities for specific students identified previously through a case study assignment. Working within the SPED 6000 course, the preservice graduate students wrote justifications for accommodations and modifications along with reflections on the redesigned plan. Project deliverables included an original lesson plan, a completed UDL checklist, a redesigned lesson plan (with changes noted in red type), and a reflection paper.

We concluded that the redesigned lesson plans were better suited to meet the individual needs of a class of students diverse in strengths, challenges, and exceptionalities. In addition, those we were teaching benefited from this conspicuous collaboration project by being able to make explicit connections between what they were learning in their special education and their general education courses.

Shared class meetings

We held three combined class sessions of TCHR 6030 and SPED 6000 students during regularly scheduled class times. The first combined session featured introductions of ourselves and the students and an overview of the collaborative projects. During the second combined session, our students presented their work on the *Shadowing/Assessment Project* and submitted the accompanying documents. The third and final combined class session focused on using a variety of strategies to develop literacy in inclusive classrooms.

The modeling of conspicuous collaboration was a primary outcome of the three shared class meetings. This occurred through co-planning, co-teaching, preservice teacher involvement, co-evaluating, and co-reflecting. Anecdotal comments by students included positive reactions to having two professors engaged in purposeful learning in the same classroom and benefiting from our unique expertise.

21st Century Classroom Design

Working a semester in advance, we completed collaborative planning about 21st century classroom design for inclusion in two undergraduate courses. The syllabi for both classes (ELEM 4300: Classroom Organization and Management in Elementary School and SPED 3004: Managing the Learning Environment) reflected the general education–special education collaborative project, which focused on demonstrating implementation and knowledge of 21st century skills on classroom design using free classroom design software. (See http://classroom.4teachers.org).

Throughout the semester, we modeled conspicuous collaboration. During the first class session, we attended both classes, introduced ourselves to the students, and discussed the collaboration that would occur between us and the general education and special education preservice teachers. Two class sessions later in the semester, we co-created and co-presented the same PowerPoint presentation on 21st century classroom design (which highlighted 21st century skills), critiqued sample classrooms and taught the preservice teachers how to use the free classroom design software.

All students in both courses incorporated their 21st century classroom design into their classroom management plans. All were required to attend one of three meetings scheduled during the last class session and the final examination sections. Once they arrived at the combined class session, we randomly assigned a special education student to work with a pair of general education students. Each group of three students reviewed each other's 21st century classroom designs and discussed similarities and differences in the proposed designs. After that review, we presented each group of three with three case studies about students with exceptionalities who would be included in a hypothetical elementary classroom. The group of three was charged with redesigning their classrooms to accommodate all three case study students with exceptionalities, using predetermined grade levels and physical constraints (e.g., room shape, room furniture, etc.). Using the software we discussed above, one person in the team then created a 21st century classroom design based on the components of the case study. Each team summarized the key assignment elements, reflected on the collaborative process, and discussed their experience during the culminating portion of the class.

We noted the resulting classroom layouts and furniture were well designed to meet the needs of a large class of students and the needs of students with exceptionalities, including those with physical, academic, and emotional disabilities. Both general education and special education preservice teachers benefited from working in teams as they strived to design one classroom that met both the expectations of all the team members and the academic and social needs of all students in the class. This necessitated the sharing of team members' differing expertise, cumulative course knowledge, and divergent internship and practicum experiences.

Successes and Challenges of Demonstrating Collaboration

We observed numerous successes that resulted from both the undergraduate and graduate conspicuous collaboration experiences. We observed preservice teachers gaining skills and appreciation for one another and their respective areas of the teaching profession. Based on the two collaborative projects (Shadowing/ Assessment and Universal Design for Learning lesson plan), the graduate students in both classes were able to demonstrate their collective skills in selecting and adjusting techniques based on individual learners.

The undergraduate juniors in the special education course listened to the elementary education undergraduate seniors who had more realistic visions and ideas due to their previous internship experiences. In contrast, the undergraduate seniors benefited from the undergraduate juniors' knowledge about special education differentiation techniques, disabilities expertise, and relationship to their surroundings. Special education and general education preservice teacher pairs collaborated to develop classroom management plans. We observed certain elements of the classroom management plans that were improved as a result of the collaboration (e.g., classroom layouts that worked well for large class sizes, group work, and students with wheelchairs; classroom management techniques that took into consideration the individual needs of students as well as the class as a whole). The subsequent class discussions were reflective and rich, and the preservice teachers were able to experience what co-planning and collaboration in the classroom would be like. Weiss et al. (2017) emphasized that preservice teachers benefit from opportunities to learn with other education professionals to plan and deliver instruction.

While the benefits of conspicuous collaboration overshadowed the challenges, we had to overcome some obstacles. As reported by other higher education collaborators and teachers, we were challenged to ensure the content was truly relevant to both courses (Artesani et al., 1998). In our case, students in both courses learned about classroom management; however, the elementary candidates were seniors who had begun their internship experience. They had an additional year of coursework and classroom experience but less coursework in special education. The special education candidates were juniors with fewer content instruction courses who were also working in a practicum setting with fewer rural K-12 contact hours and less consistency in their schedules. We capitalized on the varied background knowledge of the two groups. The elementary education students focused on content area instruction and classroom practices while the special education students focused on differentiating instruction for learners with exceptionalities. Therefore, we had to present course content in a developmentally appropriate sequence for both groups of students.

During the graduate collaboration project, the same students enrolled in both classes at the same time. Coupled with other class responsibilities, graduate students needed to combine skills and expertise from two separate courses with different goals and learning activities. The expectations of integrating skills in such a quick manner may have been ambitious considering the fast timeline of a five-week summer session.

Tips for Collaboration in Higher Education

When presenting conspicuous collaboration to preservice and in-service teachers in higher education, we suggest it may be helpful to be mindful of the following tips. Graziano and Navarrete (2012) stated that co-instructors in institutions of higher education should be flexible in their teaching approaches, accountable and respectful of their collaborative partner, and responsive to needs for time to co-plan and debrief. In this case, we co-planned all aspects of process as well as the evaluation of the conspicuous collaboration approach. We developed an initial overview of the conspicuous collaboration courses and projects, accompanied with a timeline, and agreed upon meeting dates. Our co-planning occurred prior to the start of the course (e.g., syllabi development), throughout the course (e.g., co-planning co-taught class sessions, co-evaluating projects), and after the course ended (e.g., co-reflecting on student outcomes and the process of conspicuous collaboration). We had similar philosophies on classroom management and gained additional instructional strategies by implementing approaches used by each other (e.g., learning stations, cooperative learning techniques). We routinely analyzed our collaborative experiences throughout the process during scheduled meetings. We debriefed and reflected upon each step using a Plus/Delta method to determine what was working well (e.g., assignments were organized and collaborative structures were implemented with fidelity) and what could be changed or improved (e.g., more time could be allowed for class-wide sharing of collaborative partner projects).

In general, co-instructors need to recognize each person's unique expertise and deliver instruction and use assessment methods that will benefit students. Describing strategies for successful collaborative teaching in higher education, Jorgensen et al. (2011) indicated the need to involve people with a disability who have expertise in the topic being taught, co-plan and co-teach to build joint ownership, and model and provide natural supports to each collaborative partner. Essential elements of collaboration at the postsecondary level, according to Lester and Evans (2009), include the need for extra planning and reflection, strong communication skills, and the ability to embrace diversity and differences of opinion. For this project, we saw the value in co-planning and co-teaching, and we felt ownership in the courses and with all groups of students. We were committed to maintaining open and on-going communication regarding both our collaboration and the student-to-student collaboration. We facilitated communication via scheduled meetings, emails, and phone calls. We learned from each other's varied expertise and experiences, which stemmed from our having differing teaching specialties (i.e., elementary education and special education), teaching experiences (i.e., teaching in different states and at different K-12 levels), and different approaches to teaching in higher education (i.e., cooperative learning arrangements, varied components of assignments). In addition, we served as rich resources for each other and often collaborated to problem solve student dilemmas (e.g., answer student questions, help students think through their projects). While our collaborative process at the higher education level took more time for planning, evaluating, and debriefing, the resulting student growth and high quality student products proved to be well worth the time commitment.

Strategies to facilitate effective collaboration highlight the need to clarify roles and responsibilities, discuss expectations, and schedule activities. Strategies should provide ongoing communication, joint planning time, co-planning, co-instructing, and co-assessing (Murawski & Ricci, 2019). At the conclusion of our higher education faculty collaboration project, we each wrote a reflection on the process and debriefed together. After considering suggestions for other higher educators who may want to attempt some collaboration, we concur with the list of guidelines from Devlin-Schere and Sardone (2013): collaborate with a person whom you respect but who is slightly different from yourself; remain confident in your abilities; assess your strengths and challenges; remain open to suggestions and do not be defensive; and be cautious about changing the dynamics of the collaborative relationship by adding or deleting others from the mix. For this project, we respected each other's expertise and philosophies but also appreciated our differences in teaching approaches and varied experiences. This respect was important especially during the regularly scheduled debriefing meetings in which we discussed the strengths and challenges of the collaboration. Our modeling of conspicuous collaboration for preservice teachers occurred at both the undergraduate level and graduate level in elementary and special education courses in multiple semesters. It was helpful that we were able to maintain our collaborative endeavor for all projects and we improved our approaches to communication, workflow, and ideology throughout the duration.

Tips for Translating Conspicuous Collaboration in Higher Education to Collaborating in Rural K-12 Schools

Co-teaching is a research-based collaborative strategy, which is effective for educating students with exceptionalities in the inclusive classroom (Friend & Bursuck, 2019). Collaboration among general education teachers and special education teachers is best begun in the teacher education setting in order to better understand and implement essential skills for teachers. Managing classrooms effectively, analyzing data, and completing diagnostic testing are all parts of the teaching cycle and should be modeled by instructors (Brinkmann & Twiford, 2012). The most effective elements of collaboration are sharing leadership in the classroom, planning together for co-taught instruction, developing a respectful and trusting relationship, and communicating honestly with each other (Bacharach et al., 2011). Bacharach et al. (2011) acknowledged that effective collaboration required the need for support and training in the university, handling interruptions without stopping the class, and planning specifically rather than generally. They emphasized the essential nature of communication for successful collaboration between co-teachers, the relationship of the co-teachers, classroom applications, and the teachers' knowledge base. Conspicuous collaboration at the postsecondary level can lead to successful, intentional collaboration at the K-12 level.

Benefits of collaboration and co-teaching in rural schools include increased teacher confidence, shared responsibility for student learning, decreased pupil–teacher ratios, students with disabilities having more direct instructional time, and increased support for students without disabilities as well, all of which leads to academic success (Strogilos & King-Sears, 2018). While the special education teacher has expertise in how to deliver instruction to meet the academic and social/emotional needs of the learner with exceptionalities, the general education teacher identifies priorities and generates solutions (Pugach et al., 2012). When general and special education teachers use collaborative problem solving, they are able to access more resources and facilitate greater professional collegiality, resulting in strategies that benefit learners and meet the unique challenges of rural educational systems (Pugach et. al, 2012). In addition to general and special educators co-teaching in rural areas, collaborating with paraprofessionals in educational programs leads to improved outcomes for students and increased job satisfaction for teachers (Webster & DeBoer, 2019).

Skills important for collaboration and co-teaching, according to Brinkmann and Twiford (2012), include classroom management, collaborative lesson planning, communication, data collection, interpersonal skills, differentiation of instruction, and self-advocacy. Skills identified for successful collaboration and co-teaching in a general education field setting are interpersonal communication, physical arrangement of the classroom, familiarity with the instructional content, instructional presentation, classroom management, instructional planning, curriculum goals, modifications and accommodations, and assessment (Bennett & Fisch, 2013). Skills that an educational collaborator must master, according to Graziano and Navarrete (2012), include understanding the teaching approach of one's collaborative partner; clarifying teacher roles, responsibilities, and expectations; scheduling shared planning time; utilizing effective communication; and using a professional learning community to provide flexibility for collaborative thematic and interdisciplinary units. Implementing conspicuous collaboration in the teacher preparation program may help to prepare individuals to collaborate and co-teach in rural school settings. Our conspicuous collaboration activities included a focus on collaborative class management and instructional planning, differentiated instruction and assessment, and communication and interpersonal skills.

Conclusion

Faculty members working in teacher education should embrace the concept and practice of conspicuous collaboration. Experiencing the collaboration modeled by instructors can enable both general education and special education preservice educators to recognize the symbiotic relationship that can exist throughout the education enterprise. "Teacher preparation programs need to build these understandings through authentic practice opportunities so that preservice teachers then have a conceptual foundation upon which to develop their skills in schools" (Weiss et al., 2017, p. 75). If their instructors utilize collaborative practices, preservice teacher candidates may embrace collaborative practices as they move to assuming the role of inservice teachers, effectively helping the increasingly diverse population of students in rural schools to achieve academic and social success.

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Transition to Teaching: Lessons Learned by a First-Year Rural Alternative Route Program

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This article describes lessons learned from the first-year implementation of a Grow Your Own teacher preparation alternative route program, Transition to Teaching. Implemented in a rural area in Washington State facing significant teacher shortages, the Transition to Teaching program reaches potential teachers who may not have access to a four-year college and a high-quality, competency-based teacher preparation program. The Transition to Teaching program fulfills the priority assigned by the state to recruiting and retaining teachers from underrepresented groups. Beginning with describing the design of the program and the application process, we discuss students' first-year experiences, lessons learned, and solutions developed. Content, strategies, access, and efficiencies are highlighted and advice for new programs is provided. In the end, we prove programs comparable to Transition to Teaching require clear collaboration and coordination as well as oversight to ensure teacher candidates are successful.

***Keywords*: Grow Your Own, alternative route teacher preparation, rural education, teacher shortage**

All students deserve access to a quality education; however, every year some students are denied this opportunity due to factors beyond their control, such as their zip code. This inequity, or opportunity gap, is felt strongly in rural America. According to the National Center for Educational Statistics, over half of the public school districts in the United States, including those in Washington State, are located in rural America (National Center for Education Statistics, n.d.). Thus, in 2010–2011, the opportunity gap applied to nearly one-quarter of the total public-school population (National Center for Education Statistics, 2013). More troubling is the link between the opportunity gap and poverty (Nicosia, 2017). Findings from a report from the U.S. Department of Agriculture published in 2017 indicated that education is closely linked with economic outcomes and racial and ethnic minorities in rural areas lag White students in educational attainment (Nicosia, 2017). Unequal access to qualified teachers was found to be a factor in larger opportunity gaps between students of high and low socioeconomic status in the United States (Akiba et al., 2007). Addressing this gap between students in non-rural and rural America requires that all students have access to qualified, effective teachers who understand the school and community cultures in which they serve.

Regrettably, there is a teacher shortage in rural Washington State (Geiger & Rosenberg, 2018). "Washington has experienced a 250% increase in the demand for new teachers. . . . Not only is there a teacher shortage but there is a need to improve the diversity of our educator workforce. Today 44% of Washington's children in our public schools are students of color but only 10% of the certificated staff are teachers of color" (Adams & Manuel, 2016, p. 3). Student diversity is rapidly increasing; in the last five years, students of color have increased 4% across the state (Professional Educator Standards

Board, 2018). For this reason, the state has adopted a strategic goal to increase the number of new educators who self-describe as coming from an underrepresented cultural background and are located in high-need areas, such as rural Washington (Professional Educator Standards Board, 2021b). One way in which the Washington State Professional Educator Standards Board has supported achieving this goal is encouraging the development of alternative route programs for teacher certification (Adams & Manuel, 2016).

Alternative routes to teacher certification in Washington State aim at addressing teacher shortages by improving the persistence of educators in the field as well as recruiting to increase the diversity of educators. In the rural areas of the state, a Grow Your Own alternative route program has the potential to address historic struggles with retention of teachers and current problems with recruitment as well as to increase the number of prospective teachers from underrepresented populations (García & Cook, 2017; Connally et al., 2017). Focusing on the shortage of prospective teachers, and specifically those from diverse backgrounds, will directly address the persistent marginalization of underrepresented populations in rural Washington (Adams & Manuel, 2016; Carter Andrews et al., 2019).

In this article, we describe the lessons learned in developing and implementing the first year of an alternative route program created for rural Washington called Transition to Teaching (T2T). T2T began as a brainstorming session that launched a two-year planning effort and partnership between a university, educational service district (ESD), two community colleges, and 17 rural school districts. The outcome of this work was a program designed to address issues of rural poverty by reducing teacher shortages in a rural, difficult-to-staff region in Washington State. Intended to grow the numbers of special education, English language, bilingual, and elementary education teachers in rural settings, the T2T program prepares prospective teachers to understand the context of poverty in rural central Washington State. We explore the barriers to entry into the teaching profession confronted by members of rural communities, briefly describe the program design (e.g., how it was developed to address barriers to teacher preparation), and offer lessons learned in the first year of the T2T program.

Barriers to Entry into the Teaching Profession

In order to be successful, alternative route teacher education programs need to address barriers to the teaching profession that prevent participation (McCarthy, 2015). A college completion gap between urban and rural students, and it is widening, even as rural Americans are increasingly better educated (Nicosia, 2017). Barriers to college completion and teacher certification include financial costs, testing requirements, differing languages, need for academic support and tutoring, assistance navigating federal student aid and university admission requirements (Adams & Manuel, 2016), and, significantly in the rural areas of Washington, lack of access to an Educator Preparation Program (EPP).

Rural north central Washington is served by two community colleges but lacks a four-year institution of higher education with a physical campus. Students must travel from home, at least several hours away, to attend a university. For financial, family, and cultural reasons, this is often not possible (Krupnick, 2018). Another barrier to attending college is the cost, made more difficult by the travel distance (Krupnick, 2018). In general, 50% or more of the population in these rural districts are at or below the poverty rate, as indicated by the state's low-income measure (Washington Office of Superintendent of Public Instruction, n.d.). In order to afford college, many students must work and live at home but cannot do so if attending a university requires travel. A third factor is a lack of a support network (Mottet, 2019). Many students from the region would be the first generation of their families to attend college. Typical of this demographic, students lack support from family and friends to negotiate the college process (Krupnick, 2018; Mottet, 2019). Finally, a significant barrier to college programs is the program admissions requirements (e.g., testing and testing fees) required for entry (Bennett et al., 2006; Nettles et al., 2011; Professional Educator Standards Board, 2018).

Alternative Route Programs in Washington State

Alternative route programs in Washington State are designed for career changers or members of the educational community (e.g., paraeducators, front-office staff, or emergency certified classroom teachers) who want to earn a teaching certificate. In comparison to traditional teacher certificate programs, alternative route programs are more flexible, affordable, clinically based, and shorter. In addition, Washington State alternative programs are also intended to be Grow Your Own programs that work in partnership with districts and tribal schools to recruit teachers from the community, especially from marginalized populations, who can diversify the educator workforce. Teachers in Grow Your Own programs are already members of the rural community who understand the cultural practices, norms, and language (García et al., 2019).

Washington State programs have differed in their approach to addressing barriers to the teaching profession either by prioritizing district and school needs or by adapting traditional certification requirements (Mitchell & Romero, 2010). Washington State alternative route programs work to address barriers through both approaches. In this way, alternative route programs are seen as "drivers of innovation" (García et al., 2019, p. 71) in the educator preparation field and as a strategy to diversify the educator workforce. The Professional Educator Standards Board (PESB) regulates alternative route programs in Washington State. PESB provides four pathways that EPPs can provide for prospective teachers to pursue their teaching certification (Professional Educator Standards Board, 2021a). As shown in Table 1, the T2T program, in an effort to extend learning opportunities to all teacher candidates, offers prospective teachers all four pathways to certification.

Route 1 (R1) is for prospective teachers who do not have a bachelor's degree, have a transferable associate's degree, and are already employed in a participating school district, usually as a paraeducator or paraprofessional ("para"). This route leads to a bachelor's degree and a teaching certificate but also requires that prospective teachers work to obtain additional endorsement as a teacher of English language learners, bilingual education, or special education.

Route 2 (R2) is for prospective teachers who already possess a bachelor's degree and are employed by a participating school district, usually as a para. R1 and R2 prospective teachers are classified employees and are sometimes serving in other roles such as secretary, bus driver, custodian before being recommended by their district as possessing strong potential as a teacher.

Route 3 (R3) is for prospective teachers who already possess a bachelor's degree but do not work for a participating school district. These prospective teachers are typically returning adult learners who are changing careers.

Table 1

Alternative Route Pathways to Teaching Certification (Professional Educator Standards Board, 2021b)

Alternatives	Population Served
Route 1	Paraeducator or other district staff, pursuing both a bachelor's degree and teaching certificate
Route 2	Paraeducator or other district staff with a bachelor's degree
Route 3	Career changer with a bachelor's degree
Route 4	Teacher of record with a conditional certification

Route 4 (R4) is for prospective teachers who already possess a bachelor's degree and are employed by school districts as teachers of record under a conditional certificate from the state. A condition of the certificate is that the teacher pursue an appropriate teaching certificate in a timely manner.

The Key to Alternative Route Success: Strong Partnerships

While alternative route programs in Washington State differ in the types of routes offered, program length, curricular design, and program assessment, or which endorsements they might provide for teacher candidates, *all* programs depend on strong partnerships with districts. Successful university–district partnerships require shared goals, ongoing needs assessments, and a structure that ensures the partnership's vision and mission are being met (Goree et al., 2019). Other characteristics of a successful university–district partnerships are mentor teachers committed to supporting teacher candidates, committed teacher candidates, and supportive administrators from both sides of the partnership (Coon-Kitt et al., 2019).

In any Grow Your Own setting, the partners are central to identifying individuals who might be interested and able to become effective educators. External partners can include school districts, tribal communities and schools, non-profit organizations, community colleges, or any number of groups interested in promoting a diverse educator workforce. Our external partners' investment in "growing" future educators in their communities included marketing, recruiting, advising, supporting, and, in some cases, funding prospective teachers in the program. Unlike most of the alternative routes in the state where universities partner with one district, a unique quality of our program is that we have collaborative partnerships with more than 40 districts across a wide swath of the state (García et al., 2019). We work closely with district partners and regional community colleges to seek out and advise potential teachers in rural central and eastern Washington.

In addition to these external partners, internal university partnerships are essential for the success of the program. Our internal partners, such as the Records and Registration, Financial Aid, and Budget offices have created new systems and structures needed by the program to allow for flexibility and to reduce institutional barriers to college attendance that had been invisible. The secret to these partnerships includes a shared mission we have collaboratively developed, consistent communication efforts, and a willingness to be flexible when possible.

University Requirements

In addition to state requirements, universities also have specific requirements for students who wish to earn bachelor's degrees. R1 teacher candidates must meet university entry requirements by providing evidence of a transferable associate degree or its approved equivalent. The EPP also stipulates prerequisite courses before program entry including demonstrated math proficiency (i.e., courses that meet designated proficiency for the university), English/writing proficiency (e.g., research skills, analytical writing, synthesis), and a communications course (e.g., public speaking, intercultural communication). These courses are freshman/sophomore level courses (i.e., 100 and 200 level). To earn a bachelor's degree, teacher candidates are also required to complete a course in global studies and diversity. Although we have a mandatory diversity course in our program that meets this requirement, all of the above requisites can be completed either at a community college or at the university.

In implementing T2T, we brokered adaptations to the typical university and EPP requirements to address known barriers. These included changes to admissions, registration, and course designations. For example, the T2T program and coursework had to be approved through the university curriculum review process before the program could recruit prospective teachers. Finally, in order to hold courses off campus, approval was required regarding reporting requirements, and unique memoranda of understanding were reached with our cooperating community college partners, the relevant ESDs, and school districts.

Addressing the Barriers in the Program Design

For many qualified teacher candidates, unpaid residency requirements commonly stipulated in traditional preparation programs are a primary barrier to entering the teaching profession (Wexler, 2016). For this reason, in the T2T program, we endeavored to maintain or find placements where teacher candidates could serve as employees of the district in a paid internship experience, including benefits. Persistence can be problematic, and our partners noted issues with the retention of people pursuing online programs. To encourage persistence, the university faculty and partner personnel committed to the success of teacher candidates, for the most part, recommended by administrators at the partner districts. This commitment has taken different forms depending on the circumstances but has included additional face-to-face meetings with teacher candidates, modified job assignments, changes of placements, and additional support to complete assessments.

Financial

Our regional comprehensive university is a low-cost public alternative for many students. However, providing access to university financial aid, conditional loan scholarships from the state, and low tuition for self-financed teacher candidates further eased the financial burden of college. In addition, several partner districts provided further financial support by supplementing transportation and lodging costs for teacher candidates who still had to travel significant distances just to reach the community colleges for class sessions.

Course Delivery

Another barrier to success was course delivery. Our district partners were adamant about providing a cohort for their teacher candidates based on the high dropout rate of prior employees trying to complete an online program independently. They reported that teacher candidates often felt isolated, alone, and unsupported in online programs. Connections and relationships are central to teaching and learning. Utilizing a cohort model provides not only regular contact with onsite faculty and staff, but, more importantly, fellow teacher candidates who are going through the same program and experiencing the same struggles and frustrations can communicate with and support each other. Like other Washington State alternative route programs, the T2T program was developed to incorporate hybrid course delivery, qualified instructors, a competency-based approach, individualization, and flexibility, as well as offer accelerated pathways for teacher candidates to earn specialty endorsements such as English Language Learners, Special Education, and Bilingual Education. Perhaps the most valuable part of our program was the course delivery method. We provided the only on-site teacher education program in the region. Combining a face-to-face, on-site experience with online elements allowed our teacher candidates to stay home and keep working at their current jobs.

Hybrid Coursework

Hybrid coursework offered practical benefits that reduced barriers for teacher candidates, such as allowing them to remain at home and employed after an intensive 2-week summer academy. Teacher candidates came to the campus of a local community college partner and met every day for 2 weeks in mid-summer. Coursework focused on orienting teacher candidates to the program and discussing the essentials of the teaching profession from foundations of assessment and management to introductory material on reading, special education, and English language learning. This intense experience laid the groundwork for the teacher candidates' experience in their schools the following term. In addition, teacher candidates were able to bond as a cohort, which helped with supporting one another throughout their program.

During the academic year, teacher candidates met monthly as a cohort to engage in face-to-face learning on Fridays and Saturdays at the campus of a local community college. In these meetings, teacher candidates learned specialist and core content teaching methods as well as lesson preparation using the university lesson plan format.

Qualified and Experienced Instructors

Program faculty adapted the courses they regularly taught in the traditional program for the

T2T program. They integrated program and state expectations with teacher candidates' prior experiences to design modules that included class time, hybrid materials, and course assignments that aligned with state competencies and the needs of rural Washington State teachers. Due to the nature of the program, seat time was limited so instructors had to develop courses to cover essentials during online sessions and apply content in face-to-face sessions. Through hybrid coursework connected with supervised practicum requirements, teacher candidates learned the skills needed to be successful teachers.

Competency-Based Approach

Using a standards-based approach, Washington State identifies competencies for elementary teachers (Professional Educator Standards Board, 2021a). The outcomes of any preparation program are verified by the competencies of each teacher candidate, judged by the evidence provided in coursework, fieldwork, or prior experiences in teaching settings. The PESB identifies five core competencies as indicators of proficiency and readiness: content knowledge, understanding the learner, learning community, instruction, and assessment. Each of the core competencies has a multitude of sub-competencies (Professional Educator Standards Board, 2021b). For example, one competency for the state residency certificate in elementary education appears in Figure 1.

Figure 1

Elementary Education Competencies (PESB, 2021a)

5.0 Assessment.

Candidates, individually and/or collaboratively design and implement a wide range of assessment strategies to inform instruction and support student learning within and across academic content areas.

5.A Align assessment strategies with learning targets

5.B Use a variety of formative and summative assessments that measure student performance relative to learning targets

5.C Effectively use state, district, and/or classroom assessments

5.D Use assessments, including rubrics (teacher, student, or institution generated), to promote student understanding of quality work and to improve self-reflection, peer feedback, and goal setting

5.E Build student capacity to use assessment to evaluate progress toward learning targets, reflect on learning, and make appropriate learning decisions

5.F Analyze assessment results to determine impact on student learning and to adjust instruction to improve teaching and learning (positive impact)

5.F.1 Understand student cognition in order to perform accurate error analysis and alleviate student misunderstanding

5.G Modify assessment practices so that students with exceptional needs can demonstrate mastery of concepts in alternative ways

Competency-Based ePortfolio

Competencies can be demonstrated in a number of ways. T2T used an ePortfolio to determine whether teacher candidates had demonstrated competencies and were ready to teach. Teacher candidates developed an online portfolio following the guidelines specified in an individualized Teacher Development Plan (TDP) created during the first summer academy. ePortfolios offer a research-based opportunity for teacher candidates to engage in metacognitive thinking and effective use of technology and implement teacher-reflective practice. They provide a way to document intentional forms of pedagogical knowledge and practice (Denton et al., 2008; Parkes et al, 2013). The TDP outlines prior coursework, relevant experience, and the practicum and coursework requirements needed to complete the program. This document, signed by the teacher candidate, mentor, field supervisor, and program director, serves as a program syllabus to guide teacher candidate learning and assessment.

As indicators of success, ePortfolios are one of the most promising criteria for teacher readiness (Russell & McPherson, 2001). Participants' ePortfolios followed the TDP and showcased the evidence that demonstrated that each competency has been met. Teacher candidates authored contention statements explaining how their submitted evidence met each required competency using evidence from prior coursework, work experience, personal research, and program coursework. These participant-authored contention statements served two purposes. First, they demonstrated that teacher candidates would identify evidence that addressed each competency. Secondly, they helped to provide a basis for forming evaluative judgments about the effectiveness and quality of the program. Successful completion of the ePortfolio was a T2T program requirement for graduation (R1) and certification (R1–R4).

The competency-based approach afforded flexibility into the design of the T2T program as it focused on the needs of and options available to teacher candidates in the way in which competencies might be met. Each participant determined, based on their setting and placement, how to meet a given competency. For instance, for one of the PESB sub-standards of competency 3.0: Learning Communities, teacher candidates must establish that they can create and foster student engagement, learning, and positive relationships in the classroom (Professional Educator Standards Board, 2021a). To do this, one teacher candidate could provide evidence of a completed lesson whereas another teacher candidate could provide samples of student-based evidence. This flexibility ensured equity for all participants while maintaining high standards of performance in the design of the program (Chardin & Novak, 2021).

Flexibility

Furthering the flexibility provided by the ePortfolio, PESB requires that alternative routes be flexible and individualized to meet the teacher candidates' needs (Professional Educator Standards Board, 2021a). Teacher candidates came into T2T with varying degrees of experience and education. For example, 10 teacher candidates came into our program without bachelor's degrees, but one had a master's degree; some were paras and others were teachers of record. The challenge, therefore, was to create a program that met the needs of all teacher candidates but could also be delivered by a small number of faculty and with limited resources.

The T2T program was designed to be flexible and provide multiple pathways to teacher certification. Residency requirements were also flexible, based on prior experience, placement, and teacher candidates' readiness. This flexibility allowed teacher candidates to maintain employment and receive credit for appropriate work experience, but it also required an individual residency plan for each teacher candidate.

Each pathway had a program designed to meet the needs of teacher candidates pursuing that path. For example, R1 teacher candidates needed to meet the number of credits required to earn a Bachelor of Arts in education, K-8 teaching certification, and an additional endorsement in either special education or English language learning. R2 teacher candidates needed appropriate classroom experience in a regular education elementary setting where they could teach all four core subject areas and still work. R3 teacher candidates needed a standard placement that allowed for a more traditional student teaching experience. Finally, R4 teacher candidates were already teaching but had to be mentored and supervised to further their development as teachers. Thus, a teacher candidate who was successfully meeting teaching expectations while serving as the teacher of record in a self-contained K-8 classroom did not need to do additional clinical residency hours.

Additional Endorsements

The alternative route requirements stipulated by PESB include an additional expectation for R1 teacher candidates. These teacher candidates must pursue an additional endorsement in either special education (SPED), English language learning (ELL), or bilingual education. This is an ongoing effort to address shortages in both SPED and ELL teachers in the state. These endorsements require additional coursework and practica that extend a teacher candidate's program beyond the baccalaureate. Some districts require that R2–R4 teacher candidates also complete an additional endorsement as such is the need in the area.

Lessons Learned

We designed T2T to address barriers to entry into the education profession and to increase the number of underrepresented individuals earning a teaching certificate in rural Washington State. After admitting our first cohort, despite our careful preparation, we learned that we had not anticipated all of the support teacher candidates would need to be successful in the different stages of the program.

Program Initiation

Institutional Barriers

Institutional barriers complicated the application process for T2T applicants. Like many institutions, ours required that applicants first apply to the university and then apply to a specific program (major). T2T applicants were considered similar to transfer or post-baccalaureate applicants because they were entering the university with an associate's or bachelor's degree. Applicants struggled with the admissions process, including the separate applications required for both the university and T2T program, the differing due dates and university fees required, and the paperwork required for funding, including financial aid applications like the Free Application for Federal Student Aid (FAFSA). Multiple due dates set by federal, state, university, and program policies created confusion. In addition, because the cohort began in the summer, the program spanned two academic years so applicants were required to submit two FAFSA applications to be considered eligible for financial aid. Given the complex process coupled with the distance of applicants from campus, many did not meet the due date or fee requirements on time. In addition, we were surprised to learn that many applicants did not have daily access to computers or internet service in their homes; this made the application process a struggle.

To find a short-term solution to address these issues, we worked with the districts, community colleges, and ESD to make computers or computer labs in schools available after school for applicants' use. We requested extensions from the state and university for the first cohort and personally contacted each applicant via email and phone several times to respond to questions and offer admissions advising. In order to address this issue going forward, university admissions personnel and T2T personnel developed a single application form to serve both university and program entrance needs as well as an advising protocol for admissions officers to direct appropriate applicants to this application. Program personnel also worked to streamline the website so that it offered better advising and information based on the first cohort's experience, including links to the FAFSA, university and program applications, and other required forms.

In addition to the challenges of funding and course delivery, new college students faced the institutional challenge of navigating the unfamiliar territory of a higher education institution. About a third of our applicants were first generation college students. Figuring out how to work within the university system to register, pay fees, obtain financial aid, and understand course requirements proved daunting to them. Working closely with various departments of the university, we were able to remove these barriers at the individual student level or advocate for changes based on program of entry. While time-consuming and sometimes frustrating for all involved, our efforts minimized unforeseen bureaucratic hurdles for applicants and those admitted to the T2T program.

An additional unforeseen institutional barrier to program completion was lack of access to university advising. Teacher candidates were unsure what courses to take, when to take them, or what courses from their transcripts would count toward university requirements. Typically, university advising for incoming and new students is staffed by a separate advising unit. Because the T2T program is an alternative program model than what advisors usually support, we found that T2T teacher candidates needed to be individually advised by T2T faculty. Because this level of advising is outside of the normal workload of faculty, advising workload for instructors needed to be considered. T2T teacher candidates have unique and specific needs throughout the program and require ongoing advising to offer direction and support to those who might otherwise feel frustrated and abandoned.

Testing Barriers

As predicted from the literature (Bennett et al., 2006; Nettles et al., 2011; Professional Educator Standards Board, 2018), a significant barrier to entry to the teaching profession for applicants was the prerequisite testing. All applicants to the T2T program were required to take a basic skills test, and those with a baccalaureate were required to take a content pedagogy test. Several applicants did not pass the basic skills test prior to program entry; one applicant did not pass the content pedagogy test before program entry.

To address this, we first provided test preparation and remedial assistance during our summer academy. In addition, we requested an extension for teacher candidates to remain in the program while preparing to retake their exams. At the same time, the state began a review of testing barriers and revised the policy to remove the passing score for the basic skills test and made passing the content pedagogy exam a program exit requirement. This state-level policy change greatly reduced the testing barrier for entry into the teaching profession.

At Admission

Once admitted, teacher candidates had difficulty registering for their summer coursework. Because the T2T program was unique, the courses were not available to other university teacher candidates. This meant that the courses were not searchable in the online registration platform and teacher candidates had to enter unique course codes to register successfully. In addition, the T2T program received permission to waive several, but not all, university fees. Teacher candidates with unpaid fees were not able to register. Given students' limited internet and computer access at home, the registration process proved complex and frustrating for many in the initial cohort.

To address this, we created step-by-step instructions with screen capture images of the registration process and course codes needed. We walked several teacher candidates through the registration process via phone during an advising conference. Despite this, multiple teacher candidates arrived at the first summer academy unregistered. We worked with the teacher candidates one-on-one to register them and arranged for late registration fees to be waived.

Difficulty Securing Qualified Instructors

As a self-supported program funded through grant and tuition dollars, finance for the program was limited. In addition, T2T was constrained by university barriers around faculty teaching loads. As a whole, T2T struggled to engage qualified teaching faculty due to university requirements that (a) faculty teach all courses as overage to their regular loads, (b) faculty often have to stay overnight to teach classes in rural areas because they travel 2-to-3 hours to the classroom locations, and (c) faculty have to pay for travel costs up-front and wait for the university system to reimburse these costs. For these reasons, we looked to ESD, community college, and district partners to recommend qualified faculty to teach courses in their regions. This plan met with some success. Partner–faculty were clearly qualified and knowledgeable about P-12 student needs in the rural area and could provide the application of theory to practice for specific methods courses. However, they also had to teach the courses as overage to their full-time job loads, and the university processed their employment contracts as adjuncts, requiring extensive hiring processes, time commitments, and sometimes significant delay before compensation was processed.

Unexpected Travel Costs

A significant portion of the T2T budget was devoted to travel costs, which was anticipated in the original budget proposals and grant application. However, we anticipated that the use of technology, such as Zoom, could replace some face-to-face visits. The technology expectations did not pan out as anticipated. Supervisor and mentor training, partnership meetings, and mentor conferencing were less successful via electronic meeting platforms than face-to-face interactions. Consequently, we spent additional funds in to mediate, problem solve, and train partners. This resulted in limited funding for developing more innovative curriculum and for visiting sister programs across the state and nation to learn more promising practices.

University Systems

The university supports innovative, self-supported programs and T2T, specifically. Administrative support from sectors ranging from finance to advising contributed countless hours of brainstorming and problem solving to make T2T possible within the structures of the university system. However, because T2T was designed to be “outside the box” of typical undergraduate degrees, institutional bureaucratic systems raised significant barriers to program development, implementation, instruction, and support.

While in Program

Despite efforts to design a program that intentionally addressed barriers for rural teacher candidates, we found that we had applied assumptions about traditional students to the T2T population. Technological barriers and divergent practicum placement support became apparent for teacher candidates in the program.

Technology Barriers

Many potential teachers in rural areas have limited access to educational opportunities through traditional colleges. Typically, opportunities are available in online-only format or from institutions that offer less desirable applied degrees. One of the benefits of the T2T alternative route program was that it offered a hybrid pathway to teaching certification in rural areas. As we planned for coursework in both face-to-face and online settings, we anticipated familiarity with technology (e.g., access to a computer or computer lab), ability to use programs in the Microsoft Office Suite, knowledge of how to attach documents in an online platform, and some facility with learning management systems such as Blackboard or Canvas. As did Dukes and Jones (2007), we found that several teacher candidates did not have access to home computers or home internet and required practical advice for online education. We developed instruction on how to use internet services with the whole class, practiced basic skills as a group, and then individually met with teacher candidates to provide remedial services.

Practicum Issues

In their article describing how to redesign curriculum to advance teacher education, Banks et al. (2014) described the importance of designing clinically based teacher preparation programs that intentionally, cohesively, and consistently merged coursework and fieldwork. We predicted that most teacher candidates would be paras in R1 or non-certificated teachers in R4, currently employed by the district. Based on this, we anticipated that teacher candidates would have easy access to placements in classroom settings. However, as mentioned above, many teacher candidates who entered the program were not district employees (R3). Even teacher candidates who were employees struggled to find mentor teachers and classrooms that met the requirements for the K-8 teaching certificate because, in their roles as employees, they were placed in special education or ELL settings. In addition, there was confusion with our partners around the role of the field supervisor—traditionally a liaison between the university and the placement site. In earlier conversations with district partners, we anticipated that districts would utilize building coaches or district teaching mentors, such as a Beginning Educator Support Team (BEST) mentor, to serve in this role.

The BEST program is a program facilitated through the Washington State Office of Superintendent of Public Instruction (OSPI). However, for many of the small rural partners, this was not possible, and the supervisor assigned was the building principal. However, the principal also served as the teacher candidates' employment supervisor, presenting a potential conflict of interest. Because the supervisor was a district, and not a university, employee, there were some issues with training expectations, attending training sessions, correctly using university assessments such as the lesson plan template, and following policies around problem-solving when issues arose.

When teacher candidates were employees of the school district (e.g., R1 and R2), we learned we had to negotiate their roles while completing practicum. For example, a teacher candidate who served in the role of a paraprofessional in a specific setting such as special education, needed to have a practicum experience in a general education setting to demonstrate skills and knowledge in the elementary competencies. In one district we were able to work through the district and union to set up a time where the teacher candidates would trade with another paraprofessional who was working in a general education setting. This way the teacher candidate was able to complete practicum requirements while continuing with employment in the district. In another situation, where a teacher candidate was serving under a conditional certificate as a middle school math teacher, we were able to work with the district to have that teacher candidate work to meet competencies in other core subject areas during their preparation time and also utilizing a district-provided substitute teacher. We learned these were delicate negotiation processes, but we were grateful that we had partnered so closely with our districts; thus, when issues arose, we were able to remedy them quickly.

Because field experience and residency are formative learning experiences, several teacher candidates who struggled in their roles as uncertificated first-year teachers were accountable in high-stakes ways for learning mistakes, including loss of future job opportunities. Clarification around the role of the supervisor and the principal and the learning expectations of residency became a priority for the first year of the partnership. Of particular importance was how to communicate most effectively with all partners. Our regular partnership meetings were held with a representative from each district and the ESD, usually superintendents or human resources representatives. Ensuring that meeting details reached building principals and others who had the responsibility of implementation became a priority. The communication channel needed to be broadened to include specific mentors, principals, coaches, and others in building support roles while still maintaining strong partnership communications with superintendents and district representatives.

This highlights one of the issues in our large partnership: divergent support and resources among districts in the partnership. Some districts provided a building coach, ongoing mentorship and support, and travel reimbursement. Other districts had less capacity to offer support, either in mentorship and supervision or in finances. This impacted placements as well as course and program outcomes. Specifically, the lack of music, art, and physical education specialists to observe and interact with teacher candidates meant that the program outcomes for the first quarter had to be met differently than originally planned in the four-quarter curriculum.

Disposition Issues

One thing we understood from our traditional preparation program was the importance of teaching professional dispositions to teacher candidates. Anticipating that many of our teacher candidates would be moving from a para role to that of a teacher, we felt it important to inculcate the values of the teaching profession. We did this in a way that was meant to foster inclusive excellence (Martinez & Punyanunt-Carter, 2021) through an exploration of implicit bias in behaviors and schooling norms (Hammond, 2015). Specifically, in order to better understand schooling cultures and norms, we intentionally embedded equity practices as a model of how teachers engage versus forming judgments of behaviors that do not align to school culture norms (Chardin & Novak, 2021). One expectation we made clear to our district partners was that all teacher candidates, regardless of route, would be included in professional development opportunities available for teachers. What we did not address adequately was expectations for professional conduct relative to dispositions of teacher candidates with administrators, teachers, university personnel and faculty, and fellow teacher candidates. We knew that starting a new program in such a short time frame might lead to frustrations on behalf of our teacher candidates, and we advised them regularly that when the inevitable setbacks occurred, we would work to correct miscommunications and misunderstandings in a way that would not be detrimental to them. Despite these assurances, we were surprised at the impatience and quick use of electronic communication to jump to negative conclusions by a significant number of teacher candidates. These incidents occurred enough to prompt comment from instructors and district personnel alike. Schools expect teacher candidates to demonstrate professional dispositions, especially their own employees who are transitioning roles, but given their new status, teaching candidates did not consistently perform to this expectation. Thus, we realized the need for more explicit conversations around the change of roles from para to teacher.

On the basis of our experience, we recommend that alternative route programs allot time at face-to-face sessions to inculcate teacher candidates to professional expectations and teaching dispositions. This should include explicit descriptions of the ways to interact with peers, school personnel, parents and families, university instructors, and students and to provide practice in presuming possible alternative explanations for behaviors (Hammond, 2015). For instance, the use of the Gudykunst and Kim's (2003) three-part communication protocol, Dray and Wisneski's (2011) Mindful Reflection Protocol, and clear discussions defining microaggressions and triggers that activate threats in the brain (Hammond, 2015) can help teacher candidates to understand the purpose of professional expectations and teaching dispositions. It is equally necessary to establish guidelines for appropriate dress and language. We also suggest describing typical school culture and behavioral expectations including preparation for observations, meetings, and time spent at school. Further, we suggest presenting teacher candidates a protocol to follow when questions and frustrations arise. Importantly, from a university perspective, teacher candidates need to be expressly taught that teaching is an iterative profession, and they should expect that their work will require reflection, revision, and resubmission, be it lesson plans, lessons, or even the edTPA.

Mentoring

In addition to barriers experienced by teacher candidates, we experienced unexpected challenges to the T2T alternative route design and implementation—specifically, issues with mentor and supervisor training. Traditional programs match teacher candidates with mentor teachers with whom teacher candidates work closely to observe and refine their own teaching. In T2T, teacher candidates had several different contexts that had to be considered. R1 and R2 teacher candidates were often paras working in special education or ELL settings. This meant that they had to find time to work in a general education classroom. School districts we partnered with sometimes had to revise employee work schedules to allow this to happen. R4 teacher candidates teaching in their own classrooms needed a mentor to be alongside them as they taught. R3 teacher candidates tended to have a more traditional experience. They worked to find a mentor teacher in whose classroom they volunteered time and gained practice teaching experience. All mentor teachers were asked to take part in our training to learn university expectations and requirements for our teacher candidates.

Field Supervision

In our traditional program, field supervisors employed by the university supervise numerous teacher candidates and work with mentor teachers to oversee teacher candidate preparation. With the remote location of our teacher candidates, finding field supervisors was a challenge. Larger districts provided a supervisor from its central office. Smaller districts sometimes provided principals or curriculum coaches to serve as supervisors. Supervisors observed all teacher candidates at least six times including completing observations of teacher candidate teaching and meeting with both teacher candidates and mentor teachers.

Summary of Advice for New Programs

Several decisions we made in implementing T2T addressed barriers our teacher candidates felt when entering the teaching profession. The cohort model and weekend seminars encouraged teacher candidates to develop relationships with faculty, staff, and each other in expectation of increasing retention. The cohort developed a strong support network that made a difference to the success of each individual teacher candidate and even beyond the program and into the first year of teaching. All but one teacher candidate in the first cohort successfully completed the requirements to earn a teaching certificate and remained employed in the school district. There were real successes in the first year of T2T. However, we also experienced growing pains and had the sense that we had not done enough to dismantle the barriers that impeded participant success in rural Washington. Table 2 summarizes our advice to new alternative route programs, based on the lessons we learned in our first year.

Table 2

Lessons Learned – Barriers and Advice

Barrier 1: Admissions Process

Items	Advice
1: Application Requirements 2: Program Application 3: University Fees 4: FAFSA Requirements 5: Multiple Due Dates 6: Distance to Campus 7: Lack of Access to Technology 8: Testing Barriers	Item 1: Combine university and program online applications and establish one due date. Items 1 & 2: Provide dedicated program staff to help with admissions advising or work with university admissions to provide a dedicated advisor to work with alternative route students and understand the admission differences for their applications. Items 2–6: Bring the advising to the potential students: hold multiple on-site advising sessions, with available laptops or lab spaces, to complete applications (including the FAFSA) with assistance. Item 3: Advocate for a reduction in university fees, especially for those services off-site students will not utilize. Item 6: Request a local ESD or district representative be assigned to liaison with school staff for the admissions process. This person can also serve on your advisory board or planning team. Item 7: Work with stakeholders to open and staff computer labs in local schools, districts, and community colleges in the evenings and on weekends. Item 8: Provide test-preparation through the community college or other stakeholder partner. Item 8: Advocate for a change in admissions testing for program entry in your state.

Table 2 (Continued)

Barrier 2: Registration

Items	Advice
1: Registration Issues 2: Unpaid Fees and Registration Holds 3: Lack of Access to Technology 4: Difficulty Securing Qualified Instructors Who Can Travel 5: Travel Costs	Item 1: Create step-by-step visual guides to the registration process and publish these guides online for each registration term. Items 1 & 2: Provide dedicated program staff to help with the registration advising including individualized phone calls and doublechecking rosters. Items 2 & 3: Bring the registration process to the participants: Hold multiple on-site sessions, with available laptops or lab spaces, to complete registration with assistance. Item 4: If required, partner with ESD or districts to recruit qualified instructors who meet university adjunct requirements and understand the context for learning in the alternative licensure route program. Item 4: Market your program internally. Share the benefits of service teaching in the alternative licensure route program to encourage colleagues to sign on as course instructors. Item 5: Expect travel costs to exceed your prediction. Be sure to include visits to other alternative licensure route programs to learn best practices and to troubleshoot with experienced colleagues.

Barrier 3: In Program

Items	Advice
1: Lack of Access to Technology & Internet 2: Lack of Knowledge Regarding How to Utilize Technology for Learning 3: Employees vs Participants 4: Disposition Issues 5: Practicum Support Across Routes 6: Mentor Teacher Training and Support 7: Field Supervisor Training and Support	Item 1: Work with stakeholders to open and staff computer labs in local schools, districts, community colleges in the evenings and on weekends. Item 2: Dedicate curricular time in the first weeks to establish background knowledge for technology use. Provide technical assistance and training for common areas of need. Item 3: Allot time at face-to-face sessions to inculcate participants with professional expectations and teaching dispositions. Item 4: Describe school culture and behavioral expectations. Item 4: Teach participants that teaching is an iterative profession, and they should expect to reflect and resubmit assignments. Item 5: Don't assume participants will hold positions in the same district. Provide staff and time to place the majority of the teacher candidates in a classroom with a mentor, as you might do with a traditional teacher candidate. Item 5: Take the time to talk through hypotheticals. Anticipate a worst-case scenario for performance or behavior by those participants with positions in the district, either as paras or teachers of record, and plan for how the university and district will work together to support or dismiss a participant. Will the participant be viewed as a student or as an employee in moments where mistakes might be made? Be upfront and clear about these expectations so that all stakeholders know next steps, if needed.

8: Communication With all Stakeholders	Items 5, 6, & 7: If your program works with multiple districts, work with district partners to identify the types and level of support they will provide teacher candidates. Give districts the opportunity to review benefits provided and address how to make sure there are equitable opportunities for program support across all districts. Item 8: Hold regular partnership meetings together with all stakeholders. Items 6, 7, & 8: Mentor teachers and field supervisors who are at a distance from the university. Multiple training and support sessions should be provided throughout the year. Unlike in more traditional programs, mentors and supervisors are supporting a participant on an individualized basis, and they may not be able to rely upon general program guidelines. Assure that program staff that can offer sustained support and training beyond an initial training session. This could include online training modules and regular check-in contact. Mentors and supervisors may be employees of partner stakeholders and will need to know who, to contact in moments of questions or concerns.

Conclusion

All students deserve access to a quality education. We argue that this begins with access to quality teachers. The T2T program is an effective model of regional leadership and partnership among the university, community colleges, and schools to address the needs in rural areas for qualified and effective teachers who understand the population of learners they serve.

Key lessons learned in the first year of the T2T program include (a) simplifying application procedures, (b) providing personal support for teacher candidates, (c) ensuring effective communication with district partners from district leaders to mentor teachers, (d) explicitly training for teacher candidates in professional dispositions, (e) explicitly framing teaching as an iterative process, and (f) providing access and support in the use of appropriate technology.

Those interested in developing an alternate route program are encouraged to (a) learn about and understand barriers to accessing the profession in your area, (b) create a program with a cohort model and hybrid course delivery, (c) meet with the teacher candidates to the extent possible, (d) work hand-in-hand with university administration to integrate unique aspects of the program with university systems, and (e) commit to the success of teacher candidates.

Many areas in the country are faced with teacher shortages and a lack of diversity in the teacher workforce. This problem may be particularly acute in rural school districts. Providing an alternate route program that affords access to a high-quality teacher preparation program and addresses known barriers to the profession can help to recruit and retain diverse teacher candidates and individuals committed to their local communities. It is our hope that lessons we have learned in our journey so far will encourage others to work to address teacher shortage and increase the diversity of the teacher workforce thorough an alternate route program.

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Book Review: *Teaching in Rural Places: Thriving in Classrooms, Schools, and Communities*

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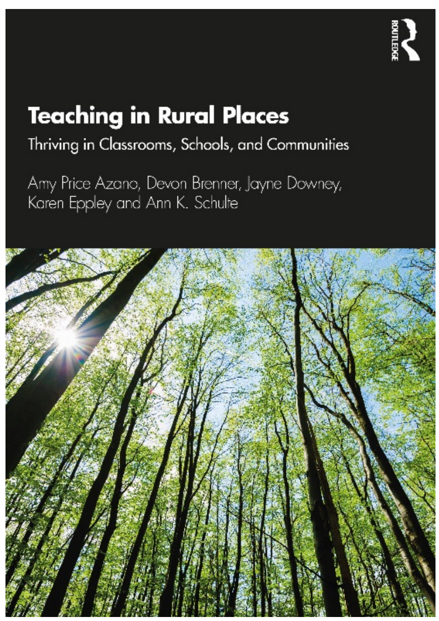
Book Reviewed: *Teaching in Rural Places: Thriving in Classrooms, Schools, and Communities,* by Amy Price Azano, Devon Brenner, Jayne Downey, Karen Eppley, and Ann K. Schulte: New York, NY: Routledge, 2021. ISBN: 9780367376383. 292 pages.

Keywords: **rural education, rural students, schools and communities**

Teacher education and teacher induction programs often encourage their participants to read one of the many books designed to provide novice educators with a foundation for their future work. The genre grows every year and many such texts are excellent. Despite the widespread popularity of such books, however, there have been no such guidebooks written specifically for new teachers in rural schools. 9.3 million students attend rural schools in the United States (Showalter, et al, 2019) and yet, as rural education scholars have pointed out, rural education is both underrepresented and unevenly represented in the research literature (Sherwood, 2000; Thier & Beach, 2019; Their et al, 2021. In my work as a teacher educator, I have observed that rural education is similarly underrepresented in practice-focused work designed for new teachers.



Teaching in Rural Places: Thriving in Classrooms, Schools and Communities (2021) fills that important gap. It is that rare text that serves as a primer, as a philosophical framework and practical guide all in one.

Amy Price Azano, Devon Brenner, Jayne Downey, Karen Eppley and Ann K. Schulte have all taught in rural schools, worked extensively with rural teachers and are well-respected scholars in the field of rural education. In addition to their work in rural teacher preparation, policy, literacy, equity, and literacy, they serve on the editorial boards of the field's flagship journals and in leadership roles in the rural education research community. [1]Their commitment to and affection for rural people and rural places is evident in this book, as is their commitment to moving rural education toward the goals of justice and equity.

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The book is built around two philosophical pillars. The first is that of social justice in rural places and how the work of rural teachers can help to dismantle “spatial barriers to economic, social and political justice” (Preface). The second is that rural teachers can and must develop the skills and cultivate the connections to thrive in their classrooms, their schools and in their rural communities. In order to do so, the authors ask new rural teachers to be critical explorers of place, of place histories and of policy and to work toward deep understanding of and full engagement with the communities in which they work. The authors employ David Greenwood’s (2013) framework of a critical pedagogy of place as a lens to examine and situate the work of teachers in rural places.

Media interest in rural America waxes and wanes. Recent attention to rural voters in the most recent presidential election and to the impact of the COVID-19 pandemic on rural communities has brought rural issues into the national spotlight. Unfortunately, as the authors describe in the text, rural is often equated with deficit perspectives. Stereotypes and essentializations of rural people are all too common. This book asks readers to examine their own understanding of what it means to be rural and to approach their teaching work with curiosity and humility.

The first portion of the book is devoted to setting the stage for teaching in rural contexts. The authors take the position that “education in rural schools *is* a project of social justice” (p.25) and use Nancy Fraser’s (2005; 2009) framework that includes *cultural justice*, *economic justice,* and *political justice*. They then dive into the question of what makes a place rural and why place matters. The remaining three sections of the book focus on rural communities, rural schools, and rural classrooms. In discussing community, the authors unpack topics such as partnering with rural families and getting to know rural communities through a “rural community walk”. This is followed by discussion of policy as it applies to rural schools and navigating trauma in a rural context. The authors then take up topics such as technology in rural schools, teaching students with disabilities and the importance of inquiry in rural classrooms. The final chapter ties all of these threads together by asking readers to engage in deep reflection about their sense of purpose as rural educators--their motivations for teaching rurally, their notions about rurality and the role of place in their own backgrounds and in their teaching.

The book is ambitious and covers a great deal of ground. As a result, some of the sections both swiftly introduce the basics of a concept or topic and then examine it through a rural lens. This can, at times, feel a little rushed. The authors could have assumed that their readers would come to the text with a basic understanding of some topics (i.e. classroom technology or the fundamentals of disability law) and then been able to devote more attention to the rural-specific aspects of those concepts or topics.

It is a book that is accessible, thought-provoking, and practical all at once. One element of the text that I found particularly helpful were the discussion and activity suggestions. These concrete suggestions encourage readers to operationalize and deepen their understanding of the concepts in the chapters. Preservice teachers sometimes complain that their teaching programs are too theoretical. This book provides grounding in important theoretical concepts and historical context while also including a wealth of pragmatic, useful suggestions for practice. It is written in a warm and personal voice and includes many real-world examples that help ground concepts in practice and in the day-to-day realities of teaching.

While the authors do not specifically reference the notion of an ethic of care (Noddings, 1984; 2005), this is a deeply caring book. The text is an example of both Noddings’s “caring for” and “caring about” rural students and rural communities. The authors are careful neither idealize nor demonize rural places. Rather, they ask readers to enter into a sense of relational, critical care with the rural communities in which they will work so that they can thrive as rural teachers.

There is a long history of rural Americans being overlooked, stereotyped, and discriminated against by those in positions of power and those who live in urban or suburban communities. While the intended readers of this book are, of course, rural teachers, ultimately, this book would be a valuable read for any new teacher, not just for those working and living in rural places.

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Editorial Board for Volume 11, Number 1

ECU RURAL EDUCATION INSTITUTE

Theory & Practice in Rural Education (TPRE)

Call for Special Issue on Rural STEM Teacher Development

Guest Editors:
Janet K. Stramel, Ph.D. (Fort Hays State University)
Earl Legleiter (Fort Hays State University)

STEM Teaching and Learning in Rural Communities: Exploring Challenges and Opportunities

All students have a right to a high-quality STEM education. Since the 1980s, a shortage of mathematics and science teachers has been recognized (Monk, 2007; Rumberger, 1987; Levin, 1985). Rural school districts face challenges recruiting and retaining in specialized subject areas. According to Lavalley (2018), the unique needs of rural education are "often obscured by their urban and suburban counterparts." Nationally 19% of all students are enrolled in rural schools, and in 13 states, that percentage is greater than 33%, and "more than 9.3 million, or nearly one in five in the United States attend a rural school" (Showalter, et.al., 2019).

STEM Teaching and Learning in Rural Communities - Challenges and Opportunities

Darling-Hammond (1999) found that "high quality" teachers are one of the most important factors to improve student achievement. Nationally, there is a shortage of qualified STEM teachers (100Kin10, 2019). These problems are magnified when disaggregated for rural schools-as rural school districts have difficulties recruiting and retaining teachers in mathematics and science (Brownell, Bishop, & Sindelar, 2005). But the challenge of rural schools in providing effective teaching and learning is not unsurmountable.

We often hear about the less than stellar performance of the United States on the NAEP reported in the media (NAEP, 2019). Contributing factors include funding issues which makes STEM resources more difficult to access, technology gaps, access to resources, cultural challenges, and STEM teacher shortages. Rural districts face these unique challenges, as well as professional development, advanced coursework, diversity, and relevant and meaningful curriculum.

While rural educators and communities face unique challenges, they also provide opportunities. They bring knowledge, experiences, and local connections that can strengthen STEM education. When the complexities of rural spaces are acknowledged and factored in, collaborative partnerships can help to bring external and internal assets together to meet the very real challenges and boost STEM learning and teaching in rural schools. When asked about advantages to teaching STEM in rural communities, Buffington (2019) said that "people who live in these communities have applied understandings of STEM and can contribute that knowledge to STEM learning." This special issue is seeking articles from the field discussing rural school success stories of how rural districts have overcome challenges to have effective and rich STEM teaching and learning in rural schools.

Call for Articles

This issue explores the complexities, practices, and challenges and opportunities facing rural schools and universities as they design, implement STEM teaching and learning. Articles might address issues such as:

- Recruiting and retaining a skilled STEM teaching workforce
- Technology and networking solutions to support/enhance STEM teaching and learning
- Partnerships to improve and support STEM teaching and/or learning
- Advantages, challenges, and/or opportunities to teaching STEM in rural communities

- Making STEM teaching and learning relevant in rural schools
- Community-based curriculum initiatives
- Using local knowledge in STEM education
- Promising and effective educational practices in rural schools STEM education
- Educator preparation for rural STEM teaching

Those interested in being considered for this special issue should submit a full manuscript to the TPRE system (http://tpre.ecu.edu) by **March 27, 2022.** Questions about possible topics or ideas should be sent to Janet Stramel (jkstramel@fhsu.edu). All submissions will go through the TPRE process of double-blind review by experts in the field.

TPRE Author Guidelines: http://tpre.ecu.edu/index.php/tpre/about/submissions#authorGuidelines

Estimated Timeline

- Manuscripts Due: March 27, 2022
  - Accepted on a rolling basis up until the close date
- Double Blind Review Process
  - Approximately 2 month turnaround (April/May)
- Articles selected for Revise/Resubmit or Minor Edits
  - Revise/Resubmit Deadline: 45 days from receipt of feedback (May/June)
- Second (limited)Double Blind Peer Review Process From resubmissions
  - Approximately 1 month turnaround (July)
- Final selection of articles selected for Minor Edits
  - Deadline: one month from receipt of feedback (September)
- Expected Publication Date: October 2022

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Call for Manuscripts to *Theory & Practice in Rural Education*
http://tpre.ecu.edu

Schedule and submission dates

Spring 2022	January 15th	General topics
Fall 2022	March 28th	**Special Issue on Rural STEM Teacher Development**
Spring 2023	January 15th	General topics
Fall 2023	February 28th	Special issue **TBA**

The editors of the *Theory & Practice in Rural Education* would like to invite authors to submit manuscripts for forthcoming issues. *Theory & Practice in Rural Education* is a peer-reviewed journal published electronically twice per year, spring and fall. We are predominantly interested in manuscripts related to promising and effective educational practices in rural schools, educator preparation for rural P-16 institutions, and issues related to distinct rural populations. We invite several types of articles and/or multimedia creations, including those with an international focus: practice-based; educational innovations; partnerships for education; research-based articles; review articles; and book reviews focusing on rural education. (Please see Author Guidelines at the website for additional submission information.)

All proposals will be subject to double blind peer review.

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