

An Undergraduate Health Care Experience Course Increases Confidence and Improves Student Understanding of Health Care Careers

Adrienne Williams* and Matthew Williams

Department of Biomedical Sciences, West Virginia School of Osteopathic Medicine, Lewisburg, WV 24901

ABSTRACT

Increasing the health care work force is critical to underserved communities. Unfortunately, students in these areas lack accessibility to the clinical experiences needed to get an introductory understanding of careers in health care. Therefore, a health care experience (HCE) course was created for undergraduate students that included didactic training, active learning exercises, and coordinated shadowing experiences. To evaluate the effect of the HCE on student interest in science, health care, and rural health a study was performed on HCE participants. This study assessed student background, interest in health care, and plans for future careers in underserved settings. Students who enrolled in the HCE demonstrated high interest in science, health care, and rural health. Evaluation of student reflections indicated students attained novel learning, gained insights, and recognized the importance of communication. The HCE course students exhibited amplified confidence in HCEs and had a significant increase in understanding of health care compared with a control group of students who had not completed the HCE. Undergraduate institutions can include courses like the HCE into curricula to increase accessibility to career experiences for students interested in health care careers.

INTRODUCTION

Health professional shortage areas (HPSAs) exist throughout the world and have a major impact on accessibility to medical care, especially in rural areas. In the United States the U.S. Bureau of Health Workforce of the Health Resources and Services Administration summarized information on HPSAs in December of 2023 and found that HPSAs are estimated to need an additional 17,637 practitioners to serve in primary medical care, 13,354 to serve in dental practice, and 8,504 to serve in mental health practice (*Designated HPSA Quarterly Summary*, 2024). Approximately 66% of all the primary medical, 66% dental, and 60% of mental health practitioners are needed in areas designated as rural HPSAs.

Medical school matriculates who report interest in practicing in small towns and rural communities have been shown to be declining (Shipman *et al.*, 2013). One of the best predictors of interest in future practice in a rural area is rural background status. Rural background has numerous definitions, but self-description of having past experience in a rural area has been consistently supported as a predictor of future rural practice (Owen *et al.*, 2007; Rabinowitz *et al.*, 2012; Hempel *et al.*, 2015; MacQueen *et al.*, 2018). Declining interest in rural health care could be because medical education characteristically exposes students to urban and suburban settings in addition to fewer rural students applying and matriculating to medical schools. Reports of matriculations to medical school demonstrates a troubling 15-y decline in numbers of students from a rural background, culminating in less than five percent of 2017 matriculating medical students having a rural background (Shipman *et al.*, 2019). This decline

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Conflict of Interest: Both authors were involved in producing the described curriculum, but Adrienne Williams assessed the effectiveness of the curriculum.

*Address correspondence to: Adrienne Williams (awilliams1@osteo.wvsum.edu).

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TABLE 1. Schedule of the fall HCE course activities

Weeks	Course activities
1	Course introduction and schedule; Prequestionnaire
2	Lectures: Introduction to healthcare; Careers in health care
3	Professionalism 1: Attire and Conduct; Professionalism 2: Ethics in Health care
4	Professionalism 3: Patient Confidentiality and HIPAA
5	Professionalism 4: Q&A; Preparation for Shadowing Experiences; Shadowing Experience #1
6-14	Weekly Shadowing Experiences Debriefings; Student-led Presentations and Discussions
15	<i>Holiday break</i>
16-17	Weekly Shadowing Experience Debriefings; Student-led Presentations and Discussions
18	Final assessment; Postquestionnaire

may reflect limited educational opportunities, limited role models, or a variety of other factors that impact pathways for rural students to enter into the rural health care workforce.

Shadowing a professional is recognized as one of the best ways to find out what a career in health care entails. It is also a great way to gain awareness of different specialties and health care environments and responsibilities. Furthermore, admission to many health care programs requires prior health care experiences (HCE) and even to obtain a letter of recommendation from a health care professional (Adams *et al.*, 2006; Hernandez *et al.*, 2009; Kitsis and Goldsammler, 2013; Stroh *et al.*, 2013; Kusnoor and Stelljes, 2016; Langenau *et al.*, 2019; Thang *et al.*, 2019; Kendrick *et al.*, 2020; Sarver *et al.*, 2020; Mafinejad *et al.*, 2022). Students typically make informal arrangements to observe health care professionals in their community. Undergraduate students with established connections to the health care community more easily secure these informal shadowing experiences. In our professional experience, many students from rural HPSAs, especially those who are first-generation college students, feel unprepared for seeking and initiating professional interactions with health care providers to experience their chosen careers. In addition, though many health care professionals recognize the importance of student shadowing and are willing to have students, scheduling difficulties, professional responsibilities, and corporation restrictions are barriers that prevent them from permitting students to shadow.

The availability of formal in-person shadowing programs are very limited in the U.S. and are mainly restricted to universities with large undergraduate premedical tracts in larger cities. Consequently, there are a greater number of prehealth professional students needing clinical shadowing experiences than there are accessible formal shadowing opportunities in the current health care setting. We believe that these early interactions and discovery of role models are key to retaining student interest and persistence in health care careers. However, there is relatively little published on the subject, and so that is one novel contribution of this study.

In this article we report on two related studies. We evaluate the impact of an undergraduate HCE course that incorporated a mix of didactic trainings, active learning activities, and structured shadowing experiences with locally practicing health care clinicians. The purpose of the HCE course was to assist students into health care and retain students who may normally find in-person shadowing experiences an impassible hurdle by providing the structure needed to involve rural community health-care partners in the education of college students. A course

providing the necessary training of students engaging with the local health care community eases health care provider burdens during these interactions. The purpose of Study 1 was to evaluate undergraduate student feedback following their clinical shadowing experiences. The goals of Study 2 were to evaluate change of student interest in science, health care, and rural health care and evaluated student confidence and understanding of health care careers, as well as, our course learning outcomes. In this article, we describe the structure and implementation of our HCE course, analyze its effects on student interests in health care and rural health care careers. In addition, we cross-sectionally evaluate student confidence in their own HCE and the HCE course's learning outcomes.

METHODS

Course Context

The HCE course was offered as a special topics course to undergraduates at West Virginia University Institute of Technology (WVU Tech) in Beckley, West Virginia, USA in the Fall 2021 semester (August to December) and to a separate cohort of students in the Fall 2022 semester. The HCE course included in-class didactic training, active learning exercises, and coordinated shadowing experiences at off-campus clinical sites that were privately owned health care facilities located within 10.5 km (6.5 mi) driving distance from the WVU Tech campus. Organization of the HCE classroom lecture series, active learning exercises, and clinical shadowing experiences are found in Table 1 and Supplemental Material 1.

The HCE course learning outcomes for students were to: 1) present themselves in a professional manner in health care situations, 2) gain a deeper understanding of multiple health care professions, 3) attain in-person clinical shadowing experience, 4) have the ability to properly debrief and discuss experiences, 5) gain skills in reflecting and understanding medical and health care ethics and etiquette, 6) complete HIPAA training and compliance with principles, and 7) gain knowledge of a variety of professional school entry requirements and processes. Didactic training included eight 50-min classroom lectures focused on: introduction to the course, introduction to health care, careers in health care, attire and conduct, requirements for immunization and safety, ethics in health care, patient confidentiality and HIPAA, professionalism, and preparation for shadowing experiences (Table 1). Active learning exercises included clinical shadowing experience reflections (Supplemental Material 2), open debriefings that occurred during the next course meeting after each shadowing experience facilitated by

the course instructor, and 20-min student led oral presentations on a health topic of their choice (Supplemental Material 3), and ensuing student discussions of these presented topics (Supplemental Material 4).

Outside of the two 50-min lecture days each week, students attended off-campus clinical shadowing for 2-h each week with different health care professional mentors during weeks 5–15 (Table 1). Students were provided schedules and assigned in pairs to be supervised by their designated clinical shadowing mentor on those days. Student pairs rotated weekly among nine health care clinics that represented 13 areas of specialty: addiction counseling, cardiology, dentistry, dermatology, family practice, internal medicine, nursing, orthopedics, palliative care, pharmacy, physical therapy, podiatry, and psychiatry. Local health care practitioners had been prearranged to be part of the course by the course instructors. To arrange these practitioners for shadowing the course instructors had contacted numerous local practitioners in-person, by phone, or by email to gauge their interest in participating as health care shadowing mentors. Interested health care practitioners were provided with a course folder containing the welcome letter, instructor emergency contact information, student clinical shadowing schedule, and assigned student evaluation sheets. Practitioners were also requested to complete a memorandum of understanding and W-9 form to accept compensation of instructional time. For each 2-h student shadowing experience, with a maximum of two students per time slot, the compensation rate for health care practitioners was \$100 USD. Health care professionals were provided a rubric from course instructors to complete for each student to provide feedback on student participation and professionalism following their shadowing experience (Supplemental Material 5). During a subsequent lecture day, the in-class debrief was facilitated by the course instructor following the Promoting Excellence and Reflective Learning in Simulation (PEARLS) framework of learner-guided discussions (Eppich and Cheng, 2015; Kolbe *et al.*, 2021).

Grading was based on in-class assignments (17%), clinical shadowing experience reflections (Supplemental Material 2) and in-class debrief (33%), clinical shadowing participation (21%; Supplemental Material 5), HIPAA certification through SOLE, and the Protected Health Information, Confidentiality, and Security Agreement (4%; Supplemental Material 6), and completion of the health care student oral presentation (25%; Supplemental Material 3). During the course, students were recommended to complete selected Collaborative Institutional Training Initiative (CITI) Program training modules and required to complete healthcare information privacy and security training. Proof of successful completion of the HIPAA certification and Protected Health Information, Confidentiality, and Security Agreement, and institutional Travel Authorizations were required before clinical shadowing.

Study 1: Student Debrief Evaluation

The goal of Study 1 was to evaluate undergraduate student feedback following their clinical shadowing experiences. At the beginning of the class session following their clinical shadowing day students completed an experience debrief form (Supplemental Material 2). Students who had not completed a shadowing experience the previous week (e.g., due to cancellation or rescheduling of student shadowing) were asked to use that

time to search for application requirements to a school or program that they were interested in pursuing and to briefly summarize the information on the back of the paper. After students completed the experience debrief form (approximately 10 min) the instructor led an in-class discussion using the learner-guided PEARLS debrief framework. Students would contribute to the debrief by describing their previous experiences and reactions, providing learners' self-assessment, leading learner guided discussions, and summarizing their insight during the in-class debriefing session (approximately 40-min).

Although qualitative analyses of student perspectives of their shadowing experiences are uncommon; evaluations of open response feedback have demonstrated that health care shadowing experiences have potentially multiple levels of benefit with few drawbacks. Three studies provided a basis for evaluating undergraduate student open response feedback following their clinical shadowing experiences in this study. In 2020 Sarver, Seabold, and Kline reported feedback from RN nursing staff that their shadowing experiences in other units provided 1) an understanding of other unit's workflow, 2) recognition of challenges experienced by the unit the RN shadowed, and 3) the importance of the shift and the unit they were assigned to shadow (Sarver *et al.*, 2020). Langenau *et al.* (2019) cross-sectionally surveyed medical students to describe their shadowing experiences before and during medical school. Medical students described the most rewarding parts of their shadowing experiences before medical school as: interacting with patients (24.5%), having positive clinical learning experience (23.0%), exposure to specialty and styles (17.1%), interacting with clinicians/networking (15.9%), and having career guidance (validation and direction; 12.4%; Langenau *et al.*, 2019). A portion of these students described having nothing frustrating about their shadowing experiences before medical school (23.0%), whereas other students described having difficulty among 12 separate subcategories, of which, finding shadowing (12.7%) was the greatest frequently described response (Langenau *et al.*, 2019). Furthermore in 2016, Kusnoor and Stelljes analyzed in what way second year medical students who wrote reflections on interprofessional shadowing experiences described the shadowed discipline's role and collaboration in patient care. In their study, 13 descriptive themes were identified, where medical students most frequently described specific tasks the shadowed discipline performed, the shadowed discipline's general role or purpose, and value or importance of the shadowed discipline's role (Kusnoor and Stelljes, 2016). These three previous studies provided a basis for beginning to evaluate undergraduate student feedback following their clinical shadowing experiences.

To categorize what undergraduate students were describing from their clinical shadowing experiences we assembled an initial coding definition list key (Supplemental Material 7) based on the works of Kusnoor and Stelljes, 2016; Langenau *et al.*, 2019; Sarver *et al.*, 2020. The 13 coded themes included: learning something new, insights, communication, specific functions, career guidance, general role/purpose, limited exposure, value of discipline's role, interacting/networking, workflow, role differences, team or teamwork, and patient safety. Learning something new differs from insights in that instances of learning something new are where the student described information about something specifically learned or state a fact that

they learned. Whereas, insights are the capacity to gain an accurate and deeper understanding of someone or something and implied a major take-home message student learned from the experience that may shape the student's future practice. Other colloquial descriptions of instances of gaining insight include an Ah-Ha-, Eureka-, or lightbulb-moment. Interacting/networking differs from communication code in that the students describe working relationships among different health care disciplines, whereas communication is a student mentioning the impact or importance of communication during their shadowing experience in their open response debrief form.

Deidentified copies of the experience debriefing forms were retained for evaluation of student shadowing experiences feedback. Student responses to open-ended questions were coded using a coding definition list key containing 13 theme codes (Supplemental Material 7) and then frequency of the code was determined by whether or not the code was present in each reflection. Any excluded codes were subsumed by other codes or were not represented in these data.

Study 2: Pre–Post HCE Course Survey Method

In the second study, the pre–post HCE survey was used to evaluate student interest in health care careers. We adopted and modified the Assessment of Interest in Medicine and Science (AIMS) questionnaire for pre- and postcourse assessments, which provides a multilevel framework to assess students' interest at multiple distances from a curriculum (Romine *et al.*, 2016). The three distances used in this particular study were: Interest in Science (distal), Interest in Healthcare (proximal), and Interest in Rural Health Care (close). This three-subscale tool in assessing personal interest is useful to provide a more complete understanding on how students are impacted by HCE course instruction. Two additional items were added to characterize impact of the course on our students' confidence. Item H19 "I feel confident in my understanding of health care careers" and item H20. "I feel confident in my HCE." We used a two-page, paper-based, self-administered anonymous questionnaire to collect our data (Supplemental Material 8). The questionnaire consisted of items arranged across two main sections: Science (9 items) and Healthcare (20 items). Items were evaluated using a four-point Likert-like scale (1 strongly disagree – 4 strongly agree). Identical questionnaires were administered on the first (precourse) and last (postcourse) day of scheduled classes in 2021 and 2022 (Supplemental Material 8). Before implementation, this protocol was acknowledged by WVU Office of Human Research Protections received as Not Human Subjects Research and not requiring IRB review, amendments, or approvals.

Study 2: Cross-Sectional Survey Method

An independent cross-sectional survey was used to evaluate student confidence in and understanding of health care careers. The questionnaire was administered using the Qualtrics software (Qualtrics, Provo, Utah, USA, February 2023) and sent to the Biology-major school e-mail list compiled from the previous 2021–2022 academic years. The Qualtrics program released the online survey to students in February 2023 and it was voluntary for students to complete the questionnaire. Students were asked whether they had completed the Healthcare Experience course in 2021, 2022, or not at all to assist in grouping

students. Biology-major students who have not completed the Healthcare Experience course at the time were included as a comparison group (Biology-CG) and Biology-major students who completed the HCE course in either 2021 or 2022 were comprised of the interventional group (Biology-HCE) for analyses. Items were evaluated using a four-point Likert-like scale (1 strongly disagree – 4 strongly agree), as well as, brief fill-in-the blank sections. Before implementation, this study was reviewed and approved by WVU Office of Human Research Protections using the WVU Flexibility Review Model (protocol number 2302725400).

The survey consisted of four questionnaire sections: characteristic information, post-HCE course, student interest in careers in rural health care, and careers in underserved community health care items. Participant characteristic information included: gender, rural background, health care interest area, rank of preferred location of work, and applied to postundergraduate program. Of the 10 Biology-HCE students, six had completed the HCE in 2021 and four had completed the course in 2022. For the cross-sectional post-HCE course survey design (Supplemental Material 9), we reselected items from the previous pre/postcourse assessment items (H12 = Q25, H13 = Q26, H16 = Q27, H17 = Q28, H18 = Q29, H19 = Q23, and H20 = Q24) and included new items pertaining to the HCE student learning outcomes from the course syllabus (Q12–Q22). To assess whether students who had enrolled in HCE course were disposed to interests in careers in rural and/or underserved communities the cross-sectional assessment also included items related to working in rural health care and working in underserved health care settings. Five survey items pertaining to student rural health care career plans (Q30–Q35) were used (Casapulla, 2017) and additional survey items were created (Q36–Q46) that related to student's plans for careers in underserved health care communities.

Data Collection and Analyses

All data were anonymously collected or deidentified before analyses. Descriptive statistics, including median and frequencies, were used to describe study survey items. Because all surveys were anonymous, the pre- and postquestionnaires, as well as, the cross-sectional post-HCE questionnaire were not linked for analyses. For each item, the number of student responses were counted for each score category (1-strongly disagree, 2-disagree, 3-agree, and 4-strongly agree). For the pre–post HCE course survey, Wilcoxon matched-pairs signed rank test with multiple comparison of ranks using the two-stage linear step-up method of Benjamini and colleagues (2006) to control the False Discovery Rate (FDR) (desired FDR (Q) = 1%) was used to compare each item's score for pre-HCE questionnaire compared with the post-HCE questionnaire. P values were computed for each comparison and P values less than Q are flagged as a discovery. Therefore, if null hypotheses are true, there will be only a 1% change that you find one or more discoveries. The calculated q values are FDR-adjusted p values, q values are generally larger than the corresponding P -value as they depend on not only one comparison but on the distribution of P -values and number of comparisons.

For the cross-sectional survey, Biology student median responses to items related to the cross-sectional course survey items were analyzed using two-tailed Mann-Whitney U test

TABLE 2. Comment excerpts for learning something new

Learning something new theme	Comment excerpts
General learning	“– and learn how this <u>field</u> works.”
Work environments	“How often you had to move around in this <u>environment</u> .”
Specialization	“They can pick and <u>choose</u> what services they offer ”
Specific tasks	“I learned much about the <u>rehabilitation process</u> .”
Perspectives	“–learning the provider’s philosophy on addiction and how it changed my <u>perspective</u> –.”
Patient conditions	“taught us a lot about bipolar <u>disorder</u> , and I really thought it was interesting–”

with multiple comparison of ranks using the two-stage linear step-up method and a desired FDR (Q) = 1%. Students reporting to be Biology majors who did not participate in the HCE course in 2021 or 2022 were the comparison group (Biology-CG). Students reporting to be Biology majors who had completed the HCE course in 2021 or 2022 were the interventional group (Biology-HCE). GraphPad Prism statistical software was used for all statistical analyses (GraphPad Prism version 9.5.1 for Windows, GraphPad Software, San Diego, California USA, www.graphpad.com).

RESULTS

HCE Course Participants

A total of 33 students enrolled and completed the HCE course in Fall 2021 or in Fall 2022 at WVU Tech. Of these students, 32 completed the voluntary anonymous precourse questionnaire and 31 completed the postcourse questionnaire. Most students enrolled in the HCE were majoring in Biology (30/33), two students were Psychology majors, one student was a double major in Biology and Chemistry. Students were in their 2nd to 4th year of undergraduate university education.

One aim of the study was to determine whether an HCE course increased student interest in pursuing rural health careers. We assumed going into this study that student interest in careers in rural and underserved health care would be relatively low as WVU Tech is located in Raleigh County which has a population of approximately 75,000 residents and is desig-

nated as a metropolitan county by the U.S. Health Resources and Services Administration. However, many students who attend WVU Tech are commuters originating from areas near Beckley and surrounding counties such as Boone, Clay, and Fayette that are considered rural counties.

Study 1: Student Debrief Evaluation

Students in the HCE course rotated through a variety of locations and specialties over 10-wk and a majority of these encounters were well-described in student reflections. Evaluation of shadowing experience debrief forms revealed that students felt that they learned something new, gained insight from their experience that may shape the student’s future practice, and also recurrently mentioned mentor communication. Specific comment examples for students “Learning something new” described general learning, work environment, specialization, specific tasks, perspectives, and patient conditions (Table 2). For the student “Insights”, specific comments were associated with patient encounters, work ambiance, school and life, support, pace, personal identity, and patient relations (Table 3). Student remarks related to “Communication” were largely related to describing student-mentor communication and mentor-patient communication (Table 4).

Study 2: Pre–Post HCE Course Survey

Confidence in HCE. Students completing the HCE course showed an increase in confidence in their own health care

TABLE 3. Comment excerpts for insights

Insights theme	Comment excerpts
Patient encounters	“Every <u>patient</u> you see is different and requires different treatment plan even if they have the same problem/disorder.”
Work ambiance	“A good <u>atmosphere</u> will always help patients and workers.”
School and life	“I got more <u>insight</u> on medical school, residency, and <u>life</u> after residency.”
Support	“Never get <u>discouraged</u> by your job or school –” “Make sure you <u>love</u> what you do”
Pace	“–I like shadowing a more fast <u>pace</u> clinic rather than slower/relaxed.”
Personal identity	“I never <u>pictured myself</u> liking –until my shadowing experience.”
Patient relations	“I don’t like how short-lived the <u>patient-physician relationship</u> is.”

TABLE 4. Comment excerpts for communication

Communication theme	Comment excerpts
Student-Mentor communication	“...in depth <u>explanation</u> of the lab along with their typical scheduling/office practices.” “...able to ask a lot of <u>questions</u> and all were answered respectfully and in great detail.” “... had to <u>ask</u> to be shown around and have things explained to us. It seemed like they wanted to talk to us, but couldn’t because they were too busy.”
Mentor – Patient communication	“ <u>talks</u> to those [patients] who attend and makes sure everything is going well...” “patient-provider <u>trust</u> is stronger, because they’ve almost created a friendship.” “ <u>Understand</u> the wants and needs of the patient before treating them.” “I really like the patient-physician interaction...”

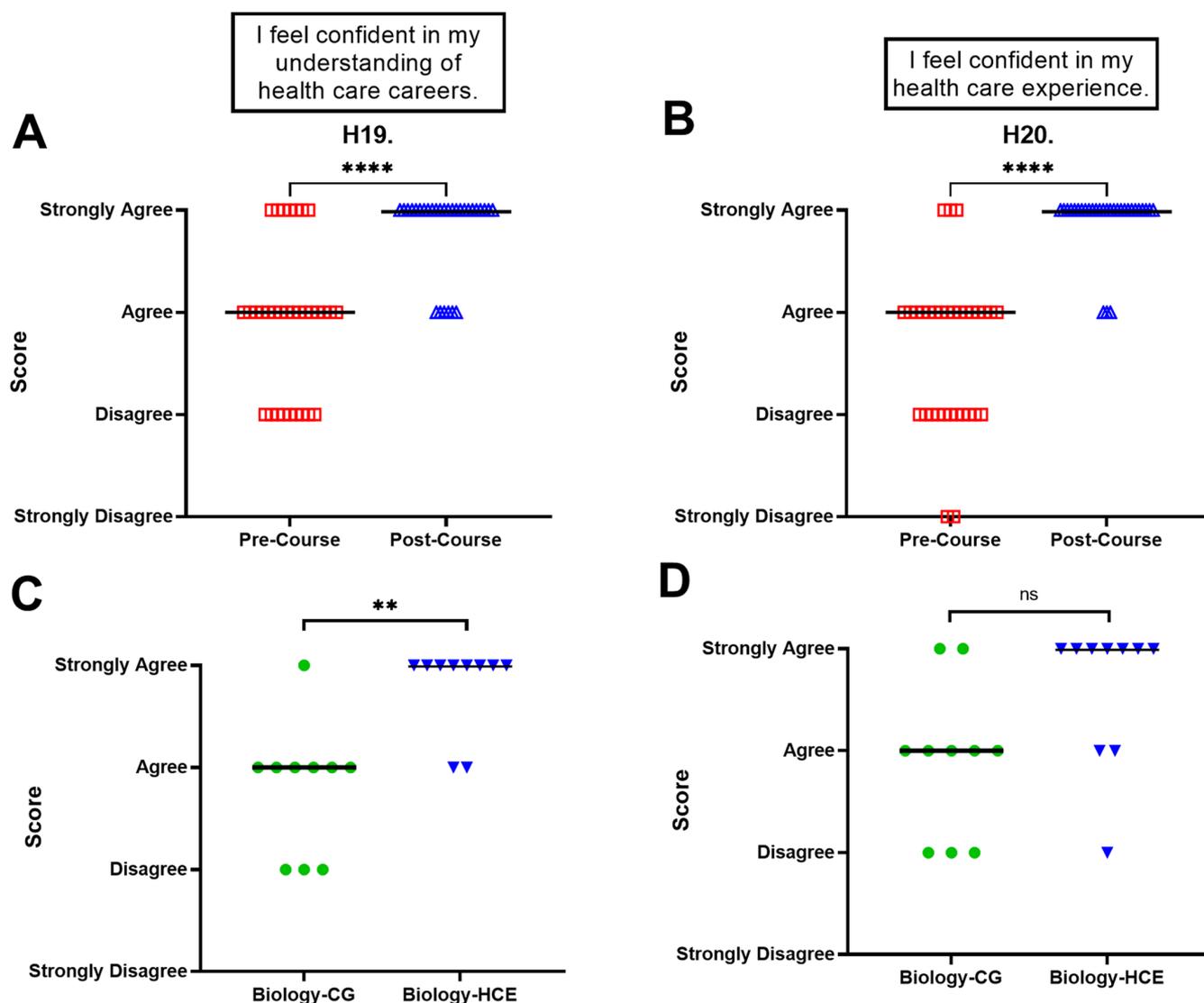


FIGURE 1. Student responses to items related to confidence in understanding of health care careers and to confidence in HCE. Panels A and B indicate response distributions from the Pre–Post course surveys in 2021 and 2022. Panels C and D indicate student response distributions from the 2023 cross-sectional survey comparing students who had completed the HCE course responses to a comparison group. **** Discoveries using the Wilcoxon matched-pairs signed rank and multiple comparison test (P value < 0.0001); ** Discovery using the Mann-Whitney U test with multiple comparisons (P value < 0.01); Abbreviations: CG = comparison group; HCE = Health Care Experience; n.d. = not discovered (P value > 0.05).

understanding and experience. Survey items assessing confidence showed the greatest pre–post changes in student responses. Items H19 and H20 showed discovered increases from a median response of Agree in the pre–course survey to a median response of Strongly Agree in the post–course survey items, respectively. For the item H19 “I feel confident in my understanding of health care careers” students indicated median agreement of 48% pre-HCE course and strongly agreed 80% post-HCE course (P value < 0.000001 and q value = 0.000001; Figure 1A). Also, item H20 “I feel confident in my HCE” precourse median agreement was 52% and postcourse strong agreement was 90% (P value = 0.000084 and q value = 0.000722; Figure 1B).

Interest in Science, Health Care, and Rural Health Care. Students completing the HCE course had increased interest in

science, health care, and rural health. Table 5 reports the median response and frequency for each statement item of the pre- and postcourse surveys related to science, health care, and rural healthcare categories. The highest frequencies of Strongly Agree in the Science Interest category were for “I like learning science” (90% pre- and 97% postcourse) and “I plan to take a lot of science classes” (87% pre- and 90% postcourse; Table 5). Students disagreed (58% pre- and 48% postcourse) with the statement “I would like to work in a science laboratory.”

The highest frequencies for the Strongly Agree in the Health Care Interest category were for the following three statements: “I would like to work in a medical field” (100% pre- and 100% postcourse); “I am interested in how the body works” (90% pre- and 97% postcourse); and “I would like to help improve people’s health” (94% pre- and 90% postcourse; Table 5). Students

TABLE 5. Descriptive statistics of scores pre- and post-HCE course 2021–2022

Items	Pre-course (n = 32)		Post-course (n = 31)	
	Median	Frequency	Median	Frequency
Science Interest (distal)				
S1. I like learning science.	SA	90%	SA	97%
S2. I enjoy doing experiments.	SA	55%	SA	74%
S3. I plan to take a lot of science classes.	SA	87%	SA	90%
S4. I would like to make discoveries using science.	SA	55%	SA	52%
S5. More time in school should be spent doing science experiments.	A	61%	SA	45%
S6. I like learning how to use science in my life.	SA	68%	SA	74%
S7. I enjoy reading about science.	A	48%	SA	48%
S8. I would like to work in a science laboratory.	D	58%	D	48%
S9. Learning about science makes me a better person.	A	42%	A	42%
Health Care Interest (proximal)				
H1. I want to learn more about careers in medicine.	SA	77%	SA	90%
H2. Studying how parts of the body work is boring. ^a	SD	77%	SD	87%
H3. Making discoveries in medicine would be interesting.	SA	81%	SA	74%
H4. I would like to become a doctor or nurse someday.	SA	84%	SA	84%
H5. I enjoy reading about doctors.	A	45%	SA	52%
H6. I like helping people get healthy.	SA	84%	SA	81%
H7. I would enjoy working in a medical laboratory.	A	39%	A	42%
H8. I would like to work in a doctor's office.	SA	61%	SA	73%
H9. Helping a doctor or nurse over the summer would be interesting.	SA	77%	SA	87%
H10. Working in a hospital over the summer would be interesting.	SA	71%	SA	87%
H11. I would like to work in a medical field.	SA	100%	SA	100%
H14. I am interested in how the body works. ^b	SA	90%	SA	97%
H15. I would like to help improve people's health. ^b	SA	94%	SA	90%
Rural Health Care Interest (close)				
H12. I want to know what it is like to be a rural health practitioner. ^b	A	48%	SA	63%
H13. I would like to be a rural health practitioner. ^b	A	42%	A	50%
H16. I would like to learn more about jobs in rural health care. ^b	SA	61%	SA	67%
H17. I would enjoy caring for people in a rural community. ^b	SA	61%	SA	67%
H18. I plan to pursue a career in rural health care. ^b	SA	42%	SA	53%
H19. I feel confident in my understanding of health care careers. ^c	A	48%	SA	80%
H20. I feel confident in my HCE. ^c	A	52%	SA	90%

^aNegatively-worded item.

^bStatement was modified from the AIMS to reflect interest in rural health care.

^cStatement created to assess student confidence.

Abbreviations: SD = Strongly Disagree; D = Disagree; A = Agree; SA = Strongly Agree.

also Strongly Agreed to “I want to learn more about careers in medicine” (77% pre- and 90% postcourse; Table 5). The highest frequency of Strongly Disagree was for the negatively-worded statement “Studying how parts of the body work is boring” (77% pre- and 87% postcourse; Table 5).

Student Interest in rural health showed the highest frequency of Strongly Agree for the two statements “I would like to learn more about jobs in rural healthcare” (61% pre- and 67% postcourse) and to the statement “I would enjoy caring for people in a rural community” (61% pre- and 67% postcourse; Table 5). Students Agreed to the statement “I would like to be a rural health practitioner” (42% pre- and 50% postcourse); “I plan to pursue a career in rural healthcare” (42% pre- and 53% postcourse), and “I want to know what it is like to be a rural health practitioner” (48% pre- and 63% postcourse; Table 5). Multilevel assessments of interest indicated that students' responses to their Interest in Science, Health Care, nor Rural Health Care were not associated with

a change in their responses Pre-Post HCE (unpublished data).

Study 2: Cross-Sectional Survey

Characteristics of Participants. A total of 20 student Biology majors enrolled in and completed the February 2023 cross-sectional survey. Ten student participants who had completed the HCE were the interventional group (Biology-HCE) and 10 students who had not taken the HCE course were grouped as the comparison group (Biology-CG). Self-reported characteristics of the Biology majors surveyed showed similar distributions of gender (70% female and 30% male) and rural background (60–80% yes) between the Biology-CG and Biology-HCE groups. Mean ranks of preferred locations of work included: Small city ranked 1.9–1.9; Rural 3.2–2.3; Suburban 2.8–4.0; Large urban center 3.2–3.5; Global 4.7–4.9; and Remote 5.2–4.5, respective to Biology-CG and Biology-HCE groups. There were seven selected health care interest areas within the

TABLE 6. Characteristics of undergraduate biology majors surveyed (N = 20)

Characteristic	Biology-CG	Biology-HCE
	(n = 10)	(n = 10)
BIOL 393: Healthcare Experience course:	No. (%)	No. (%)
No	10 (100)	0
Yes, in 2021	0	6 (60)
Yes, in 2022	0	4 (40)
Gender:	No. (%)	No. (%)
Female	7 (70)	7 (70)
Male	3 (30)	3 (30)
Rural Background:	No. (%)	No. (%)
Definitely Yes	1 (10)	6 (60)
Probably Yes	5 (50)	2 (20)
Might or Might Not	4 (40)	0
Probably No	0	1 (10)
Definitely No	0	1 (10)
Health Care Interest Area:	No. (%)	No. (%)
No interest in health care	1 (7)	0
Dentistry	2 (13)	0
Generalist specialty	2 (13)	2 (20)
Nursing	0	0
Pharmacology	2 (13)	0
Physical therapy	1 (7)	1 (10)
Primary care	1 (7)	4 (40)
Psychology	2 (13)	0
Other specialty	4 (27)	3 (30)
Rank of preferred location for work:	Mean rank	Mean rank
Large urban center	3.2	3.5
Small city	1.9	1.9
Suburban	2.8	4.0
Rural	3.2	2.3
Remote	5.2	4.5
Global	4.7	4.9
Applied to postundergraduate program:	No. (%)	No. (%)
Yes	2 (20)	5 (50)
No	8 (80)	5 (50)

Biology-CG group and four indicated health care interest areas within the Biology-HCE group (Table 6). At the time of the survey, 20% of the Biology-CG group and 50% of the Biology-HCE group had applied to a postundergraduate program.

Assessments of Rural Health Care and Underserved Health Care Careers. Students who completed the course were strongly interested in rural and underserved healthcare, but this was not significantly different than the control group of students who had not completed the course. One question following the HCE course was whether students who completed the course would have greater rural or underserved health care interest compared with students who had not completed the course. Cross-sectional assessment included items related to working in rural health care and working in underserved health care settings. Summary of medians, frequencies, *U* value, and *P* values are in Supplemental Material 10 and Supplemental Material 11. Though there was a trend toward support for the idea that this course may increase rural and underserved health care interest, analysis of items for rural health care career inter-

est, as well as items related to career in underserved health care community, were not discovered to be different (FDR (*Q*) = 1%) between Biology-HCE and Biology-CG groups as both groups indicated strong interest in these types of careers. Both the Biology-HCE and Biology-CG students strongly agreed with items related to interest in careers in rural health (70–100% of Biology-HCE and 22–89% Biology-CG students). In addition, Biology-HCE (63–88%) and Biology-CG (50–88%) students agreed or strongly agreed to items related to interest in underserved health care careers.

Assessment of HCE Course Learning Outcomes and Confidence in HCE. Students who completed the HCE had increased self-reported competence and confidence compared with students who did not participate in the HCE course. During the cross-sectional assessment, students who had taken the HCE course were compared with student peers who had not taken the HCE course to assess whether students reported competence in important health care facets such as debriefing and professional interactions. In the HCE course, students learned through participation in didactic lecture and by engaging in active learning exercises in the classroom and in a variety of clinical settings. In the cross-sectional survey, seven items related to HCE course learning outcomes showed significant increases in level of agreement on items related to the HCE course Learning Outcomes for the Biology-HCE in comparison to Biology-CG students (Table 7).

The greatest difference in median response was observed for item Q14 “I am confident in my ability to properly debrief and discuss HCEs” and showed a split in the Biology-CG where 50% disagreed and 50% agreed to this item. Whereas for Biology-HCE students, 20% agreed-80% strongly agreed to feeling confident in their ability to debrief and discuss HCEs (*P* value = 0.000227 and *q* value = 0.001837, Table 7). This statement Q14 reflects student confidence in their ability to communicate as was guided and performed during the weekly classroom clinical shadowing debriefs using the PEARLS framework. The next two items that showed discovered differences were for Q13 “I have a deep understanding of multiple healthcare professions” (*P* value = 0.001093 and *q* value = 0.002945) and Q19 “I understand how health care professionals interact with patients in a clinical setting” (*P* value = 0.000877 and *q* value = 0.002945) and are reflective of students’ mentor-guided shadowing experiences during the HCE. Particularly, 80 and 90% of Biology-HCE students strongly agreed with these statements, respectively. Whereas for the Biology-CG group, 60% disagreed to item “I have a deep understanding of multiple healthcare professions” (Q13). For item Q19 “I understand how health care professionals interact with patients in a clinical setting,” 20% of Biology-CG students disagreed and 70% just agreed with this statement (Table 7).

In addition, HCE course students learned from a variety of student-led health care presentations and discussions. The increased agreement for the statement Q18 “I understand a variety of health professional school entry requirements and processes” (Learning Outcome 7) in the Biology-HCE group compared with the Biology-CG group (*P* value = 0.005499 and *q* value = 0.007406; Table 7) is supported by the observation that students presented these for a variety of health care professions

TABLE 7. Comparison of biology students' responses to HCE course learning outcomes

Items	Biology-CG (n = 10)		Biology-HCE (n = 10)		U value	P value
	Median	Frequency	Median	Frequency		
HCE Learning Outcomes						
Q12. I am competent in presenting myself in a professional manner in healthcare situations.	A	50%	SA	90%	24.5	0.0495
Q13. I have a deep understanding of multiple healthcare professions.	D	60%	SA	80%	9	0.0011 ^a
Q14. I am confident in my ability to properly debrief and discuss HCEs.	A	50%	SA	80%	5	0.0002 ^a
Q15. I am competent in my ability to discuss health care literature.	A	50%	SA	80%	15.5	0.0045 ^a
Q16. I understand medical and health care ethics and etiquette.	A	70%	SA	90%	14.5	0.0049 ^a
Q17. I am confident I understand HIPAA and compliance with its principles.	A	40%	SA	100%	20	0.0108
Q18. I understand a variety of health professional school entry requirements and processes.	A	50%	SA	70%	14	0.0055 ^a
Q19. I understand how health care professionals interact with patients in a clinical setting.	A	70%	SA	90%	9	0.0008 ^a
Q20. I am familiar with a variety of health care settings.	A	40%	SA	70%	19	0.0185
Q21. I feel confident in my ability to perform well in a clinical setting.	A	50%	SA	70%	20.5	0.0270
Q22. I have a good understanding of what it takes to be a successful candidate in applying to professional schools.	A	50%	SA	80%	17	0.0113
Q23. I feel confident in my understanding of health care careers. ^b	A	60%	SA	80%	12	0.0028 ^a
Q24. I feel confident in my HCE. ^b	A	50%	SA	70%	24.5	0.0519

^aDiscoveries using the Mann-Whitney *U* Test; Reject H_0 if *P* value < *Q* (desired FDR 1%); *q* values are not shown.

^bQuestion was in pre-post surveys for HCE course 2021–2022 (H19 and H20).

Abbreviations: SD = Strongly Disagree; D = Disagree; A = Agree; SA = Strongly Agree.

during their student-led presentations (Supplemental Material 3). In addition, the learning topics of health care ethics and etiquette (Learning Outcome 5) were carried on throughout the semester from not just the first month of didactic lectures (Table 1), but also into student-led presentations and discussions (Supplemental Material 3). Therefore, evidence of learning is supported in that Biology-HCE students showed significantly higher agreement with Q16 “I understand medical and health care ethics and etiquette” compared with Biology-CG students (Table 7). Lastly, Q15 “I am competent in my ability to discuss health care literature” had higher agreement in the Biology-HCE group compared with the Biology-CG students (*P* value = 0.004503 and *q* value = 0.007406) and could be indicative of student learning from and presenting current literature and findings in preparation for their presentations.

In Table 7, items Q23 “I feel confident in my understanding of health care careers” and Q24 “I feel confident in my HCE” were items that were previously used on the pre- and post-HCE course assessments of interest as item H19 and H20, see Figure 1, C and D, respectively. Although comparison of responses for Q24 were not discovered to be different (*P* value = 0.051852 and *q* value = 0.026185); comparison of responses in the cross-sectional survey for item “I feel confident in my understanding of health care careers” (Q23) showed discovered differences in the Biology-CG compared with the Biology-HCE group (*P* value = 0.002847 and *q* value = 0.002875; Figure 1C). The Biology comparison group demonstrated agreement of 60% and 50% for these same items, respectively (Table 7) and with distributions comparable to the pre-HCE student values.

DISCUSSION

In the health care field private practitioners often state that they must limit shadowing experiences due to time constraints and lack of ability to train students in necessary practices before a shadowing experience. Courses like the HCE could help facilitate these interactions by shifting trainings off clinicians through providing structured lectures and coursework before shadowing experiences. By providing trainings through coursework, dedicated time for scheduled shadowing for full-time students, and assembling vetted local clinical practitioners who are engaged in undergraduate student learning, we hope to make meaningful healthcare experiences attainable to students. Overall, this project's goal was to help recruit and retain more students into health care professions, develop a dedicated pathway to move students towards health care careers, and involve rural community health care partners in the education of college students.

A large majority of students indicated on the first day of the HCE course agreement with items related to interest in rural health care careers (Table 5). Simply, students may have already had higher agreement towards rural health care careers regardless of their academic and HCEs. Therefore, in the subsequent cross-sectional survey a statement was included to assess to what extent students identify themselves as coming from a rural background (Supplemental Material 9 on page 15). The majority of responding Biology-HCE students indicated “definitely yes” or “probably yes” to the statement of having a rural background (Table 2), whereas the Biology-CG were less certain of their rural background. Therefore, one potential

confounding variable in our analyses are that students who are seeking and enrolling in courses such as this HCE course are those who would likely represent first-time college and/or students with a rural background.

Although definitions of rurality are varied, it is recognized that people self-identifying as having grown up rural have high probability to continue in their careers in a rural or underserved community (Owen *et al.*, 2007; Pretorius *et al.*, 2010; Rabinowitz *et al.*, 2012; Hempel *et al.*, 2015). Students from rural backgrounds may not be able to go out to seek HCEs on their own. Therefore, in order to build a more diverse and broad health care workforce, it is imperative to generate these structured undergraduate HCEs in situ and meet rural students where they are currently located at this juncture of their careers. In this study, creating an undergraduate course provided students' academic credit for successful career exploration experiences, course instructors removed barriers by identifying and organizing shadowing and active learning exercises, and generated essential protected time in busy undergraduate student schedules that ensured students attended to their career development.

The Alliance for Research on Regional Colleges (ARRC) is a research collaborative and resource hub with the mission of increasing appreciation for, and understanding of, regional rural-serving colleges and their contributions to opportunity and community wellbeing. The ARRC identified WVU Tech as a Rural-Serving Postsecondary Institution (RSI) www.regional-colleges.org/map/rsi-map (Koricich *et al.*, 2022). The RSI report in 2022, identifies a total of 1087 RSIs in the U.S. including 33% of all private, 4-y institutions, 46% of all public, 4-y institutions, and more than half of all public, 2-y colleges (Koricich *et al.*, 2022). Research and literature are lagging for determining the effects of structured health care courses implemented within the undergraduate level before students even applying to medical or other professional programs. It is reasonable to assume that development of other targeted undergraduate courses similar to the HCE at the numerous other RSIs would also be suitable for improving admission of students with underserved backgrounds by implementing earlier positive clinical experiences, which could make current medical and professional school interventions and curriculum more effective. As such, there is a large opportunity for our curriculum and content to be transferred to other institutions seeking to increase student access to health care careers.

A new theoretical framework surrounding career literacy involves self-efficacy and the career experiences that shape and contribute to student success and posits that these should be emphasized more than academic literacy (Valentine and Kosloski, 2021). As defined by Valentine and Kosloski (2021), career literacy preparation involves a set of experiences that lead to the knowledge acquisition and skill development necessary to understand, interpret, and evaluate career-related information (Valentine and Kosloski, 2021). As such, undergraduate courses could also provide this framework as is demonstrated in our current study. For instance, students' perceived confidence in their HCE and understanding of health care careers showed the lowest levels of agreement at the beginning of the HCE course, which significantly increased in the postcourse survey (Table 5). Notably, the students who had completed the HCE, showed strong agreement in feeling confidence in their understanding of health care careers (80%; Figure 1C) and in their HCE (70%) at

a later time (Figure 1D). As such, more research should explore the effects of courses on improving self-efficacy and confidence in the development of health care career literacy.

In our HCE course students were exposed to the realities of clinical work through their shadowing experiences and also discussion of these experiences communicated during the weekly in-class debriefs. Qualitative examination of student debrief reflections was data rich. In the majority of these reflections, students described having learned something new, gained insights, described the importance of communication, described specific functions they observed, the general role or purpose of the discipline observed, and whether they received career guidance. Of note, although the vast majority of described experiences were positive, not all experiences were positive, in some situations students described disinterest in pursuit of a particular discipline or even described feeling they had limited exposure to patients and their shadowing mentors.

Limitations

Volunteer bias is a concern in survey-based studies. Recall bias may affect answers to the open-ended cross-sectional survey questions and for in-class reflections. As mentioned previously, a confounding factor in evaluation of interest in working in rural and underserved communities is that students may already be predisposed and seeking opportunities to enter into these careers. It has historically been problematic to define rural background and each definition of rural has been critiqued. Therefore, our reliance on student perspectives of their own rurality could be viewed as a limitation of this study. The location and timing of the data collection may have influenced responses as the pre- and postsurvey was administered in class and the cross-sectional survey was administered online via institutional email communication.

CONCLUSION

These results from our study have major implications for student performance, confidence, and understanding of health care careers. Our study supports the idea that universities that are in or adjacent to underserved communities can promote the success of students from these areas through the creation of courses like the HCE course that develop career literacy and improve accessibility of HCEs for students. These institutions are important educational access points for student populations that are often excluded by other postsecondary institutions. Additionally, these colleges are critical instruments of workforce development and support the overall well-being of their local communities.

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