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Inclusive excellence through digital learning: an undergraduate research experience to pilot cross-institutional collaboration between a historically black university and a predominantly white institution

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ABSTRACT

Increasing diversity in higher education and the workforce requires undergraduate students to learn to work together effectively to address scientific and social issues. Our goal is to learn how best to facilitate teamwork among students from Historically Black Universities (HBU) and Predominantly White Institutions (PWI) to promote collaborative learning. We analysed the evolving knowledge, perceptions, and attitudes of participating students as they developed close working relationships through a 'study-within-a-study' design where student pairs (one from an HBU and one from a PWI) conducted their own research project while we analysed how these students interacted with their partners. The Association of American Colleges and Universities (AACU) rubric of Intercultural Knowledge and Competence was used to develop a set of codes for assessing transcripts of student meetings. AACU defines six attributes of this rubric including cultural self-awareness, cultural worldview frameworks, empathy, verbal and nonverbal communication, curiosity, and openness. Our pilot results suggest that students willing to engage collaboratively with others from different cultural or educational backgrounds can display attributes of intercultural competence, while those not willing to engage in the collaborative process may not exhibit such competence. We also learned that students require the same initial preparation necessary for the assigned project.

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Introduction

Increasing diversity in higher education programs and in the workforce requires undergraduate students to learn how to work together effectively to address scientific and social issues (McGill et al. 2021). Research has found that small learning groups involving undergraduate students promote understanding

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science and technology concepts, appreciating art, retaining knowledge, and developing critical thinking skills in active and engaged student-student interactions (Cabrera et al. 2002; Kilgo et al. 2015; Harney, Hogan, and Quinn 2017). Yang, Woomer, and Matthews (2012) evaluated the collaborative learning aspects of a community health nursing project involving needs assessment and intervention planning, conducted by groups of undergraduate students. They reported that prior perceived obstacles to collaborative learning among students were mainly reduced and identified important traits of successful teamwork including good communication and cooperation among team members. Laal and Ghodsi (2012) also highlighted some beneficial outcomes of collaborative learning including that it creates self-esteem, increases productivity, and facilitates supportive and committed relationships among participants. Nevertheless, differences in students' educational and cultural backgrounds bring challenges to student interactions, because each individual in a culturally diverse team brings their own traditions, norms, and habits to the collaboration, and comes with a specific level of knowledge of other cultures (Cabrera et al. 2002). Cultural knowledge (Earley 2006) and individual attitudes (Cheng et al. 2016) have been identified as important aspects to consider when culturally diverse groups are working together.

Cultural knowledge may improve interpretation of other individuals' cultural behaviour (Earley 2006). It is one of the factors used by Crotty and Brett (2012) to assess cultural metacognition levels, where cultural metacognition 'refers to cultural consciousness and awareness during social interaction' (Crotty and Brett 2012; Earley and Ang 2003). Janssens and Brett (2006) categorised different levels of metacognition from low to high depending on the level of cultural sensitivity of an individual's state of mind and behaviour. Crotty and Brett (2012) identified metacognition as an antecedent for boosting team creativity for cross-cultural work teams. They tested the concept of fusion teamwork, where every member's cultural backgrounds are respected by other team members, using models of Likert-scale survey responses for cultural metacognition and fusion teamwork. The study results suggested that diversity of ideas and perspectives with meaningful participation can enhance team creativity and improve work quality (Crotty and Brett 2012). Moreover, Popov et al. (2014) tested a virtual collaborative-learning process with multidisciplinary and multicultural groups of students to assess perceptions and learning outcomes through analysis of survey data. They found that differences in comprehension and perception of the learning process could be influenced by differences in learning styles, human relations, rules of behaviour, communication style, attitudes, and belief systems that are all related to differences in cultural backgrounds. More recently, Weissmann et al. (2019) reviewed the science, technology, engineering, and mathematics (STEM) education literature to compare low-context learning environments (individualised work, task oriented, linear thinking, strict time schedule) with cases of high-context learning

environments (open and interactive work, process oriented, non-linear thinking, flexible time schedule). They concluded that female and minoritized students often learn best in a high-context setting and suggested that adoption of multi-context educational approaches may result in engaging a diverse learning community.

Individuals' attitudes about cross-cultural interactions can have positive or negative effects on collaboration, affecting both learning processes (Cheng et al. 2016) and meaningful participation (Crotty and Brett 2012). Salazar et al. (2012) developed a model for this process, where open communication and shared understanding can lead to increased trust, openness to new perspectives, group identity, and ultimately, enhanced cognitive integration. Crotty and Brett (2012) observed that people with high cultural metacognition develop openness and tolerance in their interactions with peers, adaptability, and ability to interpret cultural differences. Zhang et al. (2019) studied individual engagement in collaborative teamwork. They analysed Likert-scale surveys of 181 postgraduate students divided into small groups and working through a virtual communication tool. Their results suggested that mutual trust and social influence can promote teamwork which increases students' learning quality. However, Cheng et al. (2016)'s investigation of trust development in a semi-virtual multicultural collaboration of undergraduate students highlighted potential impediments to collaborative learning. They analysed the collaborations based on six criteria of trust development (risk, benefit, utility value, interest, effort, and power) using longitudinal surveys, which suggested that trust is not stable over time and is more challenging to achieve in multicultural teams compared with teams with members from a single culture. Taken together, these findings indicate that collaborative learning in a multicultural environment can enhance learning, but attention must be paid to establishment and maintenance of trust through attainment of multicultural knowledge.

Our goal is to learn how best to facilitate teamwork among students from Historically Black Universities (HBU) and Predominantly White Institutions (PWI) to promote collaborative learning in a multicultural setting. These collaborations have the potential to increase cultural knowledge and improve attitudes among students from both educational backgrounds. Our pilot cross-institutional inclusive learning study, involving a PWI and, an HBU created multicultural collaborations and then analysed the evolving knowledge, perceptions, and attitudes of participating students as they developed close working relationships. Insights gained from this pilot effort are intended to inform future program development.

Methodology

This work utilised a 'study-within-a-study' design (Figure 1). While student pairs (one from each institution) conducted a research project of their own design, we

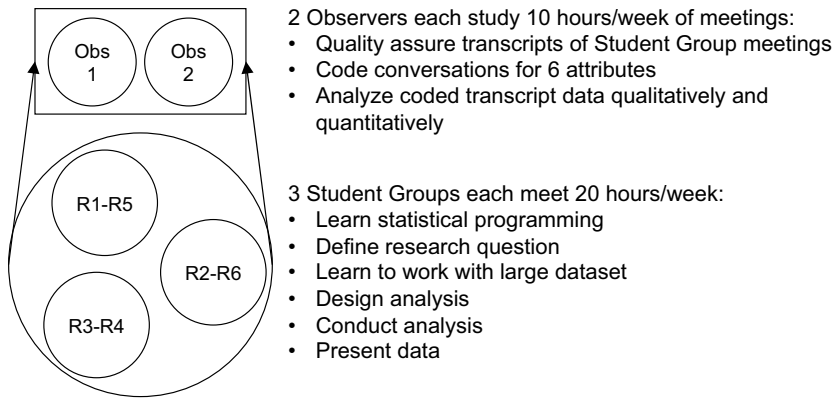


Figure 1. Conceptual model of the ‘study within a study’ design where insights of student group interactions were gleaned from transcripts of recorded Zoom meetings.

analysed how these students interacted with students from the other institution, who have had different perspectives and experiences. Students conducted their collaborations remotely, and transcripts sampled from the meetings were analysed over the 12-week duration of the study to assess evolving knowledge, perceptions, and attitudes of the students. The PWI’s Institutional Review Board (IRB) granted approval for the project on 12 March 2020. IRB protocol to protect human subject participants has been followed with the students’ completion of consent forms and in maintaining confidentiality for the research process.

Institutions

The project brought together students from an HBU and a PWI. Both were founded in the 1800s and are public land-grant doctoral research universities located in the Southeastern region of the United States. The PWI’s 2018–2019 common data set reported that 67% of its undergraduate students were Non-Hispanic White, whereas 5.5% were Non-Hispanic Black or African American. On the other hand, the HBU’s 2018–2019 common data set revealed that 81% of students were Non-Hispanic Black or African American, and 5.7% of students were Non-Hispanic White. Non-resident aliens of any races were excluded from both data sets.

Recruitment

Undergraduate students were recruited from each institution through an initial email recruitment announcement. Talking points for recruitment included explanations of what the data analysis project involved, the purpose of the data analysis project, what the larger research project about collaboration between the two institutions entailed, and the purpose of the larger research

project in exploring how students from an HBU and a PWI can work together remotely using a combination of interviews and observations. To participate, students had to attend school full-time, be at least 18 years old, and be enrolled in STEM programs with an environmental focus. Students were selected on a 'first-come, first-serve' basis.

A total of six students, three from each institution, were recruited. The three students from the PWI were of white race, and the three students from the HBU were of Black race. Among the students from the PWI, all identified as male. One student was in his early thirties, and the other two were in their early twenties. The student in his early thirties returned to the PWI after several years in the military and performing manual labour. The younger students attended college immediately after high school. All PWI students majored in Environmental Technology and Management, and other than the research assistant position for this study, they did not have other jobs. Among the HBU students, one was a female in her early twenties and attended college immediately after high school. The other two were males in their mid- and late-twenties, respectively, and both experienced some interruptions in their undergraduate studies due to personal and financial circumstances. The HBU student in his late twenties balanced school with two other jobs, including this position as a research assistant. All students from the HBU majored in the Built Environment. Students from the PWI program had a statistics requirement in their curriculum, whereas the HBU students did not.

Pairings were made to match the students by age and experience to the extent possible. The female HBU student was paired with a male PWI student in his early twenties. The male HBU student in his late-twenties was paired with the male PWI student in his early thirties. The male HBU student in his mid-twenties was paired with a male PWI student in his early twenties.

The small number of recruitments is due to the preliminary nature of the study and limited budget for the project. The project was designed to be a pilot experience and a first step in a sustained collaboration across a larger public institution system. Specifically, the partnership was intended to provide a model for collaboration across PWIs and HBUs by establishing successful practices for cross-institutional, multicultural interactions using distance learning technologies.

Student research collaborations

To achieve the study objectives and foster close working relationships among students, each PWI student was paired with an HBU student from the first week. For a 12-week period, student pairs worked together on a research project conceived and conducted by them.

Students met for approximately 4–7 hours per week during the academic year (1 April – 17 May 2020) and 20–24 hours per week during the summer (18 May–

30 June 2020). Most of the time was spent by the student pairs working, and meetings of the entire group occurred typically once per week for 1–2 hours. The Zoom web conferencing application was used as a platform for the meetings. All student meetings were recorded and transcripts generated automatically via Zoom were saved to be used for the research project analysis.

Following an established schedule of activities (Appendix 1), students were first trained to learn the R Statistical Software Programming Language (v.4.0.0) for data analysis via workshops over Zoom and using online resources. Student pairs worked together on these training sessions. Then, each student pair generated a research question about energy usage in the U.S. Students found the appropriate data to evaluate their research question from the 2015 Residential Energy Consumption Survey (RECS) published by the U.S. Energy Information Administration (Energy Information Administration EIA 2015) and designed an analysis to address their research questions (Appendix 2). This database was chosen because energy consumption spans the fields of both environment-focused programs and so creates an opportunity for shared interest. Students analysed data using R, collaborated on an interpretation of their results, and wrote research papers, slide presentations, and posters. Some student posters were presented at state and university symposia.

Evaluation of student interactions

The recorded transcripts were analysed to assess students' evolving knowledge, perceptions, and attitudes. Transcripts were corrected for mistakes in the artificial intelligence algorithm used by Zoom to create the transcript. Students' names were then de-identified and coded as R1, R2, and R3 for the PWI students and R4, R5, and R6 for the HBU students.

The Association of American Colleges and Universities (AACU) rubric of Intercultural Knowledge and Competence was used to develop a set of codes for assessing the transcripts (Appendix 3). AACU defines six attributes of this rubric including cultural self-awareness, cultural worldview frameworks, empathy, verbal and nonverbal communication, curiosity, and openness (Association of American Colleges and Universities 2009; Bennett 2008, 1993; Deardorff 2006). These six attributes describe knowledge of various cultures, identification of differences with one's own culture, understanding of one's experience, ability to act in a supportive manner, showing interests in learning from peers' culture, and initiating and developing interactions. The rubric classifies four levels starting with baseline and then increasing in sophistication.

NVivo qualitative analysis software was used to identify and code recurring discussion themes, biased statements, and openness to diversity and new perspectives, based on elements within the AACU rubric (Association of American Colleges and Universities 2009; Bennett 2008, 1993; Deardorff 2006). Elements were developed for each of the AACU attributes (Table 1). In NVivo,

Table 1. NVivo codes deduced from the AACU Intercultural Knowledge and Competence Rubric (Association of American Colleges and Universities 2009; Bennett 2008, 1993; Deardorff 2006).

Attributes	Elements
Attitudes – curiosity	Asks questions
Attitudes – openness	Initiates interactions
	Develops interactions
	Guarded statements
	Stops interactions
Knowledge – cultural self-awareness	One's own cultural rules
	Biases
Knowledge – cultural worldview frameworks	History
	Values
	Politics
	Communication styles
	Economy
	Beliefs and practices
Skills – empathy	Empathy
	Intercultural experience
	Lack of empathy
Skills – verbal and nonverbal communication	Understanding cultural differences – verbal
	Misunderstanding cultural differences – verbal
	Understanding cultural differences – nonverbal
	Misunderstanding cultural differences – nonverbal

these elements were identified in the transcripts to characterise the nature of each interaction. Frequency of occurrence of each element was tracked as a measure of changing intercultural knowledge and competence, and results were compared across meetings and groups by the proportion of the number of words for each attribute and group. Additionally, the proportion of speech (in number of words) by each student in a pair was measured to account for contribution to each meeting. Ideally, each student in a pair would contribute 50% of the conversation (or half of the students' words if the graduate mentor joined part of the meeting to instruct the group).

Approximately 200 hours of meeting recordings were generated during the 12 weeks of the students' teamwork (Table 2), and approximately 10–15% of the recorded meetings were transcribed from each week. Approximately 24 hours of transcribed meetings were selected for NVivo analysis, where samples were taken at random from the first hour of the day, middle of the day, and last hour of the day in a ratio of roughly 2:1:1. The meeting transcripts randomly selected for coding were split among two reviewers who compared the generated written transcript with the audio recording, corrected errors in the written transcript, and assigned codes to the transcript text for each of the six AACU attributes where relevant.

Table 2. Summary of time statistics for sampled interactions.

Paired Research Groups	Total Time (hr)	Time Sampled (hr)	Hours Coded
R1 - R5	56.63	25.15	9.42
R2 - R6	85.47	46.77	11.70
R3 - R4	59.30	11.42	2.78
Total	201.40	83.33	23.90

Uncertainty in the assignment of codes was assessed by comparing agreement in the coding process among the two reviewers. The reviewers coded the same 43 minutes of transcripts, and uncertainty was determined by how different the two reviewers' codes were. We quantified agreement (A_j) for each reviewer j by calculating the ratio of the number of words attributed to a given attribute i by both reviewers (r_i) to the total number of words attributed to reviewer j (n_j):

$$A_j = \frac{r_i}{n_j} \quad (1)$$

We are defining high agreement as $A_j = 0.7$ – 1.0 , moderate agreement as $A_j = 0.3$ – 0.7 , and low agreement as $A_j = 0.0$ – 0.3 . Although these assignments are somewhat arbitrary, they indicate the extent of uncertainty between the two reviewers, where high agreement in assignment of codes indicates low uncertainty and vice versa (Table 3). Highest agreement was found for Skills – Empathy and for Knowledge – Cultural Worldview Frameworks. Lowest agreement was found for Knowledge – Cultural Self-awareness.

Results and Discussion

Over the 12-week project, PWI students spoke $67 \pm 1\%$ of the words, while HBU students spoke $27 \pm 1\%$ of the words for the meetings that were transcribed. The 1% uncertainty in word counts was assigned for the proportion of words in the transcripts that could not clearly be attributed to either of the students. The remaining 6% of words were spoken by the graduate student research assistant, who would check in with the students periodically. The number of words spoken per week was typically 2–3-fold higher among PWI students compared with HBU students (Figure 2). This observation may be partially attributed to prior statistics training of the PWI students, leading to statement of more words in the meetings where they were likely to take the lead in portions of the statistical analysis discussions. Similarly, Zhang et al. (2016) studied the effectiveness of collaborative learning, where groups of students were formed with

Table 3. Uncertainty testing of the coding process. The proportions shown represent the ratio of the number of words only coded by one reviewer to the number of words coded by both reviewers for a given domain.

Attributes	Number Shared	Reviewer 1 Only		Reviewer 2 Only		Average	Agreement Designation
Attitude – Curiosity	5	9	0.36	9	0.36	0.36	Moderate
Attitude – Openness	8	7	0.53	20	0.29	0.41	Moderate
Knowledge – Cultural Self-awareness	2	6	0.25	4	0.33	0.29	Low
Knowledge – Cultural Worldview Frameworks	2	0	1.0	1	0.67	0.83	High
Skills – Empathy	7	0	1.0	1	0.88	0.94	High
Skills – Verbal and Non-verbal Communication	1	3	0.25	0	1.0	0.63	Moderate

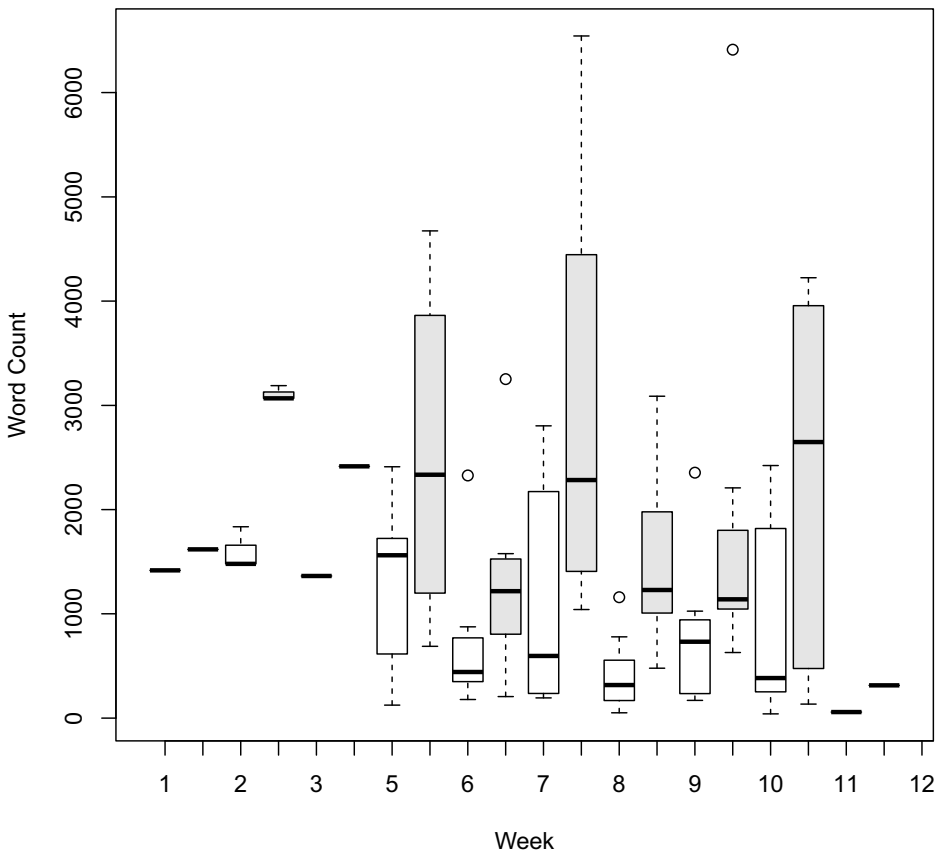


Figure 2. Word count by university and week. The HBU is shown in white (first position for each week), and the PWI is shown in grey (second position for each week).

mixed prior knowledge in computer programming (some had high knowledge and some lacked knowledge), while some groups were comprised of students with similar backgrounds in computer programming. They concluded that prior knowledge may influence collaborative learning environments and outcomes. Zhang et al. (2016) observed that students with less prior knowledge learned more if they worked in a heterogeneous group compared with those working in a homogeneous group. They posited that students with greater prior knowledge are more likely to lead the working collaboration in a heterogeneous group. Lack of confidence among the HBU students may have influenced the relative amounts of speech among the PWI and HBU students. For example, R5 expressed during the first week of the collaboration:

R5: I was like I don't know, these guys are smart, I just don't know if I can do this. And she was like you're just as smart as them, it just takes time, if you don't know anything, ask a question. But yeah. On Friday I was like, Oh God, why did I do this?

Based on the weekly breakdown of words spoken by students from each school (Figure 2), the difference in contributed speech did not appear to improve over time. This could indicate that students from the HBU did not become more confident in their contributions to the project over time. Studies surveying students on classroom participation showed mixed results. One survey of classroom participation based on social group membership suggested that students of White race participated at a higher rate than students from minoritized groups (Yaylaci and Beauvais 2017); although Howard et al. (2006) observed higher participation among students of White race than those of colour in males, but higher participation among female students of colour compared with male students of colour. Hence, the basis for this finding may be differences in participation among students of different groups rather than any attribution to the specific group.

Groups R1-R5 contributed 40% of the words coded for different attributes from the AACU rubric (AACU 2009), Group R2-R6 contributed 49% of the words coded, and Group R3-R4 contributed 11% of the words coded (Table 4). Group R3-R4's representation was lower because they only spoke 10% of the total words that were transcribed compared with 26% for Group R1-R5 and 64% for Group R2-R6. The relatively small proportion of words was due to the members of Group R3-R4 often working in silence compared with the other two groups. Group R1-R5 spent more of their time talking about politics and current events. The work coincided with the George Floyd murder in Minneapolis, MN on 25 May 2020 and both students were attending Black Lives Matter events and held similar political views. In a conversation strongly demonstrating the attitude of openness with one another:

R1: ... they're teargassing innocent crowds, but yeah didn't have anything to do with Minneapolis.

Table 4. Number of meetings and percent of words transcribed per group overall and by AACU attribute (AACU 2009).

	R1-R5	R2-R6	R3-R4
Meetings Transcribed (N)	19	24	11
Words Transcribed (N)	44,275	107,820	15,994
Words Transcribed (%)	26%	64%	10%
Words Coded (N)	29,996	37,381	8,455
Words Coded (%)	40%	49%	11%
Attitude – Curiosity Coded (%)	60%	35%	6%
Attitude – Openness Coded (%)	35%	51%	13%
Knowledge – Cultural Frameworks Coded (%)	64%	36%	0%
Knowledge – Cultural Self-Awareness Coded (%)	58%	42%	0%
Skills – Empathy Coded (%)	31%	64%	5%
Skills – Verbal & Non-verbal Communication Coded (%)	81%	2%	16%

R5: Yeah, this is a sight. I will say that at first I was scared, but then I was just kind of got like numb to it. It's okay.

R1: I've seen a bunch of the pictures of broken windows stuff like that. Burned places downtown. I guess I mean it's unfortunate that our local businesses but you know it kind of comes with it now protest and everything like that.

R5: So that's the ship of frustration. Frustration will bring destruction.

Qualitative feedback from the students in Group R1-R5 suggested that this pair formed the closest personal bond among the groups, which would explain the larger relative share of words coded to the AACU rubric for Intercultural Knowledge and Competence (AACU 2009). Group R1-R5 had the most coded words for four of the six attributes: Attitude – Curiosity, Knowledge – Cultural Frameworks, Knowledge – Cultural Self-Awareness, and Skills – Verbal and Non-verbal Communications (Table 4).

Group R2-R6 spoke at times about their personal lives, but they tended to discuss non-controversial topics such as car repairs and other jobs. Qualitative feedback from both students in this group suggested a cordial and productive working relationship. Group R2-R6 had the most coded words for two attributes: Attitude – Openness and Skills – Empathy. Students R2 and R6 show empathy towards each other as they realise that they are both returning students:

R6: Well y'all made me feel that bad because I should have been graduated in 2018.

R2: Oh, dude, do not feel bad. This is actually, so my first semester in college was in 2007.

R6: Wow, I was 14 so you got me about seven years.

R2: I mean to be fair wasn't in school that whole time. But yeah, this is attempt number two for me at the whole being in college.

R6: This is attempt two for me too, but the first I didn't drop out because of me. I was having family issues and I had to deal with it myself and send myself back. So that's what happened to me.

Throughout this conversation, both students are focused on reassuring each other about their academic progress.

In addition to Group R3-R4 having the lowest proportion of words, the students spoke very little about their personal lives. Qualitative feedback from the individual students in this group suggested the least connected working relationship. Student R3, from the PWI, complained to the graduate research assistant that he was pursuing the idea from Student R4, from the HBU, but Student R3 felt that Student R4 did not contribute to the work, according to further feedback from the graduate research assistant. Student R4 complained that she was not being included in the work. Group R3-R4 had the lowest number of coded words for five of the six attributes. Group R3-R4 was the only mixed gender group in the study. Cheryan and Markus (2020) describe how 'masculine defaults', or bias towards male characteristics, has influenced the treatment of women in the workplace. They pointed to examples where masculine default bias has been overcome through systematic changes to expectations of students' prior experiences. While it is not possible to know if masculine defaults, racial biases, or other interpersonal differences were responsible for the negative dynamics of this group, this example creates a compelling argument for working with students who bring a similar level of proficiency to avoid power dynamics within the team. Nevertheless, their research project was successfully completed, suggesting that despite these teamwork challenges, this group was still productive and met their commitment to complete the research project.

Each student group successfully produced a poster (Appendix 2), report, and presentation. Group R1-R5 studied energy usage as a function of insulation type and region of the US. Although this group had the most connected working relationship among the three, their analysis was the least sophisticated and contained the most errors. The students ran analyses in the R software to include stratifying data by insulation type and region and to produce graphs that conveyed this information clearly. However, this group's research question was written too broadly and did not entirely match the analysis performed. The students presented null and alternative hypotheses that were not specific to the research question nor the analysis performed. It was unclear how the students structured their test of the hypotheses and their conclusions were unclear. Their poster also included several misspellings, grammatical, and usage errors. Group R2-R6 studied unhealthy home temperatures as a function of income level and participation in a Low-income Home Energy Assistance Program (LiHEAP). The students set two clear objectives to show associations and used the χ^2 test, calculation of Spearman's correlation, and simple and multiple logistic

regression to test for associations and plot their results. Group R2-R6 also set a third objective to show that the program should be expanded, which was not testable. This team misstated some statistical concepts but set up and reported their statistical tests in a reasonable manner. Their conclusions were sensible in light of their analysis and test results. Group R3-R4 studied energy burden as a function of income level and participation in the LiHEAP for distributing government financial support for energy expenses. Despite strain between the group members, Group R3-R4 presented the most sophisticated data analysis (although they did not adequately link their results to their conclusions). Null and alternate hypotheses were tested for statistically significant differences in mean and equality of variances using Tukey's Honest Significance Tests for difference in energy burden (ratio of energy bills to total gross income) and percent of eligible households participating in LiHEAP between pairs of two regions of the US. F-tests were also used to compare all regions of the country. They discussed the limitations of their analyses and identified a need for further research to test how federal assistance is distributed across the country. Presented at the end of the poster are statistics identified to relate energy poverty to health concerns, although little connection is made between these factors and the results of Group R3-R4's analysis. This last point underscores a failure to tie the sophisticated analysis to the significance of their study. This is potentially related to the limited connection made between the students, who added individually to the work product but were unable to develop an integrated result.

The majority of words regarding attitudes of curiosity and openness, knowledge of cultural worldview frameworks, and the skill of empathy were made by the PWI students, with ratios ranging from 1.6:1 to 2.3:1 (Table 5). The majority of words regarding knowledge of cultural self-awareness and verbal & non-verbal communication were made by HBU students, with ratios ranging from 1.5:1–2.2:1. Throughout the project execution, PWI students in Groups R1-R5 and R2-R6 were more focused on data analysis, while HBU students contributed more of the ideas about study topics and writing. HBU students from both of these groups would often engage their PWI partners in discussions of personal matters and tie the projects to their personal lives (Knowledge of Cultural Self-awareness), while discussions of research methodology and implementation would more often be initiated and sustained by the PWI students in these

Table 5. Knowledge, skills, and attitudes by school for coded data.

Attribute	PWI	HBU
Attitude – Curiosity	62%	38%
Attitude – Openness	64%	36%
Knowledge – Cultural Worldview Frameworks	63%	37%
Knowledge – Cultural Self-Awareness	40%	60%
Skills – Empathy	70%	30%
Skills – Verbal & Non-verbal Communication	31%	69%
Total	63%	37%

groups with effort to engage their partners (Skill of Empathy, Attitude of Openness, Knowledge of Cultural Worldview Frameworks). Both partners in Groups R1-R5 and R2-R6 would regularly participate in discussions. In Group R3-R4, Student R3 forged ahead with both activities and did not always involve Student R4 for either task. Student R4 attempted to increase their participation several times but was not readily included by Student R3.

Sadowsky et al. (1994) recognised, in the context of psychological counselling, that changing demographic patterns within the United States necessitates 1) recognition of one's own power regarding race, ethnicity, culture, and language and 2) effort invested to understand cultural factors outside their own. Although studies of intercultural competence often focus on international interactions, criteria identified by Deardorff (2006) in a survey of intercultural researchers as important to intercultural competence can be applied within a diverse setting such as the United States. These criteria include demonstration of curiosity and respect for other cultures, knowledge of one's own cultural positions, and skills to listen and observe with intended outcomes of building greater empathy for those of different backgrounds and behaving appropriately in intercultural settings.

Limitations

The small cohort size used in this pilot study is the greatest limitation of this work. Hackshaw (2008) highlights the benefits of small studies, with respect to ease of implementation and low budget for testing new areas of inquiry. However, small studies cannot produce reliable statistics – and therefore cannot produce conclusions with confidence – given that small sample sizes equate to wide confidence intervals (Hackshaw 2008). Onwuegbuzie and Collins (2007) point out that the importance of sample size depends on the goals of the study. For our pilot study, our goal is to increase our knowledge of how students from HBCUs and PWIs can learn collaboratively, which we accomplished. Our results enabled insights that will inform future collaborations of this nature, and these new pairings will provide additional data that can improve the statistics of our analyses.

In our pilot study, evidence of each of the six attributes was identified, albeit often with some uncertainty (Table 3). Deardorff (2011, 2006) recognised a lack of consensus around definitions of intercultural competence, in terms of which attributes are important and how to identify those attributes. Definitions often vary across fields and are interpreted differently by researchers. Arasaratnam (2016) pointed out that building intercultural competence is often clouded by innate cultural perspectives of the evaluator. But Deardorff (2011) emphasises that developing such competence is a continual process involving growth in critical thinking, openness of attitudes, and the ability to empathise. Our combination of recognising speech having different attributes and analysing

student group conversations to ascertain work patterns is intended to build greater confidence in our assessments of these working relationships. Furthermore, specific quotes analysed with respect to an attribute in the discussion of this paper are those that were agreed upon by both analysts to possess that attribute. For this reason, partially divergent coding may add uncertainty to the quantification of attributes in [Tables 4 and 5](#) for those attributes with lower confidence (Knowledge – Cultural Self-awareness, Attitude – Curiosity), but it is unlikely to change the qualitative analysis presented herein. A second limitation is that the students in each group did not have the same preparation. For this reason, data analysis was more often taken up by the PWI students, and the HBU students in Groups R1-R5 and R2-R6 balanced the project workload distribution by taking on more of the writing. The PWI student dominated the work process in Group R3-R4. Although the level of sophistication of that analysis was higher, the assessment of regional differences in energy poverty lacked connection to potential factors either causing or deriving from this condition. Better inclusion of the HBU student, who suggested the topic because they lived through energy poverty, in the study design process beyond topic suggestion could have enriched the study by incorporating lived experience in the variable selection process.

Conclusions

Our pilot study results suggest that students willing to engage collaboratively with others from different cultural or educational backgrounds can display attributes of intercultural competence, while those not willing to engage in or excluded from the collaborative process may not exhibit such competence. Our study focused on collaborations formed between those from an HBU with those from a PWI. The small sample size inhibited deduction of the reason for each HBU-PWI student group's interpersonal dynamics, which could relate to racial bias, gender bias, differences in educational preparation, some other unexplored factors, or a combination thereof. We were unable to quantitatively demonstrate changes in intercultural attitudes, knowledge, or skills over the 12-week duration of our pilot study. Future research would involve a larger number of participants and explore factors influencing each of the attributes, such as student age and gender identity.

This work yielded insights for future program development. First, we will ensure that a future project involving cross-institutional collaboration will be designed such that students from both institutions have the same initial preparation necessary for the assigned project. Selection of a project that is more qualitative in nature may allow for greater parity across different aspects of the project. Second, we will include ongoing training in implicit biases to increase the students' self-awareness of their inherent biases to increase both the students' self-confidence and their faith in their partners. Dobbins and Kalev

(2018) demonstrated that diversity training does not reduce biases when administered as a one-time program. However, ongoing bias reduction training may produce improvements over time (Dobbins and Kalev 2018; Forscher et al. 2017; Devine et al. 2012). Sustained orientation and mentoring programs for such intercultural collaborative efforts may also have to consider personality and temperament in establishing sincere connections among the students.

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Data availability statement

De-identified data from this study will be made available by the authors upon request if the request does not conflict with terms of the IRB agreement..

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