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A CASE STUDY OF THE EDUCATION CHANGES POST-COVID PANDEMIC ON AFRICAN AMERICAN STUDENTS

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ABSTRACT

The COVID-19 pandemic had a profound impact on education, reshaping how students and educators interacted with learning through significant global changes, including a shift to online learning, hybrid models, and an increased reliance on digital tools and platforms. Educators adapted to new technologies, transforming assessment practices and policies, while the pandemic highlighted inequalities, affected mental health, and accelerated technology integration, fostering flexible teaching with lasting implications for the future of education. This research builds on a prior study presented at the ASEE conference in 2023 and focuses on the experiences of minority students at a Historically Black College and University (HBCU). This year, another survey was conducted with Engineering Technology and Architecture students from various academic levels, examining their experiences with teaching methods before, during, and after the pandemic. The study provides an in-depth analysis of survey data, focusing on changes in academic experiences, engagement, and career prospects during and after the pandemic, while highlighting the demographic diversity of respondents, primarily African American students, and the institution's commitment to underrepresented groups. The authors reflect on their experiences with courses in design, technology, and lab-based subjects, utilizing online quizzes, recorded lectures, virtual office hours, and resources to adapt to new learning conditions. The paper explores innovative approaches to ensure hands-on learning and discusses feedback from students and faculty, with special attention to the impact on minority and underrepresented students. Key findings reveal significant declines in concentration, motivation, and engagement during the pandemic, largely due to the abrupt transition to online learning and its associated challenges. However, post-pandemic recovery trends indicate improvements in these areas, emphasizing the resilience of students and the return to traditional learning formats. Notable outcomes include enhanced self-study skills, increased familiarity with digital tools, and positive shifts in career aspirations driven, and more interest and involvement in teamwork by new opportunities in remote and technology-driven roles. Despite these successes, challenges such as digital inequities, financial constraints, and adapting to hybrid learning models remain critical areas for improvement. The study underscores the importance of robust institutional support, mental health resources, and flexible learning environments to foster adaptability and inclusivity. These findings provide actionable insights for enhancing education in a rapidly changing world.

Keywords: COVID-19, Educational changes, African American students, Digital tools and platform, Assessment practices, Mental health and well-being, Technology integration, social experience, teamwork

1. LITERATURE AND BACKGROUND

The assessment of undergraduate students is a crucial aspect of education [1]. In this context, investigating the distance learning experience in an academic program becomes particularly significant [2], especially during the pandemic, when its importance was further emphasized. Mulay et al. (2023) investigated the Effects of Distance Learning on African American Students in Engineering Technology Courses During the COVID-19 Pandemic [3]. This paper examines the results after COVID-19 as a continuation of the previous research. A general overview of other researchers' themes and topics is also presented. The global Themes in Engineering Education Post-COVID are listed below:

Engineering education adapted to online formats in the time of the COVID-19 pandemic, and as a result, the universities shifted to adopting online and hybrid presentations and investigating the effectiveness of online learning tools and methodologies [4]. Different researchers explored and examined changes in student engagement and participation in virtual classrooms during the pandemic and post-pandemic. The effectiveness of virtual labs and collaborative tools was assessed [3, 5]

Adopting new technologies in engineering education is investigated post-COVID. Virtual reality (VR) and augmented reality (AR) are studied in engineering courses [6].

Changes in assessment strategies and methods need to be explored, and the use of remote proctoring and alternative assessment tools needs to be investigated [7].

Social and emotional well-being was another essential matter investigated during the COVID pandemic. It is necessary to examine the impact of the pandemic on the mental health and well-being of engineering students, and this needs to be explored after the strategies to support students emotionally and socially post-COVID [8].

Faculty must adapt their teaching methods post-COVID. There is a need to explore perspectives on challenges and opportunities in remote teaching and if it can be adopted in the future based on the faculty experience [9]. These themes are the critical aspects to be covered in engineering education and investigate the student behavior changes after the COVID-19 pandemic. Many schools and universities adopted online learning to continue education during lockdowns. This led to a greater emphasis on technology and digital resources.

Learning Management Systems (LMS) such as Canvas, Blackboard, or Moodle became widespread for course delivery, content management, and student engagement and improved during and after pandemic. This also resulted in improved systems, and the knowledge of the faculty enhanced because of using them [10].

Educational institutions increasingly embraced digital textbooks, open educational resources (OER), and multimedia content to support online learning [11]. Engineering courses incorporated virtual labs and simulations to provide hands-on experiences in a digital format [12]. Institutions utilized a mix of synchronous (real-time) and asynchronous (self-paced) learning to accommodate diverse student needs [13]. Adaptive learning technologies were employed to personalize learning experiences based on student progress and needs.

Hattie and Donoghue (2016) used learning strategies of synthesis and conceptual Models [14]. Interactive virtual labs and simulations provide hands-on experiences in engineering courses. For example, tools like LabSter offer virtual experiments in various scientific disciplines [15].

The digital divide became more apparent as students faced varying access levels to reliable internet and devices [16]. Maintaining student engagement online requires innovative approaches such as gamification and interactive content [17]. Faculty members engaged in professional development programs to enhance their online teaching skills and adapt to new technologies

[18]. University training for the faculty shifted to online training, allowing the faculty to attend a greater variety of training. Implementing secure online exams or alternative assessment methods to ensure the integrity of student evaluations [19].

Many institutions are exploring hybrid learning models combining in-person and online components for a flexible and blended approach [20]. Even after the pandemic, there has been more approach to shift to Hybrid Learning Models. Educational institutions continuously evaluate and refine their online learning strategies based on feedback and emerging technologies [21]. Ensuring online materials and platforms are designed with accessibility to accommodate diverse learner needs [22]. Adaptive learning technologies can be integrated into the online component, providing personalized feedback and adapting content based on individual student progress [23]. Hybrid models increase access to education, allowing students who may face geographical or time constraints to participate in courses [8]. Institutions may realize cost savings by optimizing physical space utilization and reducing the need for extensive on-campus infrastructure [24].

Faculty members may need training and support to design and implement hybrid courses effectively, incorporating technology and balancing in-person and online components [25]. Maintaining consistency in the learning experience across both modalities can be challenging. Ensuring that online and in-person components complement each other is crucial [26]. Institutions must invest in robust technology infrastructure to support online and in-person instructional needs [27]. Student engagement in virtual and physical environments requires intentional design and interactive elements [28]. Institutions can use data analytics to assess the effectiveness of hybrid models and make informed decisions about instructional strategies [29]. Regular assessment and feedback from students and faculty informs ongoing improvements in hybrid learning design [30].

Building Information Modeling (BIM) and Procore Software BIM tools like Autodesk Revit or Trimble Tekla Structures are integrated into construction engineering education for collaborative project design and management [31]. Challenges may include faculty training, ensuring technology equity, and addressing potential distractions in online learning environments [32]. Maintaining academic integrity in online assessments and preventing cheating requires careful consideration and using secure assessment tools [33].

Augmented Reality (AR) and Virtual Reality (VR) applications are emerging in engineering education for immersive experiences, such as virtual site visits or equipment simulations [34].

2. METHODOLOGY

This study employed a mixed-methods approach, combining quantitative survey data and qualitative reflections to analyze the educational changes experienced by students during and after the COVID-19 pandemic.

The methodology was designed to capture the diverse academic, social, and psychological experiences of students, particularly those from underrepresented communities. Since the paper is provided by a group of faculty members, the related analysis resulted from the discussion and survey among this team. Research Questions that are tries to be answered in this research include:

- How did the COVID-19 pandemic affect concentration, motivation, engagement, and academic experiences among African American students?
- How did students perceive changes in teamwork, instructor support, and social interaction before, during, and after the pandemic?
- What impact did the pandemic have on students' confidence regarding career opportunities and professional preparation?
- What educational practices and institutional support systems should be maintained or improved after the pandemic?

2.1.Survey Design and Administration

The survey consisted of structured questions, addressing key themes such as: Academic performance and engagement, Mental health and well-being, Accessibility of resources, Career prospects and professional readiness and Experiences with online, hybrid, and in-person learning modalities.

The questionnaire was distributed electronically to ensure accessibility and encourage maximum participation. To accommodate varying levels of technological access, students could complete the survey using smartphones, laptops, or on-campus facilities. The survey included the quantitative items rated on a Likert scale (0–5), and several open-ended qualitative questions to capture detailed reflections on educational experiences.

Example survey questions included:

- Rate your ability to concentrate before, during, and after COVID-19
- How would you evaluate your engagement in classes?
- Rate your confidence in job prospects before and after the pandemic.
- How frequently did you participate in teamwork or group activities?

Quantitative analysis relied primarily on descriptive statistics and percentage-based interpretations to compare educational experiences before, during, and after the pandemic. Comparative analysis highlighted changes in concentration, engagement, teamwork, and instructor support.

Although the study mainly used descriptive statistical analysis, future research should incorporate inferential statistical methods such as paired t-tests or repeated-measures ANOVA to determine statistical significance and strengthen interpretation of the findings.

Open-ended responses were analyzed thematically to identify recurring themes related to remote learning challenges, mental health concerns, digital access, and academic support. Participation was voluntary, and all responses remained anonymous. Institutional Review Board (IRB) approval was secured before data collection.

2.2.Participants:

The study had a 97% response rate, with 87 students participating in Construction Engineering Technology, Electronics Engineering Technology and Architecture Bachelor programs. The participants represented a diverse cohort, spanning multiple academic levels:

Freshmen to Seniors ensured comprehensive insights into the challenges and recovery trends.

Gender Representation: Included responses from male (63%), female (34%), and non-binary students (2%), reflecting an inclusive survey approach.

Ethnicity: Predominantly African American students (82%), with representation from Hispanic, Asian, and White students, providing a focus on underrepresented communities in STEM fields.

Academic Disciplines: Majority from construction engineering technology and related fields, ensuring discipline-specific insights.

Since the same students answered questions about different time periods, their responses reflect their memories, which may be influenced by changes in their age, academic level, and school experience over time. While the results may not perfectly capture each period's reality, they remain valuable as they provide insight into students' recollections, complemented by faculty observations and analysis.

2.3.Data Collection:

Data collection occurred Fall 2024, through the questionnaire, the students answered questions about their experience, Pre-Pandemic Baseline, During the Pandemic, and Post-Pandemic Recovery. So, the comparisons where based on the same students' experience in different ages and conditions. Faculty reflections complemented student surveys, detailing the adaptation of teaching methods such as: the use of online quizzes and virtual labs for STEM courses, transition to recorded lectures and synchronous discussions to ensure continuity, and challenges and innovations in maintaining academic rigor and engagement in remote settings.

2.4.Statistical Analysis:

The survey data underwent quantitative analysis using statistical tools to identify trends and correlations:

Descriptive Statistics: Provided summaries of student responses, including mean scores and percentage-based interpretations.
Comparative Analysis: Highlighted differences in student experiences across pre-pandemic, during-pandemic, and post-pandemic phases.
Thematic Analysis: Applied to open-ended responses, identifying recurring themes in student feedback.

Key metrics such as motivation levels, engagement, resource accessibility, and career confidence were tracked to assess both disruptions and recovery over time.

Open-ended questions allowed students to share personal reflections on the psychological effects of isolation during remote learning, the challenges of balancing academic, work, and family responsibilities and the experiences with institutional support, including mental health resources and technology assistance.

These qualitative responses were coded and grouped into themes to provide a richer narrative of the quantitative findings.

2.5.Ethical Considerations

To ensure ethical compliance:

Participation was voluntary, with informed consent obtained from all respondents. Data was anonymized to protect participants' identities and maintain confidentiality. Institutional Review Board (IRB) approval was secured prior to conducting the study.

3. Challenges and Limitations

This study provides valuable insights into the resilience, learning experiences, and career outlooks of minority students at HBCU before, during, and after the COVID-19 pandemic. However, several challenges and limitations should be acknowledged:

*3.1.*Reliance on Student Memory and Perception

Self-reported data may introduce biases, such as overestimation or underestimation of experiences. Since students reflected on different time periods, their responses were based on recollection, which may be influenced by memory biases. The accuracy of their experiences before and during COVID-19 might not be fully precise.

*3.2.*Financial Accessibility and Digital Inequities

Many students faced financial constraints affecting their ability to access technology, stable internet, and study resources during remote learning. The survey may not fully capture the depth of these challenges, as students with the most significant hardships may have been unable to participate.

*3.3.*Variability in Learning Environments

Students' experiences varied based on factors such as course structure, instructor adaptability, and individual circumstances. While some students thrived in remote learning, others struggled, making it difficult to generalize findings across all respondents.

*3.4.*Limited Longitudinal Data

This study captures student perspectives at a single point in time, relying on retrospective self-reporting. A longitudinal study tracking students throughout the pandemic would provide more precise insights into evolving challenges and resilience.

*3.5.*Self-Reported Data Limitations

The study relies on self-reported survey responses, which may be influenced by personal biases, social desirability, or differences in individual interpretation of questions.

3.6. Impact of External Factors

Other external factors, such as family responsibilities, mental health, and employment status, may have influenced students' academic experiences, but these were not the primary focus of the study.

3.7. Response Rate and Sample Representation

While the study achieved a high response rate (97%, with 87 students responded), the findings are based on a specific population within construction and electronics engineering technology. The results may not fully represent students in other disciplines or HBCUs broadly.

Despite these limitations, the study offers meaningful insights into how minority students at an HBCU navigated the challenges of the pandemic, highlighting areas for institutional support and future research.

4. DETAILED SURVEY RESULTS AND DISCUSSION

This section provides an exhaustive analysis of the survey results, ensuring that all questions are covered with their corresponding results and maximum possible scores. It is clear that the students' responses were influenced by various factors beyond the pandemic, including age, higher levels of education, differences in educational institutions, and psychological conditions. However, the focus of this survey was specifically on the conditions brought about by the pandemic and its impact on students' academic experiences and career perspectives. The discussion highlights trends, challenges, and implications of the responses collected from the students.

4.1. Demographic Overview

The gender distribution among respondents was as follows: 63% male, 34% female, and 2% non-binary or third gender. The total number of respondents was 87. This demographic composition reflects the common gender distribution seen in STEM fields, particularly in construction engineering technology programs, which often have a male majority. However, the inclusion of non-binary responses, though a small percentage, indicates a degree of diversity and the presence of gender inclusiveness in the program.

Out of 87 respondents, the ethnic breakdown was predominantly African American (82%, 71 respondents), followed by White (7%, 6 respondents), Hispanic or Latino (6%, 5 respondents), Asian (3%, 3 respondents), and a small number identifying as 'Other' (1%) or preferring not to say (1%). This high representation of African American students suggests that the program successfully reaches out to minority and underrepresented communities, aligning with diversity goals in higher education.

Most respondents (47%, 41 students) were majoring in Construction Engineering Technology, followed by Architecture (36%, 31 students), Electronics Engineering Technology (11%, 10 students), and 'Other' (6%, 5 students), including majors like Facilities Management. This indicates that the feedback primarily reflects the experiences of students within construction-related disciplines, providing insights specific to this field.

The respondents were spread across different academic levels: Freshmen (14%, 12 students), Sophomores (14%, 12 students), Juniors (38%, 33 students), and Seniors (34%, 29 students). This distribution suggests that the survey captured a balanced mix of perspectives, with a significant portion from upper-level students who have a deeper understanding of their academic journey.

When asked about their academic status during the onset of the pandemic (Spring 2020), 71% (60 students) were high school students, 16% (14 students) were freshmen, 8% (7 students) were sophomores, 4% (3 students) were juniors, and 1% (1 student) was a senior. This demographic detail highlights the unique challenges faced by students transitioning to college during a period dominated by remote learning.

The financial background of respondents showed that 57% (49 students) identified as having a medium financial status, 36% (31 students) as low, and only 7% (6 students) as high. This indicates that a majority of the students might have faced economic constraints, which could have influenced their access to resources and ability to navigate the shift to online learning effectively.

4.2. Academic Experience Analysis

Students rated their ability to concentrate on a scale from 0 (very poor) to 5 (excellent). Before the pandemic, concentration levels were relatively high at 80%, supported by structured classroom environments and direct interactions with instructors and peers. During COVID-19, this dropped drastically to 49%, reflecting the significant impact of remote learning. The lack of structured study schedules, coupled with distractions in home environments, hindered students' ability to maintain focus. Post-pandemic, concentration levels improved to 70%, suggesting partial recovery as students returned to in-person classes. However, the data indicates that focus levels did not fully return to pre-pandemic levels, highlighting lingering effects on attention spans and the need for strategies to rebuild concentration skills in hybrid and physical learning settings. (Figure 1)

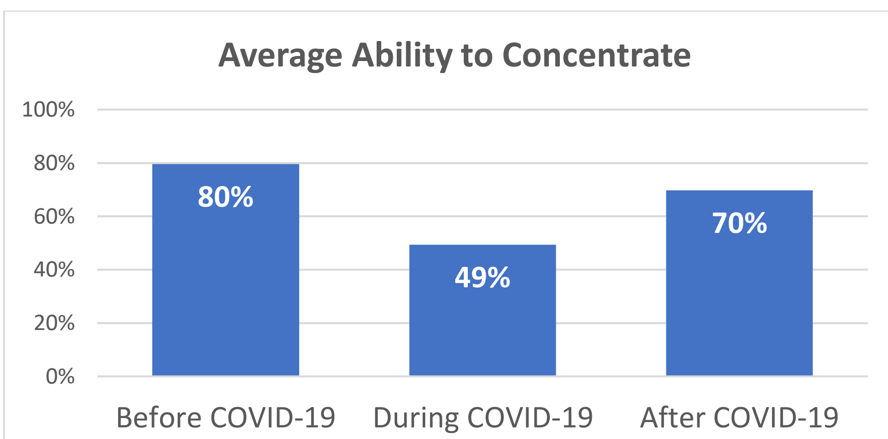

Figure 1. The Students Ability to Concentrate

Motivation levels declined sharply during the pandemic, from 82% to 51%. Pre-pandemic, motivation was bolstered by regular interaction with instructors and peers, as well as structured learning routines. As an analysis by the authors and discussion among the faculty, the pandemic disrupted these routines, leading to feelings of isolation and uncertainty about academic and career outcomes, which negatively impacted motivation. Post-pandemic, motivation rebounded to 76%, driven by the restoration of traditional classroom experiences and greater clarity about future opportunities. Despite the recovery, the data highlights that not all students regained their previous levels of enthusiasm, suggesting that additional support, such as counseling and mentorship programs, may be needed to sustain and further enhance motivation. (Figure 2)

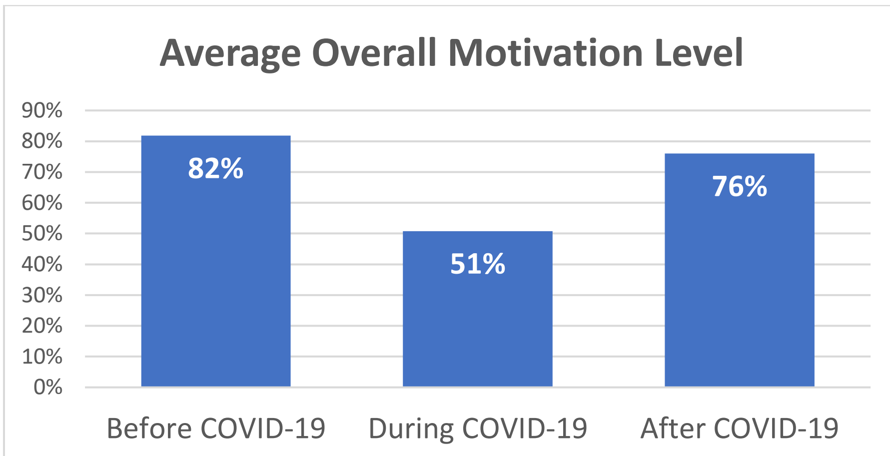

Figure 2. Motivation Levels of the Students

Figure 3 shows that the comfort in peer interactions was high before the pandemic (84%), as students benefited from the spontaneity and ease of face-to-face communication. During the pandemic, this dropped to 60%, largely due to the limitations of virtual platforms that lacked the natural flow and rapport of in-person discussions. Group activities, which are integral to collaborative learning, were significantly affected, leading to reduced social comfort. After COVID-19, comfort levels improved to 75% as students resumed direct interactions. This recovery highlights the importance of social connections in academic settings and the need for institutions to foster environments that encourage collaboration, even in virtual or hybrid formats. So the decline during the pandemic can be attributed to the shift to virtual interactions, which often lack the spontaneity and rapport of in-person engagement. The improvement post-pandemic reflects the positive impact of resuming face-to-face interactions.

At this university, the programs were used and shifted from Blackboard to CANVAS, and related training was followed before COVID, so the faculty and students were already familiar with it. Students evaluated the helpfulness of course resources such as Canvas and other digital tools. Before and during COVID-19, these resources were rated at 66%, indicating that institutions made efforts to provide consistent support despite the shift to online learning. After the pandemic, helpfulness ratings increased to 70%, reflecting improvements in how digital tools were integrated into traditional classroom environments. The data highlights the importance of continuing to enhance resource accessibility and effectiveness, particularly as digital platforms remain a central component of modern education. The steady increase in ratings indicates that digital resources became more effective and well-integrated into students' learning experiences, especially as they adapted to online learning tools. This is demonstrated in percentages in figure 4.

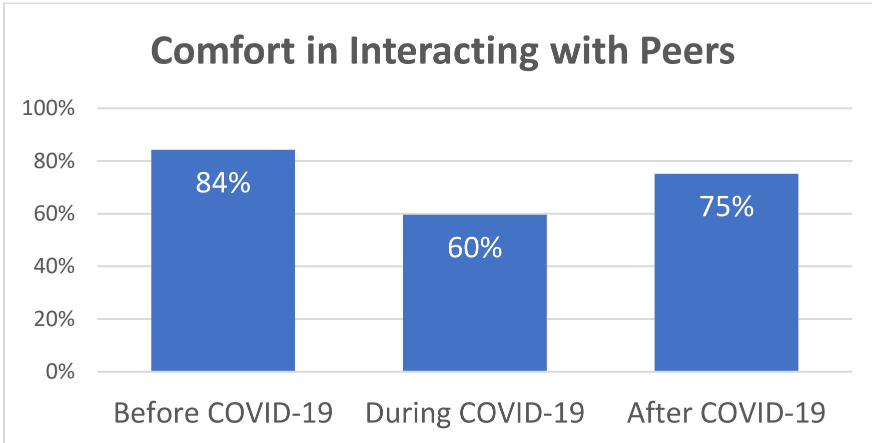

Figure 3. Comfort in Interacting with Peers of the Students

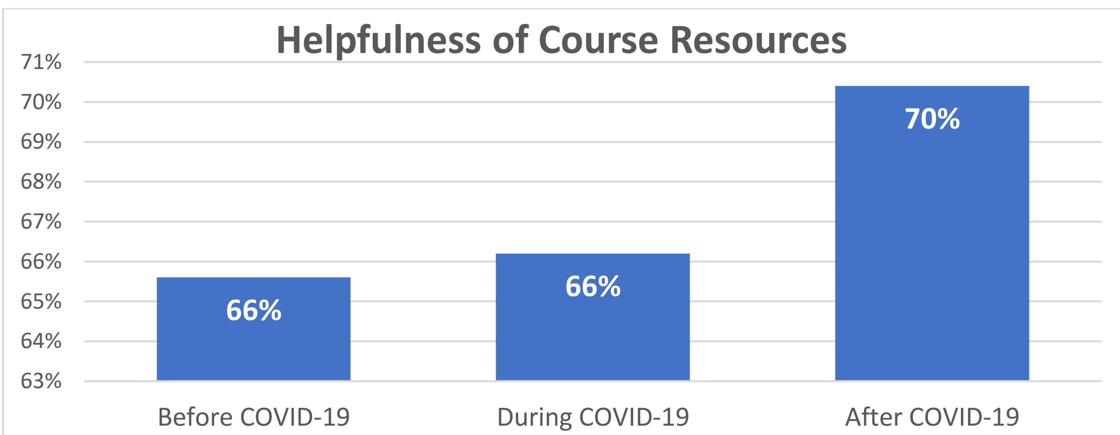

Figure 4. Helpfulness of Course Resources of the Students

Maintaining focus was challenging across all periods, with the highest difficulty reported during COVID-19 (63%). The rise in difficulty during the pandemic reflects the struggle students faced with home distractions and the monotony of virtual classes. While focus improved post-pandemic (58%), it did not return to pre-pandemic levels, suggesting residual difficulties. These findings highlight the need for strategies to minimize distractions and support sustained attention in diverse learning contexts, such as mindfulness training and structured study schedules. The higher rating during the pandemic highlights the struggle students faced with home distractions and the challenge of staying attentive in virtual classes (Figure 5).

Engagement levels were highest before the pandemic (75%) but dropped drastically during COVID-19 to 41%. Remote learning environments lacked the hands-on, interactive activities that foster engagement. Post-pandemic, engagement rebounded to 70%, driven by the return of experiential learning opportunities and face-to-face interactions. The sharp drop reflects disengagement due to the lack of interactive, hands-on activities in remote learning settings, These results underscore the critical role of active learning techniques in sustaining student interest and participation. (Figure 6).

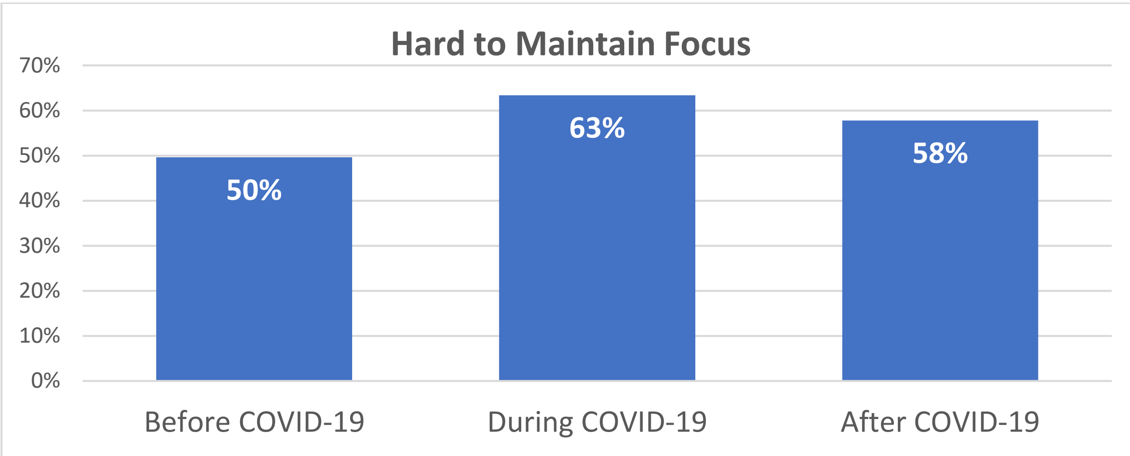

Figure 5. Maintaining Focus of the Students

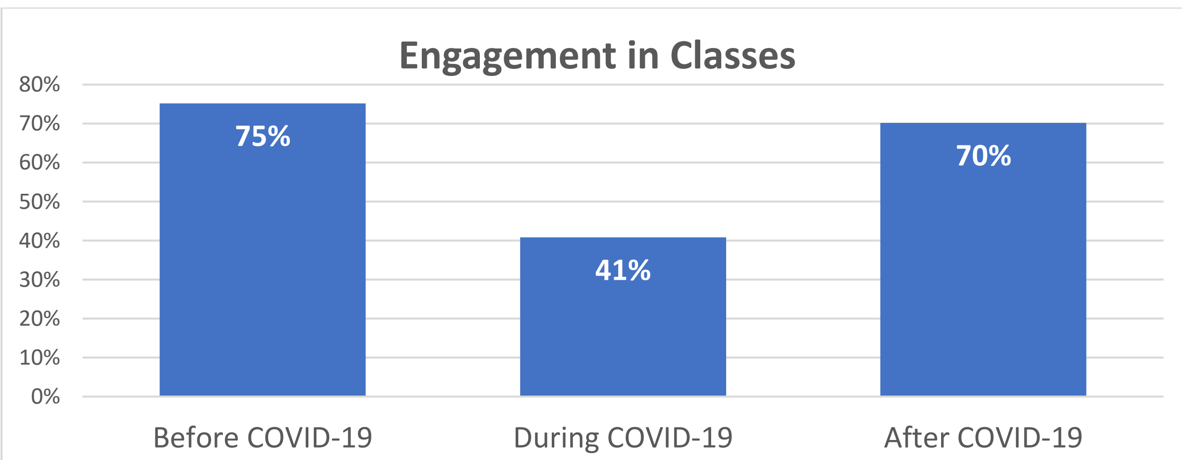

Figure 6. Engagement in Classes of the Students

Balancing work and study became more difficult during the pandemic, with ratings dropping from 53% to 49% (Figure 7). The overlap of home, work, and study responsibilities in remote environments posed significant challenges. After the pandemic, balancing improved significantly to 72%, suggesting that the separation of spaces and the return to structured routines greatly benefited students. These results highlight the importance of clear boundaries and flexible scheduling to support effective time management. The increased difficulty during the pandemic is likely due to the overlap of work, study, and personal responsibilities at home.

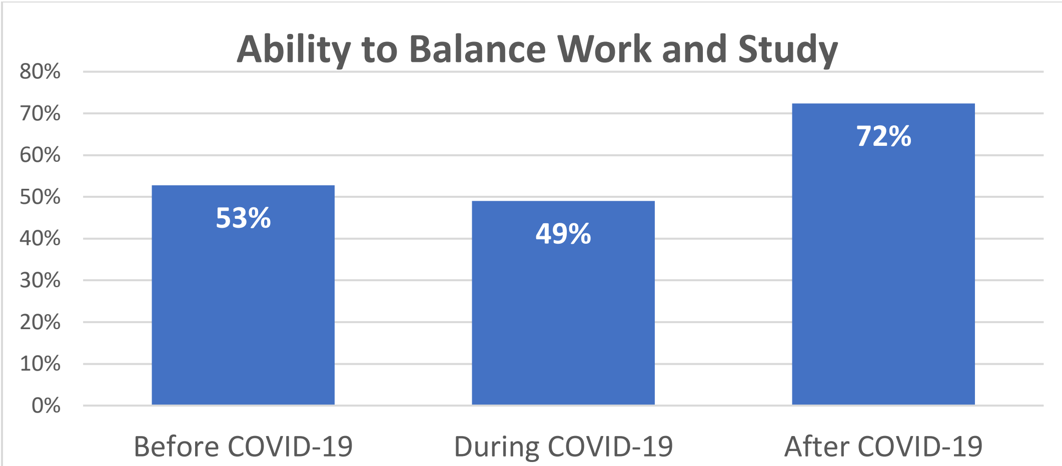

Figure 7. Balancing Work and Study of the Students

Laboratory experience quality declined significantly during the pandemic (40%), as hands-on activities were challenging to replicate in virtual formats (Figure 8). Post-pandemic, ratings improved to 66%, indicating the return of effective lab activities. These findings stress the importance of incorporating innovative solutions to ensure practical learning continuity during disruptions. The decline during the pandemic reflects the difficulty of conducting hands-on experiments remotely, while the improvement post-pandemic shows the return of effective lab activities.

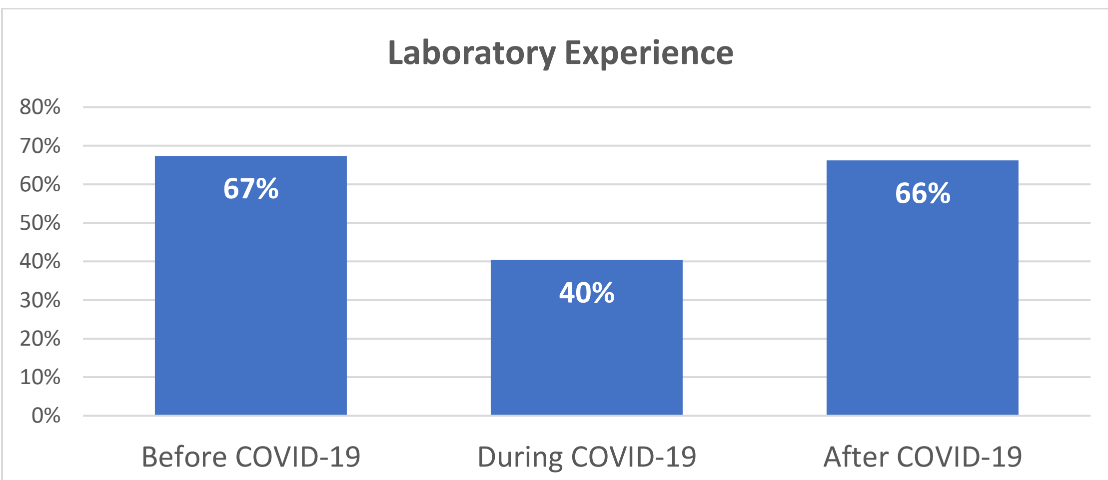

Figure 8. Quality of Laboratory Experiences of the Students

Satisfaction with instructor guidance dropped significantly during the pandemic, from 77% pre-pandemic to 57%. Students cited difficulties in communication, as virtual office hours and email exchanges were less effective than in-person interactions (Figure 9). However, ratings improved to 74% post-pandemic, reflecting the value of direct communication and support from instructors. This recovery highlights the importance of accessible faculty and consistent feedback mechanisms in fostering a supportive learning environment. As Figure 9 demonstrates, satisfaction decreased significantly during the pandemic, likely due to the reduced face-to-face interactions and limited office hours in a virtual setting. However, there was a noticeable improvement after the pandemic, suggesting that the return to in-person classes restored effective communication and support between students and instructors.

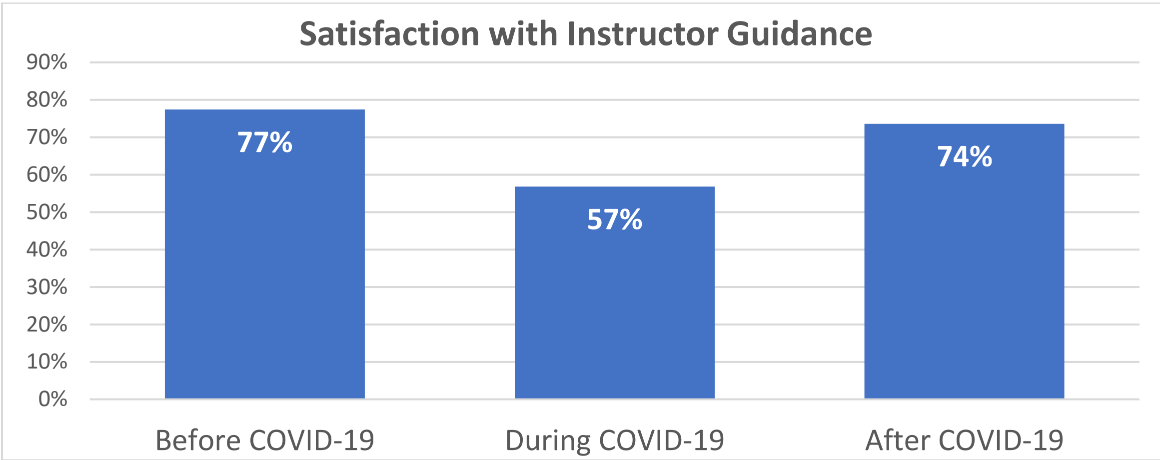

Figure 9. Satisfaction with Instructor Guidance of the Students

Overall course satisfaction dropped significantly during the pandemic, from 73% pre-pandemic to 52%. Students reported dissatisfaction with online formats, which were less engaging and effective for practical or interactive learning. Post-pandemic, satisfaction improved to 70%, driven by the return to traditional classroom environments (Figure 10). The findings highlight the need to enhance the design of online courses to ensure they are as engaging and effective as their in-person counterparts. The decline during the pandemic indicates dissatisfaction with online learning formats, which many students found less engaging and effective. However, satisfaction levels recovered post-pandemic as traditional classroom environments and hands-on learning experiences resumed.

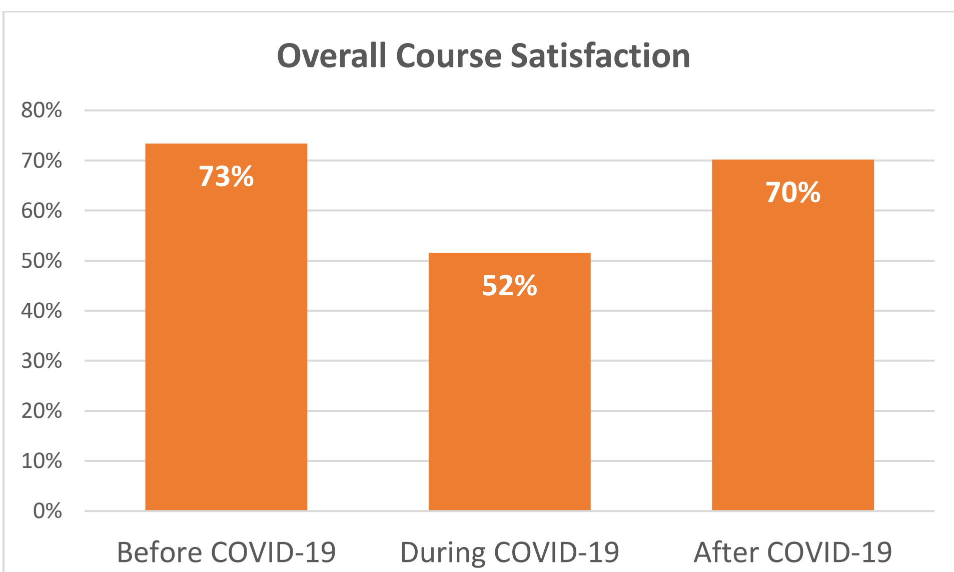

Figure 10. Overall Course Satisfaction of the Students

4.3. Social and Teamwork Experience

Engagement in team activities dropped from 72% pre-pandemic to 41% during COVID-19, reflecting the challenges of remote collaboration. Post-pandemic ratings returned to pre-pandemic levels, highlighting the critical role of in-person teamwork in fostering social bonds and collaborative learning (Figure 11). These findings suggest that hybrid approaches should include intentional opportunities for teamwork to maintain engagement. The significant drop during the pandemic highlights the difficulty in conducting group projects remotely. However, post-pandemic ratings indicate a strong return to collaborative activities, emphasizing the importance of teamwork in the learning experience.

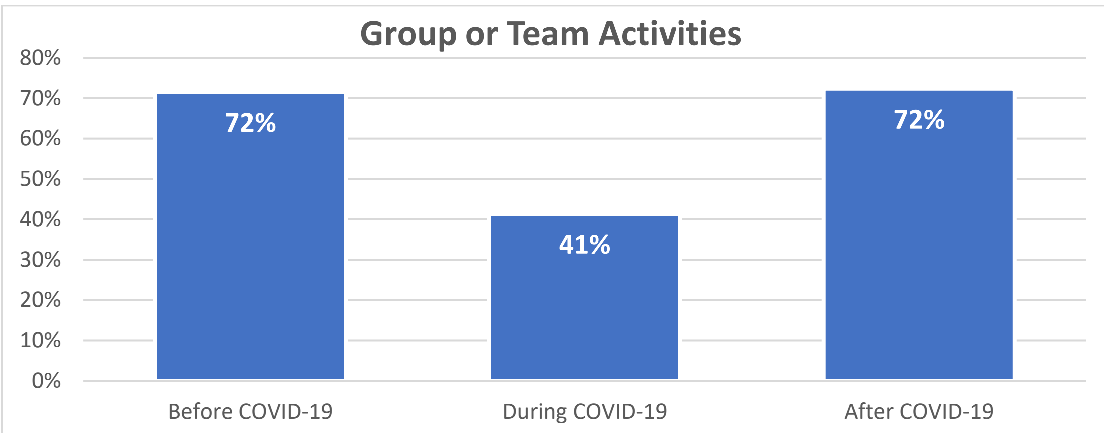

Figure 11. Frequency of Group or Team Activities

4.4. Job Prospects

Before the pandemic, students showed a mix of optimism and uncertainty regarding their job prospects. While 46% expressed confidence or high confidence, a significant proportion remained neutral (31%) or unsure (21%). This reflects a diverse range of factors influencing students' confidence, such as their individual preparedness, academic performance, and industry outlooks at the time. The relatively high number of neutral and unsure responses suggests that many students were still navigating their career paths and felt uncertain about how their academic experiences aligned with job market expectations. These findings highlight the importance of career counseling and skill development programs to build confidence and clarity in students as they approach the workforce. This suggests that before the pandemic, students generally felt optimistic about their job prospects, though a significant portion remained uncertain.

Post-pandemic, confidence in securing a job improved significantly, with 69% of students expressing confidence or high confidence in their career prospects. This increase reflects optimism as the job market stabilized and industries resumed operations. However, 6% of students remained unsure or not confident, indicating a need for targeted career support services to address lingering uncertainties and build confidence among less optimistic students. This increase in confidence post-pandemic reflects optimism as the job market stabilized.

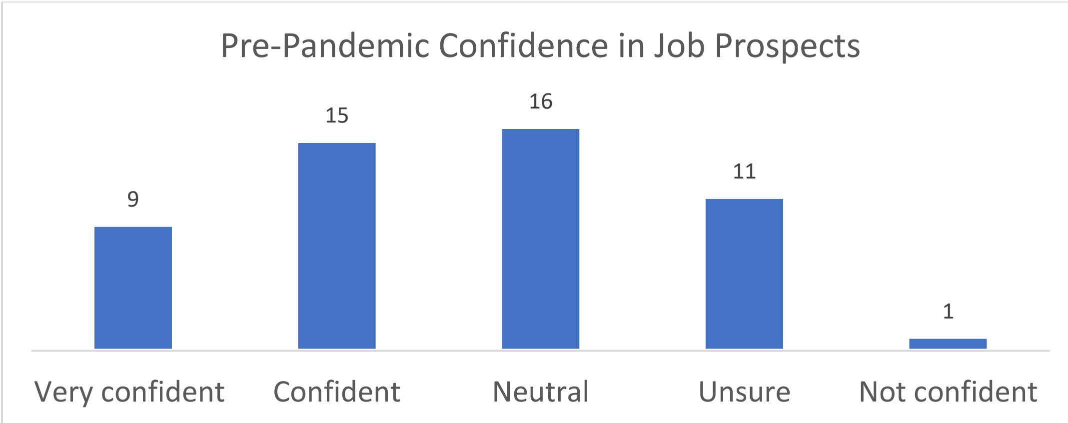

Figure 12. Confidence in Job Prospects before the Pandemic

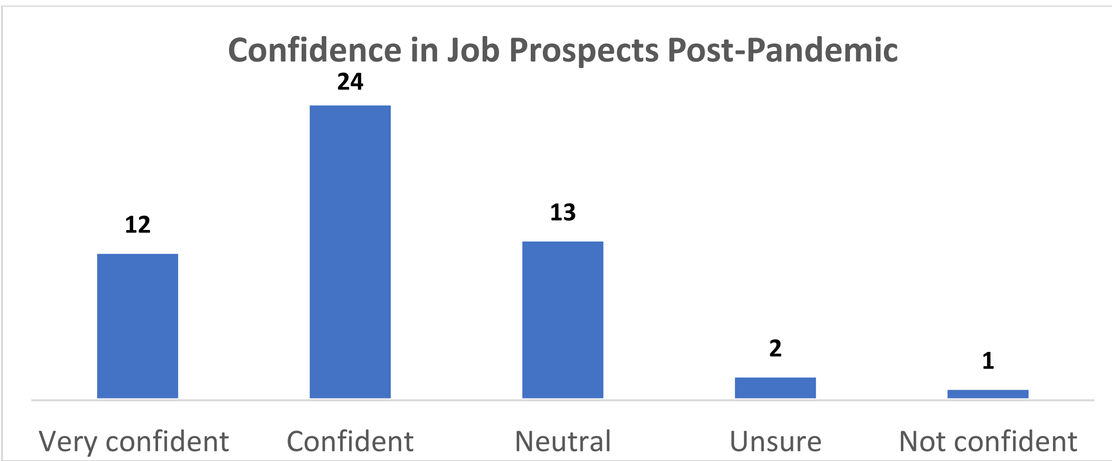

Figure 13. Confidence in Job Prospects after the Pandemic

5. KEY FINDINGS

Resilience of Minority Students at an HBCU: Despite challenges, students demonstrated strong resilience, adapting to online learning while navigating unique barriers faced by minority students.

Motivation Levels: Sharp decline during the pandemic, with partial recovery post-pandemic. Many students reported lasting struggles in maintaining focus.

Engagement and Learning Adaptation: Significant drop during virtual learning, with notable improvement after returning to in-person instruction, with students emphasizing the importance of in-person collaboration and hands-on experience, particularly in teamwork-based courses.

Technology and Digital Inequities: While students became more comfortable with online tools like Canvas and Zoom, disparities in digital access created learning challenges for some.

Equity Challenges: Financial and digital access disparities were more apparent during the pandemic, affecting learning experiences for some students.

Career Outlooks: Uncertainty about job prospects peaked during COVID, but post-pandemic optimism grew, especially in hands-on, construction-related careers.

Social & Teamwork Skills: Students at FAMU, an HBCU, valued collaboration and hands-on learning, emphasizing the importance of in-person engagement in their education.

Overall Response Rate & Sample Size: The study had a 97% response rate, with 87 of the students participating in Construction Engineering Technology, Electronics Engineering Technology and Architecture Bachelor programs.

Shifts in Career Aspirations: Uncertainty about job prospects peaked during COVID-19, but post-pandemic, students showed increased optimism, particularly in hands-on, construction-related careers.

Financial Constraints and Equity Challenges: The pandemic amplified financial struggles, affecting students' ability to focus on coursework and access necessary resources.

Motivation & Focus: Many students experienced a decline in motivation and concentration during remote learning, with only a partial recovery post-pandemic.

6. CONCLUSION

Initial disruption in focus, motivation, and engagement during the pandemic. Gradual adaptation and recovery post-pandemic, with improvements in academic experiences as in-person learning resumed.

Majority of respondents were African American, reflecting strong outreach to underrepresented groups in construction and engineering programs. Gender distribution: Predominantly male, with increasing female and non-binary representation, signaling improved diversity in male-dominated fields.

Most students reported medium to low financial status, influencing their ability to access resources and adapt to online learning.

6.1. Academic Performance

Sharp decline in concentration and motivation due to isolation and lack of structured environments during online learning. Increased difficulty in balancing work and study as home responsibilities overlapped. Perceived difficulty of courses rose during and post-pandemic, highlighting gaps in learning and increased expectations.

Significant improvements in motivation and focus after returning to traditional classroom environments.

6.2. Instructor Support and Accessibility

Pandemic Challenges: Temporary decline in accessibility and support during the pandemic due to communication challenges in virtual formats.

Post-Pandemic Improvement: Ratings improved significantly, emphasizing the importance of direct communication and face-to-face interactions.

6.3. Self-Study Skills

Positive Outcome: The shift to online learning enhanced self-directed learning capabilities, fostering time management and discipline skills. These improvements are expected to have lasting benefits in academic and professional contexts.

6.4. Career Outlook

Pandemic Impact: Decline in job confidence due to economic uncertainty.

Post-Pandemic Recovery: Rebound in optimism as the job market stabilized. Many students reassessed career paths, discovering new interests in technology and remote work.

6.5. Lessons and Recommendations

Institutional Support: Robust support systems and flexible learning environments are crucial for helping students adapt to disruptions.

Enhanced Strategies: Institutions should integrate effective digital resources while maintaining in-person interaction to foster resilience.

Future Preparedness: A balanced approach to digital and traditional methods will better equip students for evolving academic and professional demands.

6.6. Overall Conclusion

The survey captures the profound disruptions and subsequent resilience of students during the pandemic.

Enhanced self-study skills, motivation recovery, and renewed career optimism highlight their adaptability and growth.

Educational institutions must leverage these insights to build inclusive and adaptive strategies for a rapidly changing world.

In Summary, the pandemic accelerated technology integration in education and encouraged more flexibility in teaching and learning methods. These changes are likely to have a lasting impact on the future of education.

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