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Analysis of Covid-19 Impact on Minority Students in Higher Education.

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Abstract

The Covid-19 pandemic has drastically altered the lives of people around the world. College students are especially vulnerable to the pandemic, given the requisite gathering of students during instruction and often-crowded living conditions in college dormitories. Adapting quickly to the new normal during the global pandemic change was critical to chart a viable path towards a sustainable future. The current study is focused on obtaining systematic meaningful insights on the satisfaction of minority students in higher learning institutions as well as gaining perspective on different aspects ft their lives during the pandemic, including personal, financial, health-related, and educational. The inability of higher education institutions to understand the quickly address the ongoing difficulties in the lives of students may resulted in students taking time off before enrollment, the postponement of a semester or two by already enrolled students, or the abandonment of college education altogether as a realistic life goal. The data collected by conducting a survey completed by minority students at Johnson C. Smith University and analyzed using data mining and machine learning methods and techniques to pinpoint the factors that might hinder minority students from continuing their education during the virtual learning in effect. This study analyzed and identified students' transition difficulties, personal psychological resilience, stress, and anxiety due to health, technology, and pedagogical/ learning issues.

Introduction

This paper demonstrated the appropriateness and efficiency of machine learning by using AI models to enhance decision making prediction and pattern recognition. In addition, using an open-source tool like RapidMiner unified the methodology of the *entire data science* progress from data mining to machine learning/AI and predictive modeling. "RapidMiner, a leading enterprise AI platform for people of all skill levels, announced that it has been recognized as a Visionary in the 2021 Gartner Magic Quadrant for Data Science and Machine Learning.". [1]

The worldwide pandemic caused by coronavirus has painted the general picture of minority groups are at more risk to be infected with COVID-19 and account for a disproportionate number of deaths. [2] Under the circumstances of the pandemic, the minority students in higher education had to quickly respond to a rapidly evolving educational landscape in a fast new setting as they moved to a virtual teaching environment. The approach of this quantitative study was conducted to gain an understanding of the factors identified in the literature of coronavirus pandemic and minority students in higher education. The study aims to extract the main factors that help students continue their education and prevent them from dropping out of college during and after covid-19 or God forbid a similar disaster in the future.

Background History

Several studies classified the pandemic effects on universities worldwide. One of the first challenges was faced by faculty, especially those who have not had any virtual teaching experience before. These professors had to learn to transition from in person classes to teach on- line.[3] The unprepared faculty and staff found themselves facing a challenge in response

to the new remote teaching methods developed to help students to accept online instruction. Instructors had to alter many aspects of teaching such as pace, type of homework and assignments using different styles to reinforce students' dynamic learning outside of the class. [4]

Ghanaian students were surveyed to test students' fulfilment with remote where online learning has not been thriving in Ghana. [5] The research finding revealed that the absence of social life, the lack of interaction with family and friends, and the expense of internet for students who live in different time zones were some of the major challenges that faced Ghanaian students.[5] The result for undergraduate students' predictable effectiveness and reliability of the remote learning was 3.77 out of 5. Furthermore, students' result score for the tests related to remote learning was 3.51 out of 5 [5]. The literature confirms that the limited social interactions as a result of COVID-19 pandemic were very damaging psychologically, including in reduced quality of sleep despite the fact students spent longer times in bed [6]. Over 1000 survey studies were analyzed by the US Department of Education showed that students' knowledge enhanced while learning remotely in comparison by learning in person. (5) Cellini, stipulated that readiness for successful remote learning can be achieved by providing mental health and medical services, provide teacher training for on-line teaching, adjust and develop the existing curriculum.[6]

While there was increased social isolation and mental distress, institutions also made improvements in content and service delivery. Advancements in technologies were made for virtual teaching, assessment, and service delivery in addition to increased proficiency of staff and faculty in utilizing the available technologies in an intentional manner.[7]
Global inequalities in internet access and availability of technology access material crucial for virtual learning where the present racial gaps in education cannot be ignored. International Telecommunications Union Data registered by the World Bank stated that only 20% of individuals in countries such as, Afghanistan, Bangladesh, Chad, Niger, Angola, Zambia, and Pakistan have internet access. [8] Where countries such as UAE, Bahrain, Qatar, and Kuwait almost 100% of the middle class and upper class have access to the internet. [8]
Before COVID-19, racial disparities in education were very well known in the United States starting from elementary school to graduation rates in college. According to Quintana and Mahgoub, racial inequalities are associated with "limited access to educational and social capital resources, differential treatment of ethnic and racial minority students by educators, and to differential responses to educational practices". [9]

Underrepresented racial minorities who were already underprivileged suffered more economic difficulty globally as a result of the COVID-19 pandemic. Globally according to Despard, et al, unemployment and lost income were reported in 29% of low-income households whereas only 19% in middle income households and 20% of high income households.[10] Many other countries with larger inequalities in socioeconomic parameters will suffer more gaps in educational achievement. With all this in mind and increasing racial inequalities, students from these societies are more likely to drop out of university than white students.[11] Minorites in general such as African American, Hispanic, and Native American societies have less resources economically compared to the white communities. Winters wrote that "my hope for this book is that it will provide a comprehensive summary of the consequences of Black fatigue and awaken

activism in those who care about equity and justice--those who care that intergenerational fatigue is tearing at the very core of a whole race of people who are simply asking for what they deserve."[12] Covid-19 just made it worse and revealed the inequity. Many schools are underfunded as a result of being in resource-poor neighborhoods. According to a study conducted in 2019 stablished that schools from different regions and serve around the same number of students got different amount of many to support the schools, also the study revealed that regions with underrepresented minorities get $23 billion less than white regions. [13]

Methodology

A survey was conducted in the STEM department at Johnson C. Smith University in the fall of 2021 to measure the reaction of STEM minority students to on-line learning during and after covid-19. The aim of the research is to find or predict the effect and impact of on-line learning on students' retention. The method used to analyze the data is machine learning/data mining techniques to determine the relationship between the independent attributes and a dependent attribute. The analysis used is a predictive classification process Random Forest model development.

The survey asked the students: How difficult would you say it has been for you, at your institution, the transition to fully remote learning in each of the four following areas?

1- transition difficulties,2- personal psychological resilience, 3- stress, and anxiety due to health, technology, and 4- pedagogical/ learning issues.

please enter 1-4 such that 1 for very difficult and 4 not at all, the dependent attribute is: "Do you think this online learning will affect your retention?" Enter yes or no.

Transition Difficulties.

Table 1 contains descriptive statistics for questions regarding Transition Difficulties for 125 students. The independent attributes are: Accessing bandwidth/Wi-Fi, Accessing internships or practicum placements, Accessing equipment/devices, Collaborating with other students remotely, Using library resources remotely, Using remote learning applications, Consulting with faculty remotely, Accessing course materials, Accessing internships or practicum placements, Accessing health services, Accessing mental health services, Accessing emergency aid, Accessing housing/food services, Accessing career services, Accessing financial services, Accessing advising services.

Table 1
Descriptive Statistics of 125 Students Transition Difficulty

ID	*Type*			*Average*
Dependent Variable Do you think this online learning will affect your retention	Polynomial	No (58)	Yes (67)	Total 125
Independent Variables:	Type	*Min.*	Max.	Average

Accessing bandwidth/Wi-Fi	Integer	1	4	3
Accessing equipment/devices	Integer	1	4	2.976
Collaborating with Other Students	Integer	1	4	2.488
Using Library resources	Integer	1	4	2.248
remotely Using Remote Learning	Integer	1	4	2.640
Applications	Integer	1	4	2.400
Consulting with Faculty Remotely	Integer	1	4	2.664
Accessing Course Materials				
Accessing internships or…	Integer	1	4	2.448
Accessing health services Accessing	Integer	1	4	2.528
mental health services Accessing	Integer	1	4	2.632
emergency aid	Integer	1	4	2.616
Accessing housing/food services Accessing career services	Integer	1	4	2.760
Accessing financial services	Integer	1	4	2.464
Accessing advising services	Integer	1	4	2.344
	Integer	1	4	2.688

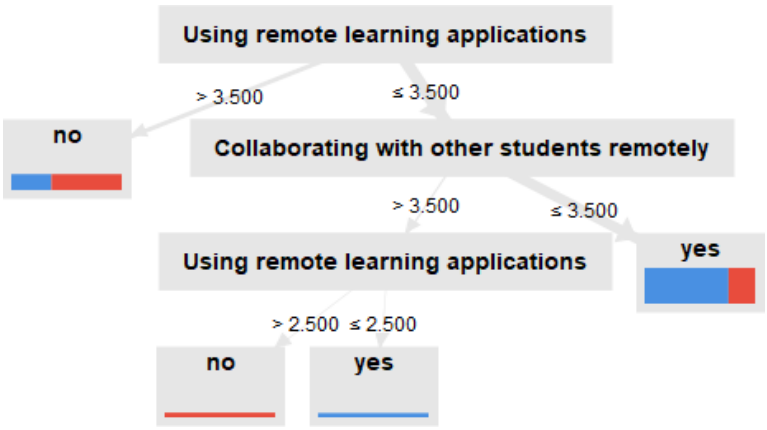

Figure 1. Random forest tree represents Transition Difficulties of 125 students: Using remote learning application attribute.

Table2
Description of Figure1 for Transition Difficulties

Using remote learning applications > 3.500: no {yes=12, no=21}
Using remote learning applications ≤ 3.500
| Collaborating with other students remotely > 3.500.
| | Using remote learning applications > 2.500: no {yes=0, no=7}
| | Using remote learning applications ≤ 2.500: yes {yes=6, no=0}
| Collaborating with other students remotely ≤ 3.500: yes {yes=60, no=19}

Figure 1 and Table 2 show within transition difficulties, 21out of 33 students 63% did not get affected by remote learning applications directly where 60 out of 79 students (76%) got affected more by remote learning application when it comes to collaborating with other students remotely.

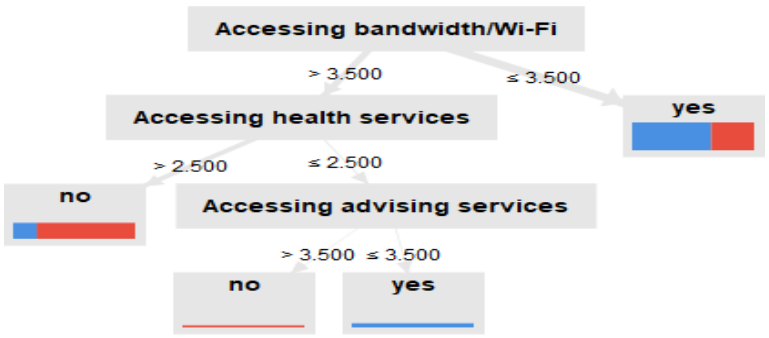

Figure 2. Random forest tree represents Transition Difficulties of 125 students: Accessing band width attribute.

Table 3
Description of Figure2 for Transition Difficulties

Accessing bandwidth/Wi-Fi > 3.500
| Accessing health services > 2.500: no {yes=8, no=33}
| Accessing health services ≤ 2.500.
| | Accessing advising services > 3.500: no {yes=0, no=2}
| | Accessing advising services ≤ 3.500: yes {yes=8, no=0}
Accessing bandwidth/Wi-Fi ≤ 3.500: yes {yes=48, no=26}

Figure 2 and Table 3 show within transition difficulties 48 out of 74 (65%) found difficulties in accessing bandwidth/Wi-Fi. Where only 8 out of 49 (16%) found difficulties in accessing health services. Also 8 out of (100%) was difficult for them to Access advising services,

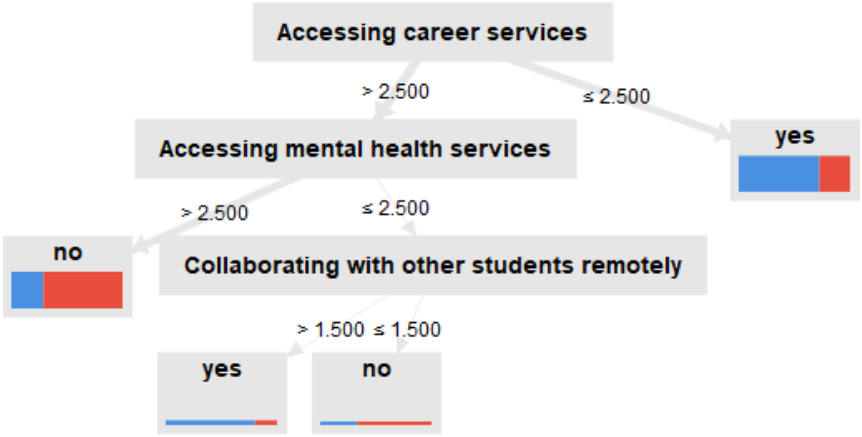

Figure 3. Random forest tree represents Transition Difficulties of 125 students: Accessing career services.

Table 4
Description of Figure 3 for Transition

Difficulties Accessing career services > 2.500
| Accessing mental health services > 2.500: no {yes=17, no=42}
| Accessing mental health services ≤ 2.500.
| | Collaborating with other students remotely > 1.5: yes {yes=4, no=1}
| | Collaborating with other students remotely ≤ 1.5: no {yes=1, no=2}
Accessing career services ≤ 2.500: yes {yes=42, no=16}

Figure 3 and Table 4 show within the transition difficulties 42 students out of 58 (72%) was difficult for them to Access career services, where 42 out of 59 students (71%) did not have a problem to access the mental health services.

Table 5
Confusion Matrix for Transition Difficulties Random Forest Trees

*Accuracy: 62.16% ** Precision: 62.50% (positive class: yes): ***Recall: 75.00% (positive class: yes)

model	true yes	true no	class precision
pred. yes	15(TP)	9(FP)	62.50%
pred. no	5(FN)	8(TN)	61.54%
class recall	75.00%	47.06%	

*Accuracy % = (TP + TN)/total number of students (TP+FN+FP+TN). **Precision = TP/total predicted positives (TP+FP). ***Recall or true positive rate = TP/total actual positives (TP+FN).

For the class prediction "yes", the confusion matrix in Table 5 shows the accuracy rate or effectiveness of the model was 621.6 %, calculated as (15+9)/ (15+9+5+8). The precision rate of 62.5% calculated as 15/(15+9) = ,625 for the class yes indicates that 62.5 % of the students predicted that their retention will be affected by transition difficulties.
Calculation of the true positive rate, termed recall rate for the class yes calculated 15/(15+5) =.75 indicating successful identification that 75% of the students find it difficult to retain,

Personal stressors
Table 6 contains descriptive statistics for questions regarding PersonaL Stressors for 125 students. The independent attributes are: Self-directed learning and time management, Finding appropriate locations, Keeping up with classes while dealing with the many stresses in their lives brought about by COVID-19, Challenges away from campus (unemployment, housing insecurity, family illness), Maintaining community, psychological strain of remote/isolated learning.

Table 6
Descriptive Statistics of 125 Students: Personal stressors

ID	*Type*			*Average*
Dependent Variable Do you think this online learning will affect your retention?	Polynomial	No (58)	Yes (67)	Total 125
Self-directed learning and time… Finding appropriate locations	Integer	1	4	2.528
	Integer	1	4	2.776

Keeping up with classes…	Integer	1	4	2.248
Challenges away from campus.	Integer	1	4	2.256
Maintaining Community Psychological Strain of remote.	Integer	1	4	2.448

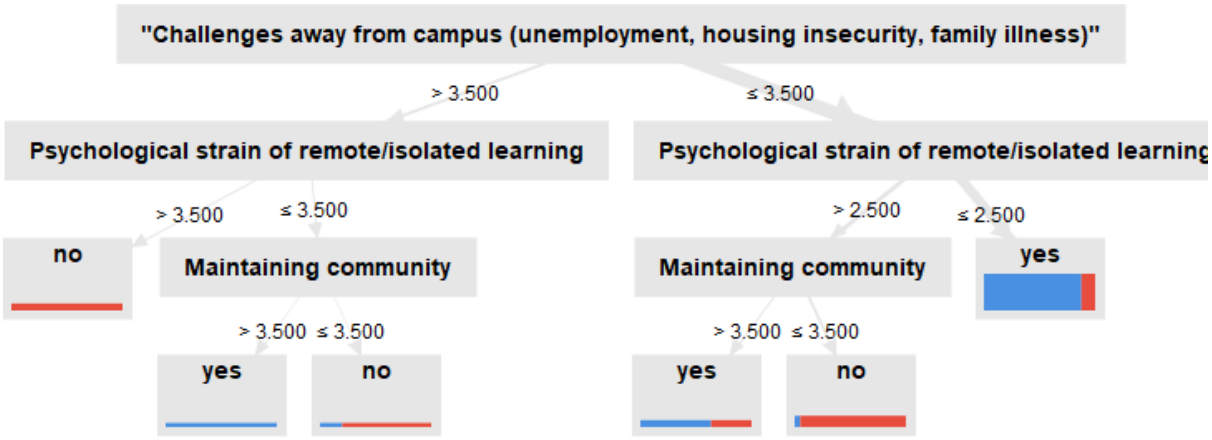

Figure 4. Random forest tree represents Personal Stressor of 125 students: Challenges away from campus (unemployment, housing insecurity, family illness).

Table 7
Description of Figure 4 for Personal Stressor

Challenges away from campus (unemployment, housing insecurity, family illness) > 3.500
| Psychological strain of remote/isolated learning > 3.500: no {yes=0, no=11}
| Psychological strain of remote/isolated learning ≤ 3.500
| | Maintaining community > 3.500: yes {yes=5, no=0}
| | Maintaining community ≤ 3.500: no {yes=1, no=4}
Challenges away from campus (unemployment, housing insecurity, family illness) ≤ 3.500
| Psychological strain of remote/isolated learning > 2.500
| | Maintaining community > 3.500: yes {yes=7, no=4}
| | Maintaining community ≤ 3.500: no {yes=1, no=19}
| Psychological strain of remote/isolated learning ≤ 2.500: yes {yes=64, no=9}

Figure 4 and table 7 show within personal stressor, “challenges away from campus” (unemployment, housing insecurity, family illness), 64 out of 73 (87%) believe that psychological strain of remote/isolated learning due to challenges away from campus make it difficult for them to retain,

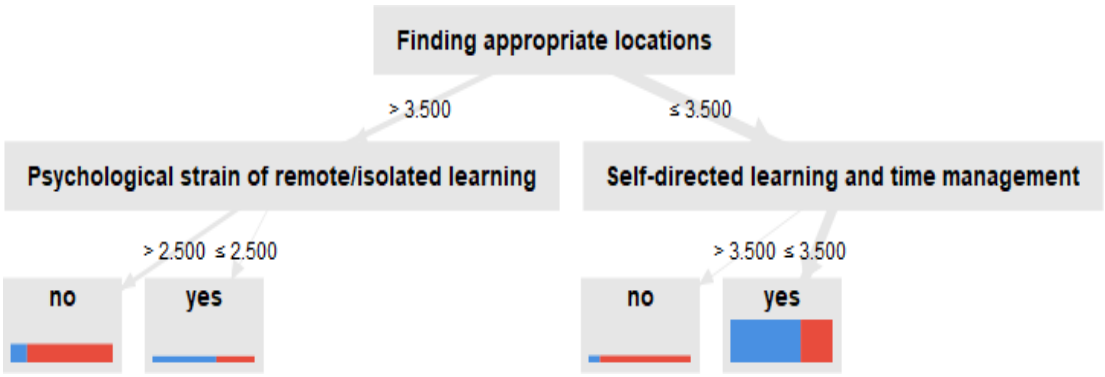

Figure 5. Random forest tree represents Personal Stressor of 125 students: Finding appropriate location.

Table 8
Description of Figure 5 for Personal Stressor

Finding appropriate locations > 3.50
| Psychological strain of remote/isolated learning > 2.500: no {yes=5, no=26}
| Psychological strain of remote/isolated learning ≤ 2.500: yes {yes=5, no=3}
Finding appropriate locations ≤ 3.500
| Self-directed learning and time management > 3.500: no {yes=1, no=8}
| Self-directed learning and time management ≤ 3.500: yes {yes=53, no=24}

Figure 5 and Table 8 show personal stressors, finding appropriate location, 53 out of 77 (69%) find it difficult to retain when it comes to self-learning and time management.

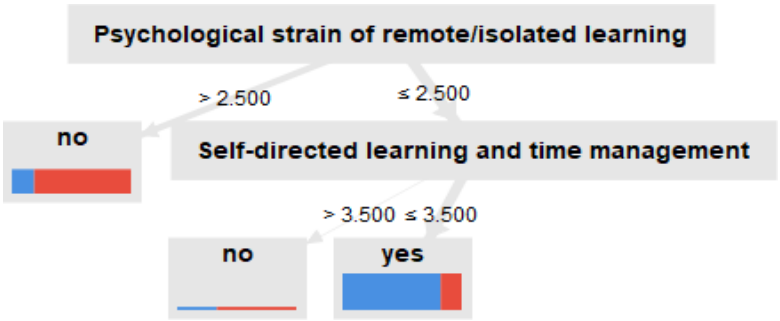

Figure 6. Random forest tree represents Personal Stressor of 125 students: Psychological strain of remote/isolated learning.

Table 9
Description of Figure 6 for Personal Stressor

Psychological strain of remote/isolated learning > 2.500: no {yes=9, no=39}
Psychological strain of remote/isolated learning ≤ 2.500
| Self-directed learning and time management > 3.500: no {yes=1, no=2}
| Self-directed learning and time management ≤ 3.500: yes {yes=61, no=13}

Figure 6 and Table 9 for personal stressor: show that psychological strain of remote/isolated learning affect the students, 61 students out of 74 (82%) find it difficult when it comes to self-directed learning and time management.

Table 10
Confusion Matrix for Personal Stressor Random Forest Trees

*Accuracy: 75.68% ** Precision: 78.95.50% (positive class: yes): ***Recall: 75.00% (positive class: yes)

model	true yes	true no	class precision
pred. yes	15(TP)	4(FP)	78.95%
pred. no	5(FN)	13(TN)	72.22%
class recall	75.00%	76.47%	

*Accuracy % = (TP + TN)/total number of students (TP+FN+FP+TN). **Precision = TP/total predicted positives (TP+FP). ***Recall or true positive rate = TP/total actual positives (TP+FN).

For the class prediction "yes", the confusion matrix in Table 10 shows the accuracy rate or effectiveness of the model was 75.6%, calculated as (15+4)/ (15+4+5+13). The precision rate of 78.95% calculated as 15/(15+4) = .78. for the class yes indicates that 78.95% of the students predicted that their retention will be affected by transition difficulties.
Calculation of the true positive rate, termed recall rate for the class yes calculated 15/(15+5) =.75 indicating successful identification that 75% of the students find it difficult to retain,

Technology

Table 11 contains descriptive statistics for question regarding Technology for 125 students. The independent attributes are: Logging in to Zoom, Use of LMS (Canvas, black board,.....), Navigating the LMS, Software issues**,** Remote access to software and specialized tools, Lab-based study, Access to specific software for disciplines restricted by license, Technology support**,** Help desk support, Software and system reliability.

Table 11
Descriptive Statistics of 125 Students: Technology

ID	*Type*			*Average*
Dependent Variable "Do you think this online learning will affect your retention?"	Polynomial	No (58)	Yes (67)	Total 101
Independent Variables:	Type	*Min.*	Max.	Average
Logging in to Zoom	Integer	1	4	3.080
Use of LMS (Canvas, black board,…)	Integer	1	4	3.280

Navigating the LMS				
Software Issues	Integer	1	4	3.136
Remote access to software…	Integer	1	4	2.792
Lab-based study	Integer	1	4	2.408
Access to specific software for..	Integer	1	4	2.704
Technology Support	Integer	1	4	2.592
Help Desk Support				
Software and System Reliability	Integer	1	4	2.680

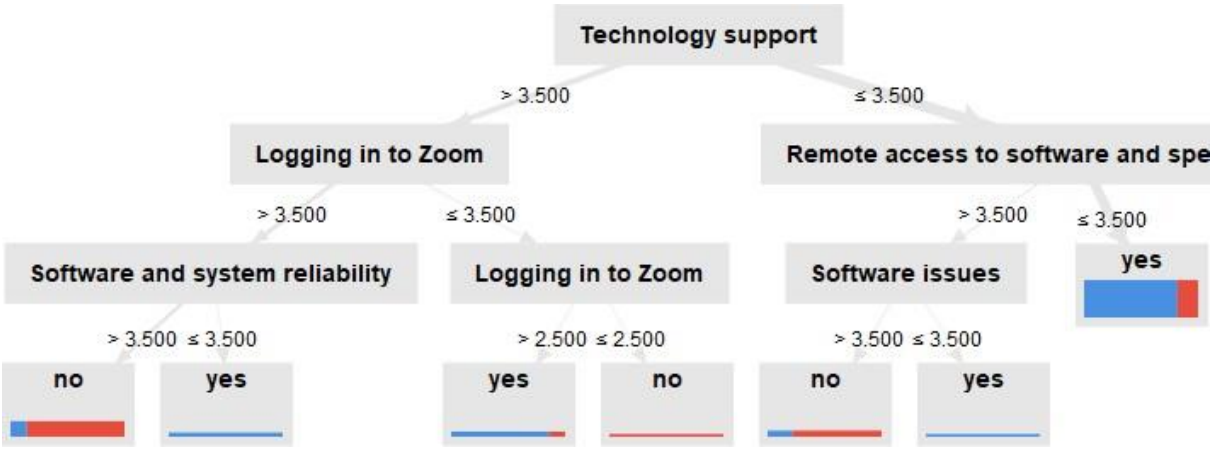

Figure 7. Random forest tree represents Technology of 125 students: Technology support(a)

Table 12
Description of Figure 7 for Technology

Technology support > 3.500
| Logging in to Zoom > 3.500.
| | Software and system reliability > 3.500: no {yes=4, no=24}
| | Software and system reliability ≤ 3.500: yes {yes=5, no=0}
| Logging in to Zoom ≤ 3.500.
| | Logging in to Zoom > 2.500: yes {yes=6, no=1}
| | Logging in to Zoom ≤ 2.500: no {yes=0, no=2}
Technology support ≤ 3.500

| Remote access to software and specialized tools > 3.500
| | Software issues > 3.500: no {yes=2, no=7}
| | Software issues ≤ 3.500: yes {yes=2, no=0}
| Remote access to software and specialized tools ≤ 3.500: yes {yes=59, no=13}

Figure 7 and Table 12 Technology: show that logging in to Zoom, and software issues are not difficult to handle only few find it difficult where 59 out of 72(82%) admitted Remote access to software and specialized tools is difficult to handle.

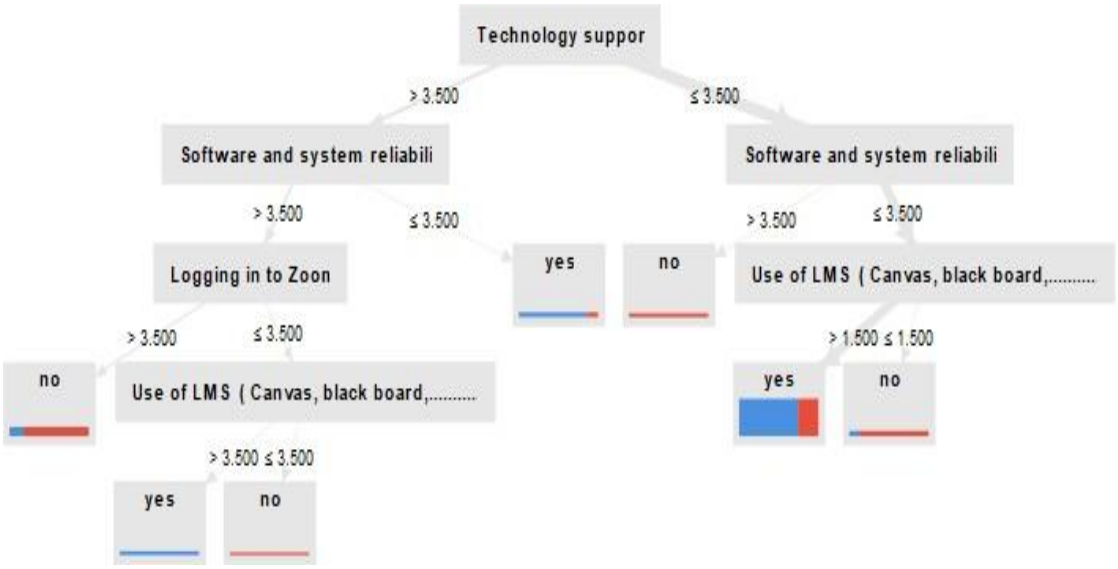

Figure 8. Random forest tree represents Technology of 125 students: Technology support(b)

Table 13
Description of Figure 8 for Technology

Technology support > 3.500
| Software and system reliability > 3.500
| | Logging in to Zoom > 3.500: no {yes=3, no=14}
| | Logging in to Zoom ≤ 3.500.
| | | Use of LMS (Canvas, black board,. .....) > 3.500: yes {yes=5, no=0}
| | | Use of LMS (Canvas, black board,. .....) ≤ 3.500: no {yes=0, no=2}
| Software and system reliability ≤ 3.500: yes {yes=6, no=1}
Technology support ≤ 3.500
| Software and system reliability > 3.500: no {yes=0, no=5}
| Software and system reliability ≤ 3.500
| | Use of LMS (Canvas, black board,. .....) > 1.500: yes {yes=60, no=21}
| | Use of LMS (Canvas, black board,. .....) ≤ 1.500: no {yes=1, no=7}

Figure 8 and Table 13 for Technology: show students find difficulty without technology support. When asked about software and system reliability 60 out of 81(74%) find it difficult to use LMS (Canvas, blackboard,,,,) due to unreliable system or software without technology support.

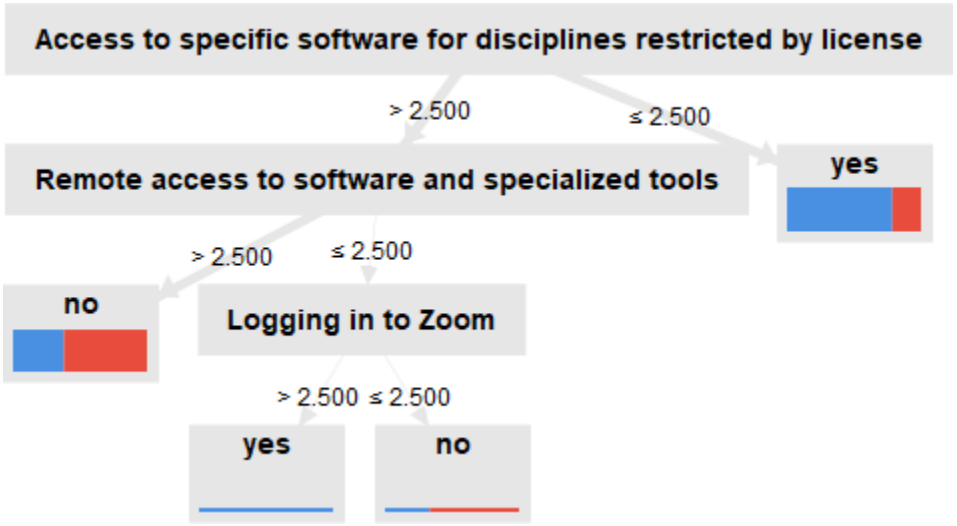

Figure 9. Random forest tree represents Technology of 125 students: Access to specific software for disciplines restricted by license.

Table 14

Description of Figure 9 for Technology

Access to specific software for disciplines restricted by license > 2.500.
| Remote access to software and specialized tools > 2.500: no {yes=22, no=36}
| Remote access to software and specialized tools ≤ 2.500
| | Logging in to Zoom > 2.500: yes {yes=3, no=0}
| | Logging in to Zoom ≤ 2.500: no {yes=1, no=2}
Access to specific software for disciplines restricted by license ≤ 2.500: yes {yes=48, no=13}

Figure 9 and Table 14 for Technology: show great difficulty when the students asked about access to specific software for disciplines restricted by license, 48 out of 61 (79%) find it hard accessing to specific software for disciplines restricted by license.

Table 15
Confusion Matrix for Technology Random Forest Trees

*Accuracy: 62.16% ** Precision: 65.00.50% (positive class: yes): ***Recall: 65.00% (positive class: yes)

model	true yes	true no	class precision

pred. yes	13(TP)	7(FP)	65.00%
pred. no	7(FN)	10(TN)	58.82%
class recall	65.00%	58.82%	

*Accuracy % = (TP + TN)/total number of students (TP+FN+FP+TN). **Precision = TP/total predicted positives (TP+FP). ***Recall or true positive rate = TP/total actual positives (TP+FN).

For the class prediction "yes", the confusion matrix in Table 15 shows the accuracy rate or effectiveness of the model was 62.16$ %, calculated as (13+10)/ (13+7+7+10). The precision rate of 63.00% calculated as 13/(7+13) , for the class yes indicates that 65.00 % of the students predicted that their retention will be affected by transition difficulties.
Calculation of the true positive rate, termed recall rate for the class yes calculated 13/(13+7) =.65 indicating successful identification that 65% of the students find it difficult to retain,

Pedagogical/learning issues

Table 16 contains descriptive statistics for question regarding Pedagogical/learning issues for 125 students. The independent attributes are: Faculty not prepared or not knowing the technology, Change of pedagogy and course design to address full remote learning for all traditional programs. Difficulty engaging with faculty and content. Testing and online Exams. Managing time zone differences. Accessibility for students using assistive technology.

Table 16
Descriptive Statistics of 125 Students: Pedagogical/learning issues

ID	*Type*			*Average*
Dependent Variable "Do you think this online learning will affect your retention?"	Polynomials	No (58)	Yes (67)	Total 125
Independent Variables:	Type	Min.	Max.	Average
Faculty not prepared or not..	Integer	1	4	2.544
"Change of pedagogy and.."	Integer	1	4	2.440
Difficulty engaging with faculty..	Integer	1	4	2.432
Testing and online Exams	Integer	1	4	2.800
Managing time zone differences	Integer	1	4	2.840
Accessibility for students using..	Integer	1	4	2.624

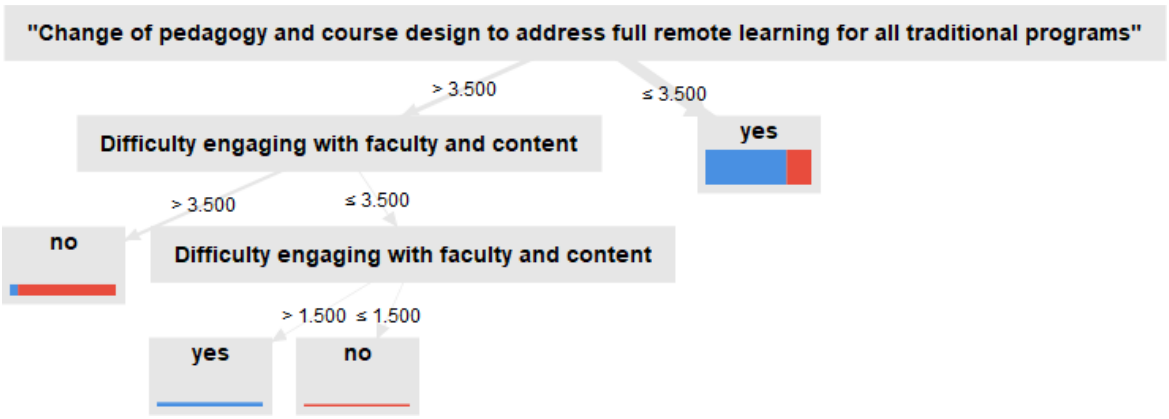

Figure 10. Random forest tree represents of 125 students: Change of pedagogy and course design to address full remote learning for all

Table 17
Description of Figure 10 for Pedagogical/learning issues

Change of pedagogy and course design to address full remote learning for all traditional programs" > 3.500.
| Difficulty engaging with faculty and content > 3.500: no {yes=2, no=24}
| Difficulty engaging with faculty and content ≤ 3.500.
| | Difficulty engaging with faculty and content > 1.500: yes {yes=7, no=0}
| | Difficulty engaging with faculty and content ≤ 1.500: no {yes=0, no=2}
"Change of pedagogy and course design to address full remote learning for all traditional programs" ≤ 3.500: yes {yes=69, no=21}

Figure 10 and Table 17 show for pedagogical/learning issues that 69 out of 91(77%) find difficulty with the change of pedagogy and course design to address full remote learning for all traditional programs.

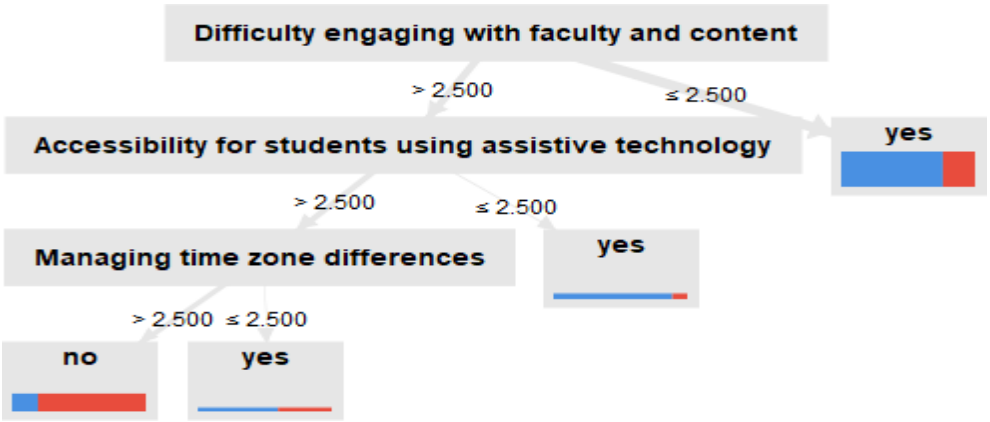

Figure 11. Random forest tree represents of 125 students: Difficulty engaging with faculty and content(a)

Table 18
Description of Figure 11 for Pedagogical/learning issues

Difficulty engaging with faculty and content > 2.500.
| Accessibility for students using assistive technology > 2.500.
| | Managing time zone differences > 2.500: no {yes=7, no=29}
| | Managing time zone differences ≤ 2.500: yes {yes=3, no=2}
| Accessibility for students using assistive technology ≤ 2.500: yes {yes=8, no=1}
Difficulty engaging with faculty and content ≤ 2.500: yes {yes=57, no=18}

Figure 11 and Table 18 for Pedagogical/learning issues: show that 57 out of 75 (76%) find it difficult when asked about difficulty to engage with faculty and content.

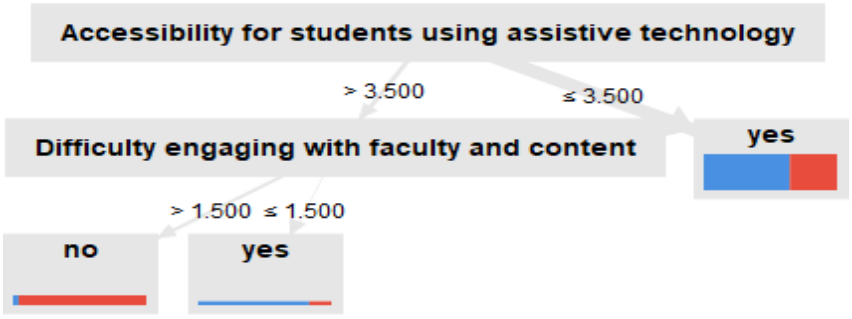

Figure 12. Random forest tree represents of 125 students: Accessibility for students using assistive technology.

Table 19
Description of Figure 13 for Pedagogical/learning issues

Accessibility for students using assistive technology > 3.500.
| Difficulty engaging with faculty and content > 1.500: no {yes=1, no=22}
| Difficulty engaging with faculty and content ≤ 1.500: yes {yes=5, no=1}
Accessibility for students using assistive technology ≤ 3.500: yes {yes=62, no=34}

Figure 12 and Table 19 show the importance of accessibility for students using assistive technology.62 out of 96(65%) find it hard when they cannot access assistive technology.

Table 20
Confusion Matrix for Pedagogical/learning issues Random Forest Trees

*Accuracy: 64.86% ** Precision: 70.59% (positive class: yes): ***Recall: 60.00% (positive class: yes)

model	true yes	true no	class precision
pred. yes	12(TP)	5(FP)	70.39%
pred. no	8(FN)	12(TN)	60.00%
class recall	60.00%	70.6%	

*Accuracy % = (TP + TN)/total number of students (TP+FN+FP+TN). **Precision = TP/total predicted positives (TP+FP). ***Recall or true positive rate = TP/total actual positives (TP+FN).

For the class prediction “yes”, the confusion matrix in Table 20 shows the accuracy rate or effectiveness of the model was 64.86 %, calculated as (12+12)/ (12+8+12+5). The precision rate of 70.39% calculated as 12/(12+5) , for the class yes indicates that 70.39 % of the students predicted that their retention will be affected by .
Calculation of the true positive rate, termed recall rate for the class yes calculated 12/(12+8) =.60 indicating successful identification that 65% of the students find it difficult to retain,

Result

This study aims to analyze and identify students' transition difficulties, personal psychological resilience, stress, and anxiety due to health, technology, and pedagogical/learning issues.
The result identified the factors hindering students’ retention:

Students transition difficulties

- Remote learning application, 60 out of 79 students (76%) find it a factor.
- Accessing Bandwidth/Wi-Fi , 48 out of 74 (65%) find it a factor.
- Accessing Career services, 42 out of 59 students (71%) find it a factor.

Personal Stressors

- The psychological strain of remote/isolated learning as a result of challenges away from campus (unemployment, housing insecurity, family illness), 64 out of 73b (87%) students find it a factor.
- Self-learning and time management due to finding the appropriate location, 53 out of 77 (69%) students find it a factor.
- Self-directed learning and time management due to psychological strain of remote/isolated learning, 61 students out of 74 (82%) find it difficult.

Technology

- Remote access to software and specialized tools without technology support, 59 out of 72(82%) find it difficult.
- Access to specific software for disciplines restricted by license, 48 out of 61 (79%) find it difficult.
- Software and system reliability 60 out of 81(74%) find it difficult to use LMS (Canvas, blackboard,,,,) without technology support.

Pedagogical/learning issues

- Accessibility for students using assistive technology. 62 out of 96(65%) find it difficult to access assistive technology.
- Students learning got affected .57 out of 75 (76%) students admitted it is due to difficulty engaging with faculty and content.
- Change of pedagogy and course design to address full remote learning for all traditional programs, 69 out of 91(77%) find their learning got affected.

Conclusion/Discussion

This paper represents how pandemic extensively affected the students' life at Johnson C. Smith University, a historically black higher education institution (HBCU), It is very important to consider all the factors to fully understand and interpret the results. Machine learning and data mining was the method for analysis. From the analysis results, we see how students find difficulties mainly during the change to remote learning such as accessing the Wi-Fi, "A recently published study from Carnegie Mellon University and the Massachusetts Institute of Technology found that that both poverty and race affect young people's access to the Internet." [14] Also accessing career services for internships and job finding. Accessing specific software and specialized tools, dealing with LMS and system reliability with the absence of technology support made it also difficult for them to continue. Minority students at Johnson C. Smith University admitted that they are dramatically affected by factors such as psychological strain of isolation and moving from campus as a result they must deal with many issues for example, unemployment, housing insecurity, family illnesses and to find a new appropriate location to be able bearing their studies and to practice self-directed learning and time management. Change of pedagogy and course design to address full remote learning for all traditional programs made it difficult for the students to engage with the faculty and to understand the course content. It is very crucial for universities to keep their eyes wide open and make it a priority to help these students to survive the effect of pandemic, "We may see the reverberations of this for years." [15] The question remains how HBCUs can help students to overcome.

The biggest concern now is these minority students might lose several years before graduation if they are lucky and graduate. Colleges and Universities, especially HBCUs must make sure to guard these students who lacked educational support even before the existence of Covid-19. In preparing for future emergencies, HBSUs should consider their students as vulnerable population whose dependency on campus housing, internet access, availability of electronic equipment needed for virtual education, social life, and the psychological strain of remote/isolated learning cannot be absorbed by their families due to economic pressures and family obligations. HBCUs need to move from Covid-19 crisis answers and learn how to recover and make sure that money and arrangements for learning recovery set the foundations for more efficient, unbiassed, and strong education systems.

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