



## Exploring higher education students' satisfaction for quality improvement: A case study of the African Centre of Excellence in Data Science

 Charles Ruranga

African Centre of Excellence in Data Science, University of Rwanda, Rwanda.  
Email: [cruranga@gmail.com](mailto:cruranga@gmail.com)



### ABSTRACT

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The objective of this study is to examine variables that affect students' satisfaction in postgraduate programmes using a case study of students at the African Centre of Excellence in Data Science (ACE-DS) at the University of Rwanda. It is important to study student satisfaction to understand how students feel about the quality of education, academic experiences, access to facilities, campus life, and extracurricular activities. A questionnaire was designed for the study, and data was collected from 81 students enrolled in master's and PhD programs at the African Centre of Excellence in Data Science. In this study, a chi-square test was conducted to select factors associated with students' satisfaction to be included in the model, and a multivariable logistic regression model was used for the analysis. The findings indicated that gender, level of study, programme of study, and the country of origin were not associated with student satisfaction. In contrast, curriculum relevance, accessing course materials, learning facilities, and the support from the ACE were statistically associated with students' satisfaction. Therefore, the logistic regression model solely took into account variables which are associated with students' satisfaction. This study uncovered the difficulties and opportunities affecting students' satisfaction, and the findings showed that accessing course materials and satisfaction with centre support were statistically significant, while curriculum relevance and satisfaction with learning facilities were not. The findings from this study inform higher learning institutions and decision makers about how to improve the caliber and efficiency of higher education.

**Contribution/Originality:** This study provides novel insights by investigating students' satisfaction in centres of excellence in order to raise awareness on how to improve the quality of education. It also suggests areas for intervention for higher education institutions and other stakeholders.

### 1. INTRODUCTION

Inclusive and equitable quality education is one of the United Nations' Sustainable Development Goals (UN, 2018). Student satisfaction has a major impact on the growth and viability of institutions of higher learning. Instruction provided at the college or university level is referred to as higher education, and the economic development of a country is greatly boosted by this education. This noteworthy outcome emphasizes the importance of postsecondary education in fostering holistic growth. Higher education provides the knowledge and skills necessary for overall student growth (Becket & Brookes, 2008). Higher education receives students as stakeholders;

therefore, raising the standard of higher education instruction positively affects students' satisfaction and increases their enrolment (Johnston & Kong, 2011).

According to Hatcher, Kryter, Prus, and Fitzgerald (1992), satisfaction is the emotional experience of college students, and it relates to their attraction, pride, or good feelings toward their institutions and universities. Rode et al. (2005) conducted a study on "Life Satisfaction and Student Performance" and found that there was a substantial correlation between overall life satisfaction and grade point average (GPA) and assessment scores. In addition, Silva and Fernandes (2012) investigated students' satisfaction with the level of services provided by the Polytechnic Institute of Bragança's School of Technology, and the management of Bragança. Their findings revealed that the overall student satisfaction with School of Technology and the management of Bragança's was high (Silva & Fernandes, 2012). Students' satisfaction is a crucial indicator of the institution's competitiveness and the caliber of its higher education programs. This highlights the significance of carrying out research to identify factors contributing to students' satisfaction in higher education.

In order to improve the quality of postgraduate education and foster collaborative research, the World Bank initiated the Africa Higher Education Centres of Excellence project. The first phase of the project was launched in 2013 focusing on the West and Central Africa region. At that time, 19 Centres of Excellence from seven countries in three core areas (STEM, agriculture, and health) were funded. A call for proposals to support the establishment of African Centres of Excellence throughout Eastern and Southern Africa's higher education in various priority areas was made public by the World Bank (2015). In the second phase, 24 Centres of Excellence in eight countries were funded. The African Centre of Excellence in Data Science (ACE-DS) is one of the 24 ACEs. In ACE II, the five priority areas considered are industry, agriculture, health, education, and applied statistics (<https://ace2.iucea.org/overview/>). Data science is an emerging field that incorporates interdisciplinary fields, including computer science, mathematics, economics, business, statistics, and many others. The big data revolution, which is currently influencing how data is becoming a valuable commodity and how to achieve sustainable economic growth, is centered on the application of data science.

The ACE-DS was founded on October 17, 2016. It is hosted by the College of Business and Economics of the University of Rwanda. The main goals of the ACE-DS are to provide high-quality postgraduate education and enhance the collaborative research capacity in data science to respond to the development challenges in the area. Since its inception, it was expected that highly qualified researchers would contribute to finding solutions to development challenges.

The ACE-DS set out to address the following national and regional development challenges:

- i. The need for an international multidisciplinary applied data science research hub that offers people the time and space to explore original answers to African problems
- ii. The lack of academic staff and recent graduates with research abilities and experience to communicate knowledge to business audiences and the government and show the benefits of applied research
- iii. The absence of partnerships between academia, the public sector, and industry in using big data, bioinformatics, data mining, reliability modeling, research design, and evidence-based policy analysis to address contemporary issues
- iv. Today's lack of relationship between innovation, employment growth and economic development and higher education and research
- v. The lack of funding to support diverse, collaborative international research projects that draw in business sector organizations from around the world.

As data-driven decision-making spreads across many industries, the ACE-DS concept is intriguing. The ACE-DS aims to provide more highly qualified and skilled data scientists on the African continent. In this regard, ACE-DS educates data scientists and researchers through postgraduate training, short courses, and joint applied research. It also collaborates with other academic institutions, commercial and governmental organizations, and businesses to

assist in teaching (including professional short courses), supervision, research, and practical attachments. It serves as a center for research for graduate students, bringing in professionals with worldwide experience and encouraging collaboration between academics, partners, and stakeholders. The Centre has offered master's and doctoral programs in data science in the fields of biostatistics, data mining, actuarial sciences, demography, and econometrics. Since the Centre's inception in 2016, 60 master's and two PhD students have graduated. Since the African Centres of Excellence were established with the primary goal of providing high-quality postgraduate education and fostering collaborative research capabilities, it is evident that gathering data on students' satisfaction is a key component of quality education evaluation.

This research aims to shed light on the key factors that determine students' overall satisfaction. It examined students' experiences, expectations, and perspectives of data science programmes at the ACE-DS. Furthermore, given the unique opportunities and problems that the continent of Africa faces, the investigation of students' satisfaction within this setting is particularly important. The study took into account demographic variables that affect the students' general satisfaction while gaining knowledge that can benefit the centre and higher education policy in general.

Research questions guiding this study are:

1. What are the main factors that influence higher education students' overall satisfaction?
2. How do the programme level, place of origin, gender, and the centre's support for students affect their overall satisfaction?
3. How do curriculum relevance, accessing course materials, and learning resources affect students' satisfaction?

With these research questions, various factors determining students' satisfaction in the data science programmes offered by the African Centre of Excellence in Data Science were examined.

This study is a significant addition to the body of knowledge regarding students' satisfaction with higher education. It enhances and expands the understanding of the factors influencing students' satisfaction in educational environments. It also provides a comprehensive analysis of the factors, laying the groundwork for important improvements in quality education. The findings indicate an implied need for change in terms of pedagogical approaches, curriculum structures, and institutional support systems, thus fostering an environment conducive to learning. The study's conclusions carry a lot of weight in terms of their potential to raise educational standards and effectiveness.

The findings have implications for improving educational quality and effectiveness, encouraging academic excellence, and advancing data science education on the African continent. For both academic and policy-related reasons, it is crucial to investigate the factors that affect students' satisfaction within the specific setting of the ACE-DS.

## 2. LITERATURE REVIEW

Higher education institutions aim to meet students' expectations (DeShields, Kara, & Kaynak, 2005). They must set market-oriented strategies in order to admit as many students as they can and ensure that they fulfil their needs and expectations. A student's motivation, the learning methodology, the lecturers' abilities, the learning environment and resources, and the course structure are among the key variables that affect academic performance and success (Le et al., 2020). Students' satisfaction in higher education has gradually attracted the attention of many researchers (Dennis, Papagiannidis, Alamanos, & Bourlakis, 2016; Manatos, Sarrico, & Rosa, 2017; Psomas & Antony, 2017). A short-term attitude that results from an assessment of students' educational experiences is known as students' satisfaction (Elliott & Healy, 2001). Colleges and universities can align their organizational structure, processes, and procedures to become more customer-oriented by concentrating on the factors that influence students' happiness.

Students' satisfaction in higher education is a multi-dimensional process that is affected by many factors. These factors include the standard of academic instruction, the resources available, the opportunity for research, mentorship,

and the overall atmosphere. Several studies have been conducted to identify factors which influence students' satisfaction in higher education, and they used both quantitative and qualitative designs. This section discusses some of those previous studies. Previous research has found two categories of characteristics that affect students' levels of satisfaction: those that increase satisfaction and those that decrease it. It was revealed that students' satisfaction is positively affected by academic factors and elements connected to other services offered by higher education institutions (Tandilashvili, 2019). Some papers provide detailed methodology using Likert scale analysis, which offers flexibility to integrate more parameters (Kanwar & Sanjeeva, 2022).

According to Appleton-Knapp and Krentler (2006), students' satisfaction is correlated with institutional characteristics such as teaching style, promptness of instructor feedback, clarity of expectations, and instruction quality, as well as personal factors such as age, gender, occupation, and preferred learning style. Furthermore, factors that affect student satisfaction include lecturers' abilities to teach, the flexibility of the curriculum, the university's reputation, the growth and development of the students, use of technology, and the campus environment (Cao, 2023; Douglas, Douglas, & Barnes, 2006; Palacio, Meneses, & Pérez, 2002; Smith, Smith, & Clarke, 2007).

Students' satisfaction is influenced by factors such as age, nationality, and academic subject (Appleton-Knapp & Krentler, 2006). Other variables, such as the origin of students (national or international) and their field of study (management, commerce, or information technology), also have an impact on satisfaction. Overall student satisfaction with university study is correlated with student involvement, with more engaged students reporting higher levels of satisfaction. Furthermore, research has also revealed that a learning environment that enhances students' participation plays an important role in student satisfaction. Likewise, student satisfaction was linked to relationships with teaching staff, administrative personnel and fellow students, and these relationships support students in managing their extracurricular activities (Appleton-Knapp & Krentler, 2006).

The findings from a study conducted in China using qualitative analysis demonstrated that the factors influencing students' satisfaction are school reputation, school environment, personal improvement, organizational management, logistical support, teaching quality, and charges and subsidies (Gu & Lu, 2023). A study conducted by Alves and Raposo (2007) revealed that the institution's image, value and quality greatly affect students' satisfaction. Other studies have analyzed students' satisfaction taking into account the teacher-student relationship, teacher preparedness and campus support facilities. Siming, Gao, Xu, and Shaf (2015) found that some students are motivated by accomplishment.

A study conducted at the College of Business Administration at Kuwait University to determine the impact of academic factors and demographic characteristics on overall student satisfaction showed that there were significant differences in the perceptions of male and female students, as well as differences based on year of study (Adnan, Mohamed, Tarek, Mun, & Hosny, 2016). Demographic factors that were found to explain the level of satisfaction with higher education were age, gender, ethnic origin, and level of education (Marzo-Navarro, Pedraja-Iglesias, & Pilar Rivera-Torres, 2005). Another study found a positive relationship between academic performance and student satisfaction (Rode et al., 2005). Furthermore, it was discovered that the course design and learning materials had the biggest effect on how satisfied students were with their online education (Barbera, Clara, & Linder-Vanberschot, 2013).

A study that was carried out in higher education institutions in Georgia examined the factors that influence students' satisfaction. The findings revealed that administrative factors were the most sensitive and they had a positive impact on student satisfaction. In the same way, academic programmes and students' satisfaction were found to positively correlate (Tandilashvili, 2019). Study conducted by Silva and Fernandes (2012) revealed that students at the Polytechnic Institute of Bragança were satisfied with the quality of service provided by the School of Technology and Management.

Scholarly research indicates that the quality of service in higher education is becoming more closely linked to students' satisfaction and school reputation (Alves & Raposo, 2007; Bassi, 2019). However, the concept of students'

satisfaction needs further research to identify appropriate measures (Mizikaci, 2006). In addition, some previous studies had limited sample sizes, and they lacked self-explanatory retention data (DeShields et al., 2005). It is also argued that in order to satisfy consumer demand, institutions concentrate on raising the quality of their services (Mehralizadeh & Safaemoghaddam, 2010), and that a company's ability to succeed in today markets is mostly dependent on the quality of its services. Therefore, it is of paramount importance to undertake research on students' satisfaction in higher learning institutions.

### 3. METHODOLOGY

This study aimed to investigate the factors affecting postgraduate students' satisfaction. In this regard, a survey was conducted with students pursuing master's and doctoral degrees at the African Centre of Excellence in Data Science (ACE-DS). A questionnaire was systematically distributed to the entire cohort of active students enrolled in master's and PhD programs at the ACE-DS. The questionnaire itself was thoughtfully designed using online forms, and it was made accessible for the month of April 2023. Respondents were conveniently able to submit their responses through a digital platform, and the data was automatically collected. The questionnaire was structured to cover key elements essential to students' experience at the ACE-DS, encompassing aspects such as training and teaching quality, research opportunities, supervision/mentorship, welfare support, and other forms of assistance provided. This comprehensive approach aimed to capture a holistic view of students' satisfaction and gather valuable insights into various facets of their educational journey. The following paragraphs provide more details on the data and data analysis.

#### 3.1. Data

The total number of eligible students for this survey was 160, and to ensure comprehensive participation, reminders through emails and calls were given to all eligible respondents. Despite the reminders, the questionnaire was filled by 81 out of 160 students. This means that the response rate was 50.6%, indicating an acceptable level of engagement among the student body.

#### 3.2. Data Analysis Methods

This study used two types of analyses. First, descriptive statistics were used, presenting students' responses to the different items in the questions. Second, a multivariable logistic regression model was used to identify factors associated to student satisfaction. A multivariable logistic regression model is a powerful statistical model for non-quantitative data with categorical and continuous predictors (Nzabanita et al., 2022).

The response variable used as indicator of student satisfaction ( $y_i$ ) is a binary variable with two values: 1 standing for "yes," representing the respondent's satisfaction, and 0 standing for "no," indicating the respondent's lack of satisfaction.  $y_i$  followed a Bernoulli distribution and could be modelled through the logit-link function, and  $k$  factors were included in the model as covariates, namely gender, level of study (MSc and PhD), program of study (Actuarial Sciences, Biostatistics, Data Mining, Demography and Econometrics), country of origin (Rwanda and other countries), curriculum relevance (Yes and No), accessing course materials (Yes and No), satisfaction of learning facilities (Yes and No) and satisfaction of support from the Centre (Yes and No). The logistic regression model is formulated as:

$$\text{logit}(\pi_i) = \beta_0 + \beta_1 x_{i1} + \dots + \beta_k x_{ik}$$

Where  $\beta$  is a vector of unknown coefficient for fixed covariate  $x_i$ . Stata software was used in this study, and unknown parameters were estimated using a maximum likelihood approach.

## 4. RESULTS

### 4.1. Descriptive Statistics

Table 1 presents the respondents' demographic and program-related variables. As indicated, 17.3% of the respondents were female and 82.7% were male. It is important to mention that 77.8% of the respondents were pursuing master's degrees, while 22.2% were doing a PhD.

Table 1. Distribution of the sample.

Variable	Category	Number	%
Gender	Female	14	17.28
	Male	67	82.72
Level of study	Master's	63	77.78
	PhD	18	22.22
Program of study	Actuarial sciences	9	11.11
	Biostatistics	21	25.93
	Data mining	30	37.04
	Demography	8	9.88
	Econometrics	13	16.05
Country of origin	Rwanda	67	82.72
	Other countries	14	17.28
Curriculum relevance	Yes	74	91.36
	No	7	8.64
Accessing course materials	Yes	54	66.67
	No	27	33.33
Satisfaction with learning facilities	Yes	72	88.89
	No	9	11.11
Satisfaction with the support from the Centre	Yes	75	92.59
	No	6	7.41
Overall satisfaction	Excellent	22	27.16
	Very good	38	46.91
	Good	19	23.46
	Fair	2	2.47

The responses to the questions are summarised in Table 2. Analysis of the data revealed that the combined positive responses of "excellent," "very good," and "good" exceed 80% of all questions presented in the table. Notably, the areas "Courses or Subjects taught effectively" and "Overall satisfaction of experience at ACE-DS" showed the highest percentage of 97.5%. The lowest percentage, but still significant, was 81.5% for the item "coaching and academic advice from supervisors." These results highlight the high levels of satisfaction among the students with many elements of their time at ACE-DS; however, there is still room for improvement, mainly in the areas of coaching and academic advising.

The results in Table 2 indicate that students enrolled at the ACE-DS expressed a high level of satisfaction with their educational experience. It is crucial to note that a higher proportion of respondents in several categories considered their experiences as "good," highlighting the need for improvement and fine-tuning in these areas. The goal for the Centre was to create a setting where more students would rate their experiences as "excellent" or "very good," demonstrating ACE-DS's ongoing dedication to excellence and continuous improvement.

Table 3 indicates the change in perceptions of respondents since they enrolled in the ACE-DS. According to the findings, 67.5% of respondents reported that their perceptions had improved over time. In addition, 25% stated that their impressions had remained the same, while 7.5% reported that their perception had declined to poor. These findings testify that the views of some students did not change and declined for others. The implication is that much effort is still needed to improve students' perceptions and their overall experience.

Table 2. Responses obtained from students using 5-point scale.

No.	Question	Excellent	Very good	Good	Fair	Poor
		5	4	3	2	1
1	Satisfaction with learning facilities	0.00	19.75	69.14	7.41	3.7
2	Appreciation of the teaching methods	19.75	41.98	29.63	7.41	1.23
3	Courses/subjects taught effectively	23.46	34.57	39.50	2.47	0.00
4	Mentorship/supervision system	14.82	35.80	37.04	3.70	8.64
5	Coaching and academic advice from supervisors	18.52	29.63	33.33	13.58	4.94
6	Support from ACE-DS staff	33.33	38.27	20.99	6.17	1.24
7	Communication between staff and students	39.50	29.63	18.52	9.88	2.47
8	Overall satisfaction of experience at ACE-DS	27.16	46.91	23.46	2.47	0.00

Table 3. Perceptions of students of the ACE-DS.

Factor	Category	Number	%
Impressions at arrival at ACE-DS	No idea	2	2.47
	Positive	79	97.53
Have your impressions changed?	Declined to poor	6	7.5
	Remain unchanged	20	25
	Improved to the best	54	67.5

The following section focuses on a multivariable logistic regression analysis. This method of analysis looked at the response variable along with its covariates, allowing a thorough investigation of the influence of covariates on the response variable. This statistical approach will make it possible to comprehend the relationships between student satisfaction and its associated factors and contributions to the outcome variable.

4.2. Multivariable Logistic Regression

Table 4 presents the findings on students' satisfaction alongside selected associated factors. This preliminary analysis helped to incorporate pertinent factors into the regression model. The chi-square test was conducted to select factors associated with the response variable.

Table 4. Distribution of satisfaction and selection associated factors.

Variable	Category	Satisfaction				P-value
		Yes		No		
		Number	%	Number	%	
Gender	Male	51	76	16	24	0.358
	Female	9	64	5	36	
Level of study	Master's	47	75	16	25	0.839
	PhD	13	72	5	28	
Program of study	Actuarial sciences	6	67	3	33	0.133
	Biostatistics	12	57	9	43	
	Data mining	23	77	7	23	
	Demography	8	100	0	0	
	Econometrics	11	85	2	15	
Country of origin	Rwanda	48	72	19	28	0.274
	Other countries	12	86	2	14	
Curriculum relevance	Yes	58	78	16	22	0.004
	No	2	29	5	71	
Accessing course materials	Yes	44	81	10	19	0.031
	No	16	59	11	41	
Satisfaction with learning facilities	Yes	58	81	14	19	0,000
	No	2	22	7	78	
Satisfaction with the support from the centre	Yes	59	79	16	21	0.001
	No	1	17	5	83	

The findings revealed that certain factors, specifically gender, level of study, program of study, and the country of origin, exhibit non-statistically significant associations with student satisfaction as evidenced by their respective P-values. In contrast, curriculum relevance, accessing course materials, satisfaction with learning facilities, and satisfaction with the support provided by the Centre emerge as statistically significant contributing factors to students' satisfaction. Consequently, only these significant factors will be included in the subsequent logistic regression model, enabling a focused examination of their impact on students' satisfaction.

Table 5 summarizes the results obtained from the logistic regression model. These findings offer insightful information on the variables affecting students' satisfaction. It is noteworthy that the findings show that two factors, namely "accessing course materials" and "satisfaction with the support from the Centre," emerge as statistically significant predictors of students' satisfaction. Conversely, there were no statistically significant relationships between "curriculum relevance" and "satisfaction with learning facilities" and students' satisfaction.

Table 5. Parameter estimates of the satisfaction.

Variable	Coeff.	SE	95% CI	OR	P-value
Intercept	-6.027	1.929	[-9.808, -2.246]	0.002	0.002*
Curriculum relevance	1.803	1.089	[-0.332, 3.937]	6.065	0.098
Accessing course materials	1.495	0.652	[0.217, 2.774]	4.461	0.022*
Satisfaction with learning facilities	1.916	1.051	[-0.144, 3.976]	6.794	0.068
Satisfaction with the support from the centre	3.155	1.277	[0.653, 5.657]	23.446	0.013*

Note: \* Significant at 5%

## 5. DISCUSSION

While examining the results presented in this paper, several significant insights emerged. The findings revealed that the ACE-DS students were generally very satisfied. However, there is space for development in many areas, particularly academic guidance and coaching. In addition, the majority of the students (67.5%) indicated that their perceptions had positively changed, and this highlights the positive impact of the ACE-DS on their experiences. Furthermore, while 7.5% reported a reduction in their opinions, 25% expressed a stable impression, indicating specific areas that need development. These findings highlight how much the students value the Centre and University's efforts to deliver high-quality postgraduate education.

A preliminary analysis of the P-values indicated that factors such as gender, level of study, programme of study, and country of origin were not significantly associated with students' satisfaction. These findings are different from Adnan et al. (2016), who conducted a study at the College of Business and Administration of Kuwait University. In fact, their study revealed that curriculum relevance, accessing course materials, contentment with learning facilities, and support were statistically associated with students' satisfaction, a situation that is different from the one in the Rwandan context. As a result, these important factors were the only ones considered in the subsequent logistic regression model.

According to the results from the logistic regression model, "accessing course materials" and "satisfaction with the support from the Centre" were statistically significant predictors of students' satisfaction. These results corroborate those of Le et al. (2020), who emphasised the critical importance of supportive learning environments and experiences in raising students' satisfaction. According to a study conducted in Georgian Higher Education Institutions (Tandilashvili, 2019), administrative factors positively affected student satisfaction. Contrarily, in this analysis, there were no statistically significant relationships between variables such as "curriculum relevance" and "satisfaction with learning facilities" and students' contentment. In the same way, Tandilashvili (2019) found a significant relationship between academic programmes and students' satisfaction.

These findings provide information on the key variables found in the dataset that had a big impact on overall student satisfaction levels. This information offers fascinating insights to improve the quality of instruction at the ACE-DS.

## 6. CONCLUSION AND POLICY SUGGESTION

### 6.1. Conclusion

Students' satisfaction is an important aspect in the assessment of the quality of education in any institution. This study examined students' satisfaction in higher education at the African Centre of Excellence in Data Science (ACE-DS). The data was collected from postgraduate students at the Centre using a questionnaire, and it was analysed using descriptive statistics and a multivariable logistic regression model. The responses revealed that the overall satisfaction among students of their experience at the ACE-DS is 97.5%, but coaching and academic advice from supervisors has the lowest percentage (81.5%). The findings revealed that gender, level of study, program of study, and the country of origin of the students were not associated with students' satisfaction. In contrast, curriculum relevance, accessing course materials, satisfaction with learning facilities, and support from the Centre were statistically associated with students' satisfaction. Consequently, only curriculum relevance, accessing course materials, satisfaction with learning facilities, and satisfaction with the support provided by the Centre were the significant factors considered in logistic regression model. The results obtained from the logistic regression model demonstrated that accessing course materials and satisfaction with support from the Centre were statistically significant. Conversely, curriculum relevance and satisfaction with learning facilities were not statistically significant. These insights clarify the main factors that substantially influence the overall student satisfaction levels and indicate areas that need attention in order to enhance quality education at the ACE-DS.

### 6.2. Policy Suggestion

The findings highlighted the overall satisfaction among students at the African Centre of Excellence in Data Science and identified specific areas for improvement, especially coaching and academic advising. The study demonstrated that students at the ACE-DS were extremely satisfied with their educational experience. Nevertheless, a substantial proportion of the respondents rated their experiences as "good." The implication is that there is a strong need for regular improvement and enhancement in these areas to create an environment where more students would perceive their experiences as "very good" or "excellent," in line with the aspirations of the ACE-DS. The model has indicated that the main factors to be considered for student satisfaction at the ACE-DS are accessing course materials and satisfaction with the support from the Centre.

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**Institutional Review Board Statement:** The Ethical Committee of the African Center of Excellence in Data Science, University of Rwanda, Rwanda has granted approval for this study on 19 May 2023 (Ref. No. 252/ACE-DS/2023).

**Transparency:** The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.

**Competing Interests:** The author declares that there are no conflicts of interests regarding the publication of this paper.

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