

# Carnegie Mellon University

## **Africa**

### Online Certificate Learner Study

### **Final Report**

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# Abbreviations

<b>Term</b>	<b>Description</b>
<b>ADDA</b>	Africa Drone and Data Academy
<b>Afretec</b>	African Engineering and Technology Network
<b>AI</b>	Artificial intelligence
<b>CMU-Africa</b>	Carnegie Mellon University Africa
<b>GB</b>	Gigabyte
<b>GER</b>	Gross enrolment ratio
<b>GNI</b>	Gross national income
<b>HEI</b>	Higher education institution
<b>HLA</b>	Humanities/liberal arts
<b>ICT</b>	Information and communications technology
<b>KCL</b>	Knowledge Consulting, Ltd.
<b>LMS</b>	Learning management system
<b>Mbps</b>	Megabytes per second
<b>ML</b>	Machine learning
<b>MOOC</b>	Massive open online course
<b>OPM</b>	Online program management
<b>STEM</b>	Science, technology, engineering and mathematics
<b>USD</b>	United States dollars

# Preface

Online learning has grown significantly across Africa in recent years as Internet access improves to complement traditional higher education, where educational institutions look for new ways to overcome infrastructure constraints to serve growing numbers of students. The forced closure of schools, universities and colleges during the COVID-19 pandemic and the shift to remote working have accelerated the appreciation and adoption of online learning. While university curricula and teaching processes are struggling to find out what new skills will be needed for Africa's transition to a digital economy, learners want to learn the new skills now so that they can compete with their peers not just nationally or regionally but globally. To address this urgent need, CMU-Africa is developing online certification programs in areas such as artificial intelligence and machine learning, which targets African graduates with bachelor's degrees in engineering and ICT fields.

Knowledge Consulting Ltd. (KCL) undertook this research to inform CMU-Africa about the motivations and aspirations that drive learners to engage in such certificate programs and to inform program design strategies and approaches that will help maximize learner enrolment, engagement and completion. The sources of information and data included research literature and published reports; interviews with stakeholders involved in designing, delivering and/or managing online programs; and an online survey of recent and soon-to-be graduates from African universities. The findings, insights and recommendations from this study are of general application. They can be used by any institution wishing to deliver online postgraduate certificate programs in the African context.

KCL is grateful to CMU-Africa for this opportunity to inform the design of its online certificate programs. KCL would like to thank the CMU-Africa team, including Prof. Tim Brown, Dr. Alexis Adams and Ms. Ariane Raissa Ineza, for their invaluable contributions and feedback during the course of this study and Dr. Jules Degila (Benin), Dr. Marilena Cabral (Cabo Verde), Dr. Solomon Atnafu (Ethiopia) and Mr. Alex Ndibwami (Rwanda) for their assistance in conducting the potential learners survey.

Based in Uganda, KCL provides strategic consultancy services to partners, drawing on our strong research and analytical base and in-depth understanding of the strategic use of ICTs in the African context, combined with practical experience of the application of ICT in various sectors. Members of the consulting team (Eng. Dr. F.F. Tusubira, Dr. Dorothy Kyeyune, Dr. Evelyn Kahiigi and Mr. Ali Ndiwalana) support policy making, strategy development and project planning and implementation at the organizational, national and regional levels. Dr. Tusubira led the team, including Dr. Kahiigi and Mr. Ndiwalana, that spearheaded the implementation of both e-labs and e-learning in Makerere University, and Dr. Dorothy Kyeyune is a customer experience expert who formally worked with Airtel Uganda and Airtel Africa.

# 1 Background

## 1.1 Introduction

**Higher education plays a critical role in training a skilled workforce, conducting research and building the knowledge base and the human capital necessary for Africa's transition to digital economies.** However, while the gross enrolment ratio (GER) for primary and secondary education in sub-Saharan Africa stood at 98.9% and 43.4%, respectively, in 2020, the GER for higher education stands at only 9.4%. This percentage is small, but it is further compounded by the fact that many higher education institutions' (HEIs) curricula do not address skills currently needed in the field.

**Addressing the acute stage of skills needed by the market drives innovative alternatives that leverage hybrid/blended learning and fully online delivery models (which we refer to as "online") to bridge the gap.** Doing this through the traditional approaches to learning in most of Africa's HEIs would, on a continent-wide level, require a revamping of curricula and developing the requisite skills among faculty — a long-term process. This is the entry point for additional postgraduate training targeted at acquiring specific skills that will add value to participants' work in the current environment.

**In response to this identified need, Carnegie Mellon University Africa (CMU-Africa) is developing online certification programs in areas such as artificial intelligence (AI) and machine learning (ML) that target African graduates with bachelor's degrees in the engineering and information and communication technology (ICT) fields but who are not yet ready for master's-level education in AI and ML.** CMU-Africa has a close partnership with seven African universities, which make up the African Engineering and Technology Network (Afretec),<sup>1</sup> and would like these partners to play a role in deploying and supporting the certificate programs.

**Specifically, CMU-Africa wanted to understand the motivations and aspirations that push learners to engage in certificate programs of this kind and to leverage program design strategies and concepts that help maximize learner enrolment, engagement and completion.** The study was designed to provide CMU-Africa with insights into the different dimensions of a compelling value proposition that considers the multi-cultural and socio-economic context on the African continent. This required, among others, the following:

- i. Identifying and understanding the key socio-cultural and contextual drivers, enablers and barriers that influence learner enrolment, engagement and completion.
- ii. Defining specific strategies and concepts to help maximize learner enrolment, engagement and completion.

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<sup>1</sup> <https://engineering.cmu.edu/afretec/index.html>

- iii. Identifying and prioritizing psychographic segments among learners as they relate to enrolment, engagement and completion.

**The findings, insights and recommendations from this study have general application and can be used by any institution that seeks to launch online postgraduate certificate programs within the African context.** The cautionary addition to this is that while the range of supply-side and consumer-side engagements covered the major regions in Africa, the objective was not to achieve statistical representation at the national or regional levels but rather to identify student-centered considerations and provide general guidance.

## 1.2 Report Layout

Following Chapter 1, which provides the background, Chapter 2 provides a summary of the methodology. In Chapter 3, the findings are discussed under various thematic areas, each informed by the different phases of the study, which are discussed in Chapter 2.

Chapter 4 gives a consolidated summary of the key considerations and actions required in launching the CMU-Africa postgraduate certificate in AI and ML (AI/ML).

While the key findings from the interviews and the survey are used in the discussions in Chapter 3, a detailed report covering these two phases of the study is provided as a standalone — this provides a deeper dive into the survey methodology and provides detailed findings and recommendations based on both semi-structured interviews and the findings from the survey.

Appendix A provides the references for the citations used throughout the document.

Appendix B provides an outline of the semi-structured guide used for interviews with various stakeholders.

Appendix C includes the list of questions used to collect data for the student survey.

# 2 Methodology

## 2.1 Key Stages

The key stages used in conducting this study are illustrated in Figure 1.



*Figure 1: Key stages in the methodology used*

To address CMU-Africa’s objective of understanding the motivations and aspirations that drive learners to engage in certificate programs of this kind and to leverage program design strategies and approaches that help to maximize learner enrolment, engagement and completion, information and data were sought under the following key themes:

- i. The opportunities for and the challenges of online learning for higher education in Africa.
- ii. What motivates learners to opt for online programs?
- iii. What predicts student success in online programs?
- iv. The “how” of online student engagement.
- v. The typology of people interested in online learning with some specific focus on AI and ML.

**The information and data on which the analysis, findings and recommendations are based have been obtained from three sources: (i) research literature and published reports, (ii) interviews conducted with supply-side respondents and (iii) an online survey of consumer-side respondents.** This provided an opportunity to examine the findings of the literature review alongside the experiential views of the people leading and/or managing online learning on the African continent and the perspective of potential learners. It also provided a means of verification and/or corroboration.



## 2.2 Desk Study

The aim of the desk study was to gather and update information about the current best practices, trends and future projections for designing and delivering graduate online certificate programs. To achieve this goal, the study used the following:

- i. A literature search using the Google Scholar website for scholarly literature on the trends and strategies related to student engagement and retention in online certificate programs with a focus on continuing education and professional development. The literature review includes a specific focus on academic literature and reports covering both past and current efforts in online education on the African continent published in the last five years.
- ii. Recent literature on online learning in Africa was identified through a search of systematic literature reviews published within the last five years covering various aspects of online education.

## 2.3 The Interviews

**Semi-structured interviews were conducted to gain experiential insights into the various approaches used to enhance student learning and completion rates in online programs.** Ten respondents (five females and five males from seven countries: Egypt, Ethiopia, Malawi, Nigeria, Rwanda, South Africa and Uganda) took part in the semi-structured interviews. Of these, nine participants are actively involved in the design, delivery and/or management of online programs, while one works as a practicing engineer in a utility company. Those actively engaged in the delivery and/or management of online programs included the head of a distance learning program, a dean for graduate studies and research, a program lead and program manager for a multi-country and multi-institutional online certificate program, two project managers for online learning programs and three lecturers involved in hybrid programs that include both on-campus and online learning components. Respondents were identified through contacts at Afretec universities in Rwanda, Kenya, Egypt, Nigeria and South Africa. One objective was to cover three language groups (English, French and Portuguese), anticipating a possible offering of the postgraduate certificate courses in multiple languages. As a result, the identification of respondents was extended to Ethiopia, a potentially large market, as well as to Benin (which speaks French) and Cabo Verde (which speaks Portuguese); the latter were identified after not receiving much interest in larger countries that use these two languages.

The conversations with each respondent covered the following broad categories:

- i. Learning methods and course duration
- ii. Learning activities and platforms used
- iii. Assessment methods
- iv. Completion rates and success factors
- v. Funding and sustainability

- vi. Evaluation and scaling
- vii. Challenges and opportunities
- viii. Support services for students
- ix. Experiential advice to CMU-Africa
- x. Licensing and partnerships

A typical semi-structured instrument is given in Appendix B.

## 2.4 The Survey

### 2.4.1 Approach

**We conducted a survey among recent (2021–2022) and soon-to-be (2023) graduates of the largest universities in selected African countries using an online self-administered instrument.** To ensure diversity, we designed the survey to cover different language groups in sub-Saharan Africa, including English, French and Portuguese.

We conducted the survey to obtain the following information:

- i. Students' views on different components of an online course or program based on their previous experience of participation in online courses or programs.
- ii. The availability of technologies and spaces that support online learning for students.
- iii. The perceptions and attitudes of students toward online courses or programs.
- iv. Student demographics, including personal and educational backgrounds, and their potential impact on their interest and performance in online courses or programs.

An English version of the online questionnaire is included in Appendix C. For Benin and Cabo Verde, we used the questionnaires in French and Portuguese, respectively.

The online survey aimed to gather responses from individuals enrolled in engineering, computer science and related courses across participating institutions. These individuals were deemed to possess the necessary background through their prior courses. In Ethiopia, where the survey was first conducted, an email list containing 500 potential students was created. However, the response rate was extremely low, reaching approximately 5%. We decided to collaborate with faculty members from the target institutions and requested that they share the survey invitation and its URL through class WhatsApp groups. This new approach of using WhatsApp groups led to an improvement in Ethiopia's response rate, which increased slightly to over 10%. This approach also helped alleviate privacy concerns around sharing student emails raised by some institutions. The WhatsApp group approach was therefore later employed in the other countries.

Table 1 provides a summary of responses received for each institution and country.

*Table 1: Proportion of responses from institutions and country*

Country	University	Responses	Proportion of total responses (%)
Benin	Université d'Abomey-Calavi	84	22.8
Cabo Verde	Universidade de Cabo Verde	13	3.5
Ethiopia	Addis Ababa University	51	13.9
Rwanda	University of Rwanda	159	43.2
Uganda	Makerere University	61	16.6
<b>Total</b>		<b>368</b>	<b>100.0</b>

It was observed from the outset that the trends remained the same even as the number of responses grew, which confirmed that there were enough returns to generate dependable findings. Comparable patterns were noted at both the country and the collective levels even though there were slight variations in nuances for each country. Thus, this warranted the cessation of response reception as there was no benefit in acquiring additional data (in the context of findings).

## 2.4.2 Demographics

This section presents the demographic information of the respondents, providing the socio-economic context from which the survey findings emerged.

*Table 2: Overview of demographic characteristics*

Demographic characteristic	Number	Proportion (%)
<b>Gender</b>		
Female	94	25.5
Male	274	74.5
<b>Age group (years)</b>		
18–24 years	282	76.6
25–34 years	78	21.2
35–44 years	5	1.4
45–54 years	1	0.3
Above 54	2	0.5
<b>Have children or dependents to take care of</b>		
Yes	51	13.9
No	317	86.1

### *i. Age and Gender*

Table 2 indicates that 74.5% of the respondents were male, and 76.6% fell between the ages of 18 and 24 years. These results imply an ongoing gender imbalance among ICT-interested students. Therefore, CMU-Africa may need to consider incentives and other approaches to increase female enrolment. The respondents were drawn from the most active age groups in terms of online activity. For example, according to a recent nationally

representative ICT survey in Uganda, most of the people who had used the Internet from any location in the past three months were between the ages of 25–34 (14.5%) and 15–24 years (13.5%).<sup>2</sup> It is important to recognize that the results may show a bias toward individuals who are more likely to take part in online surveys.

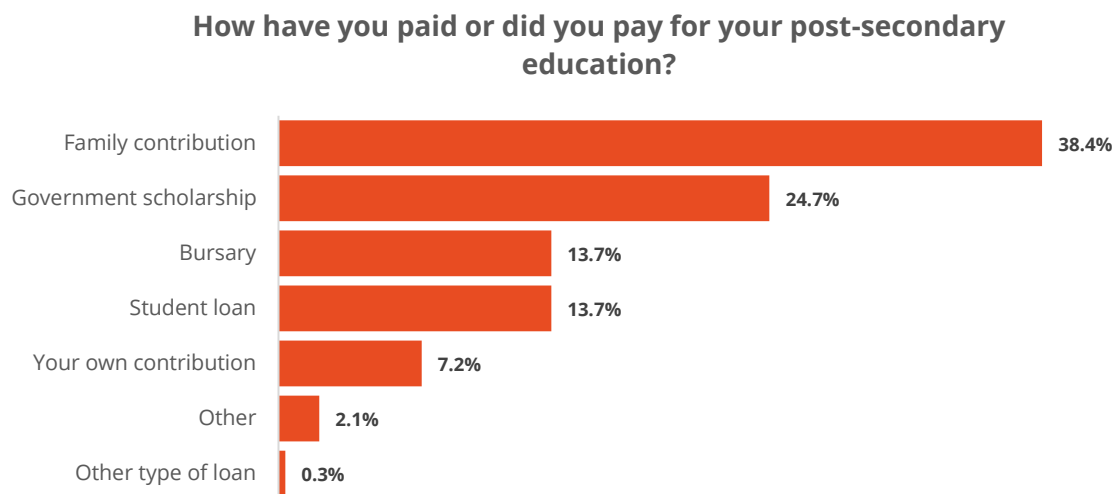
### **ii. Educational Background**

A total of 69.5% of the surveyed individuals were still enrolled in university. The individuals still enrolled in university were studying computer science (26.1%), computer engineering (24.1%), information technology (21.2%) and mathematics (17.2%).

The recent graduates had gained degrees in information technology (27%), computer engineering (19.1%), computer science (16.9%) and mathematics (10.1%). A total of 75.5% of the surveyed individuals had previously enrolled or participated in an online course or program. Of these, 85.6% had successfully completed one or more online courses or programs.

### **iii. Financial Background**

In terms of financing their education, 38.4% of the respondents relied on family contributions, and 24.7% received government scholarships. Only 7.2% of the respondents self-funded their education, as seen in Figure 2.



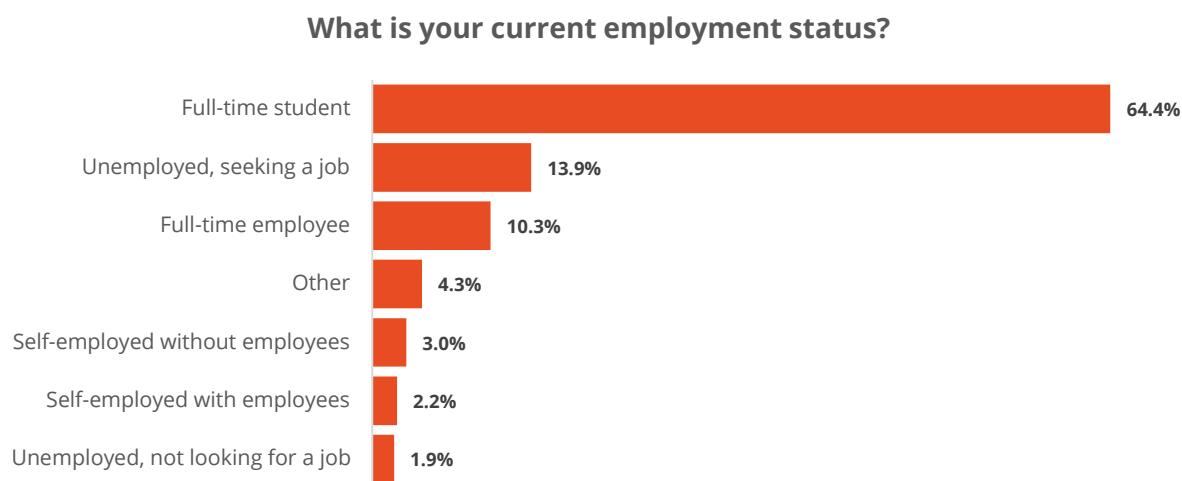
*Figure 2: Proportion of respondents by tuition source*

### **iv. Employment and Support**

The majority of respondents (64.4%) were still students, followed by 10.3% in full-time employment and 13.9% who were unemployed graduates (see Figure 3). Female respondents (71.3%) reported being full-time students more frequently than male respondents (62%). The unemployment rates of female and male respondents were

<sup>2</sup> National Information Technology Survey, 2022. <https://nita.go.ug/publications/reports/national-it-survey/national-information-technology-survey-final-report-2022>

similar (13.8% and 13.9%, respectively). In terms of age groups, the proportion of students was higher among those aged 18–24 (66.3%) in comparison to those aged 25–34 (62.8%).



*Figure 3: Proportion of respondents by employment status*

A total of 86.1% of the respondents reported not having any children or dependents to care for.

### 2.4.3 Variation of Findings from Country to Country

This section presents a concise comparison of the characteristics of the respondents from Benin, Ethiopia, Rwanda and Uganda who participated in the survey. Cape Verde is excluded from the analysis in this section since only 13 respondents were obtained from there. According to Table 3, most respondents in each country were male, indicating a continued gender imbalance among students of ICT-related programs.

The majority of respondents from all countries had previously enrolled or participated in at least one online course or program, with the highest proportion reported in Rwanda (81.8%) and the lowest in Benin (66.7%). Of these respondents, at least four out of five reported having successfully completed an online course or program they had enrolled in.

Overall, 19 out of 20 respondents (94.6%) expressed interest in the AI/ML certificate program if offered by CMU-Africa. The largest proportion of learners (98.8%) interested in the AI/ML certificate was in Benin, while the smallest was in Uganda (86.9%).

*Table 3: Comparison of demographic and other attributes across countries*

Characteristic	Benin (%)	Ethiopia (%)	Rwanda (%)	Uganda (%)	General (%)
<b>Gender</b>					
Female	15.5	25.5	30.8	26.5	25.5
Male	84.5	74.5	69.2	73.8	74.5

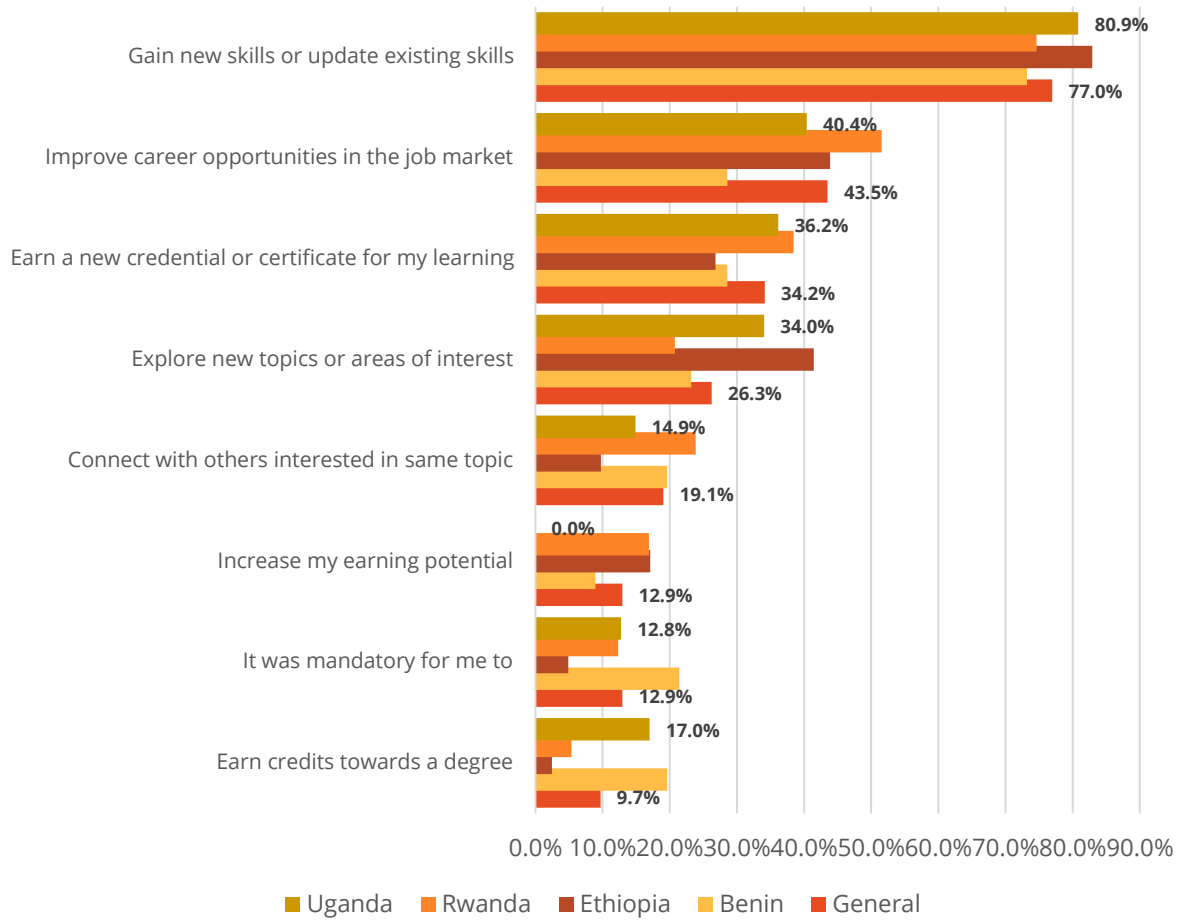
<b>Age group (years)</b>					
18–24 years	58.3	88.2	82.4	73.8	76.6
25–34 years	39.3	9.8	17.0	19.7	21.2
35–44 years	1.2	0.0	0.6	4.9	1.4
45–54 years	1.2	0.0	0.0	0.0	0.3
Above 54	0	2.0	0.0	1.6	0.5
<b>Have you ever enrolled or participated in an online course or program?</b>					
Yes	66.7	80.4	81.8	77.0	75.5
No	33.3	19.6	18.2	23.0	24.5
<b>Did you successfully complete any online course(s) or program(s)?<sup>3</sup></b>					
Yes	82.1	82.9	90.0	83.0	85.6
No	17.9	17.1	10.0	17.0	14.4
<b>Which of these digital devices do you own to facilitate online learning?</b>					
Desktop computer	6.0	13.7	10.1	9.8	9.5
Laptop computer	86.9	98.0	83.6	86.9	87.2
Tablet	8.3	11.8	6.9	8.2	7.9
Smartphone	71.4	66.7	75.5	90.2	75.8
Smartphone but no computer	11.9	0.0	14.5	13.1	11.1
<b>Are you interested in pursuing an online certificate program in AI and ML?</b>					
Yes	98.8	90.2	96.2	86.9	94.6
No	1.2	9.8	3.8	13.1	5.4

In general, the main reason for students enrolling in online courses or programs (77.0%) was to acquire new skills or update existing ones. As depicted in Figure 4, this was the overwhelming primary motivation in all countries. This was followed by students seeking to improve their employability (43.5%) and wanting to obtain a new qualification or certificate (34.2%). These final two factors were also found to be ubiquitous. Nevertheless, their significance showed variation among nations. For instance, a greater proportion of students from Rwanda (51.5%) prioritized enhancing their career opportunities, in contrast to their peers from Benin (28.6%). On the opposite side of the scale, Ethiopia had the smallest percentage of participants who decided to take an online course to earn credits for a degree (2.4%) or because they were obligated to do so (4.9%).

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<sup>3</sup> Only respondents who had previously enrolled or participated in an online course or program were asked this question.

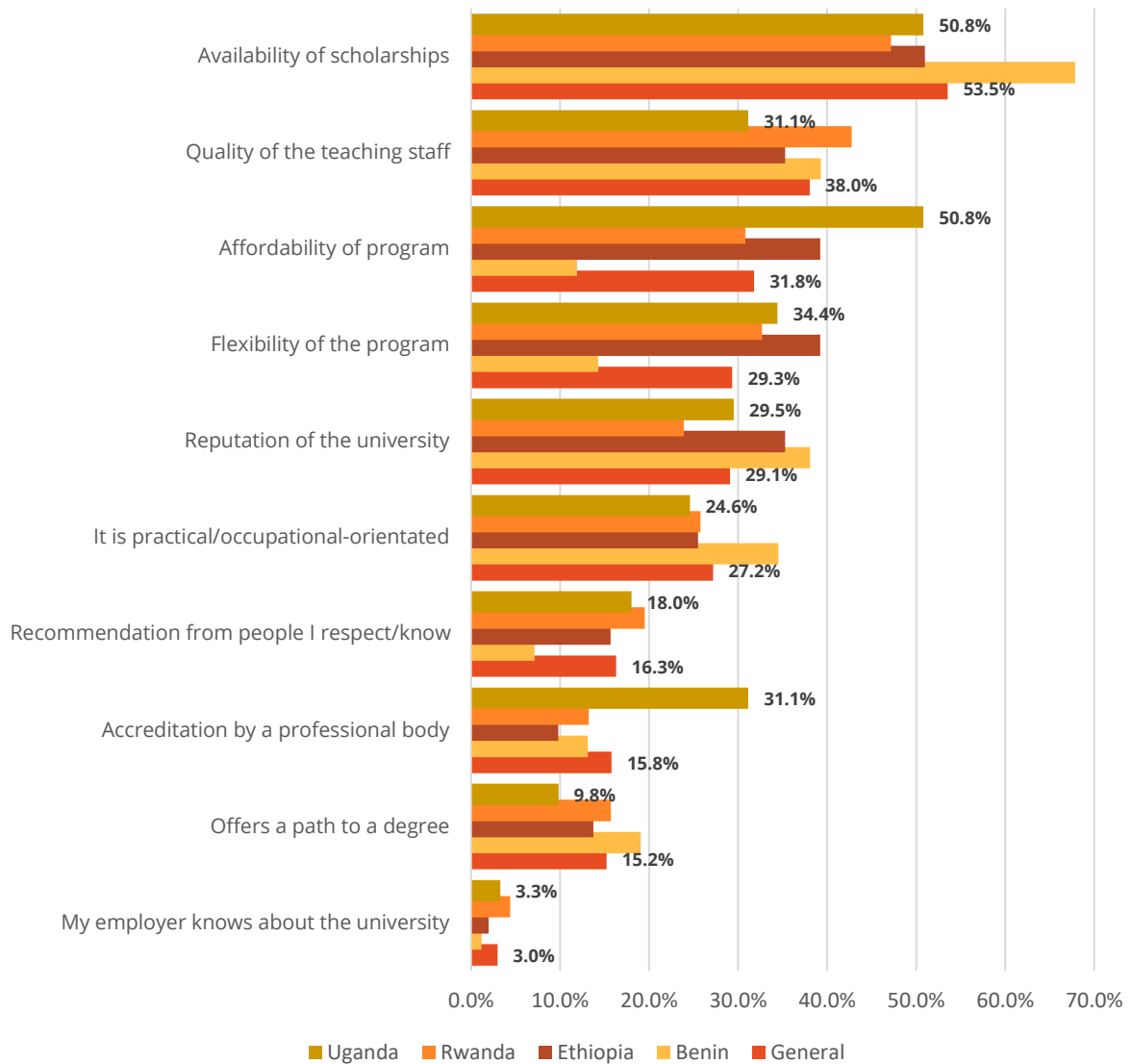
**Why did you enroll in the online course or program?**  
(select up to three options) (ranked by general population)



*Figure 4: Comparison of motivation for enrolling in online courses across countries*

Overall and across all countries, respondents identified the availability of scholarships, which also links to affordability, as the most influential factor in selecting a university for an online course or program. Other significant factors are the quality of teaching staff, and the level of flexibility. Figure 5 presents an illustration of all these factors and highlights the differences between various countries.

**What factors can influence your selection of a university to study an online certificate program?**  
 (select up to three options) (ranked by general population)



*Figure 5: Comparison of factors influencing choice of university offering online course across countries*



## 3 Findings by Thematic Area

The findings from the desk research, the interviews with key respondents and the online survey of potential students are grouped and discussed here under the identified thematic areas. These findings lead to the specific recommendations that are presented in Chapter 4.

### 3.1 The Opportunities for and the Challenges of Online Learning for Higher Education in Africa

This section examines the various mutually compounding factors that drive the opportunities for online learning in Africa, the challenges associated with it and key considerations concerning its implementation. The factors examined here include the shortage of advanced skills, particularly in the digital space; insufficient opportunities for higher education — there are simply not enough places in HEIs to meet the demand; the high cost of higher education, which often exceeds general affordability levels; and the curricula, which need updating relative to current demand, especially in technology-based courses.

#### 3.1.1 Addressing the Need and Demand for Higher Education through Online Learning

**Higher education plays a crucial role in training a skilled workforce, conducting research and developing the knowledge base and the human capital needed to transition to digital economies in Africa. However, the GER for higher education was only 9.4%, highlighting the urgent need for innovative strategies to address this gap.** In 2020, the GER for primary and secondary education in sub-Saharan Africa was 98.9% and 43.4%, respectively. However, the GER for higher education was only 9.4%.<sup>4</sup> In addition to this low percentage, the situation is made worse by the fact that many curricula at HEIs do not address the skills currently required in the field (Agbaje, 2023).

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<sup>4</sup> <https://data.worldbank.org/indicator/SE.TER.ENRR?locations=ZG>

Data source: World Bank Open Data (2023)

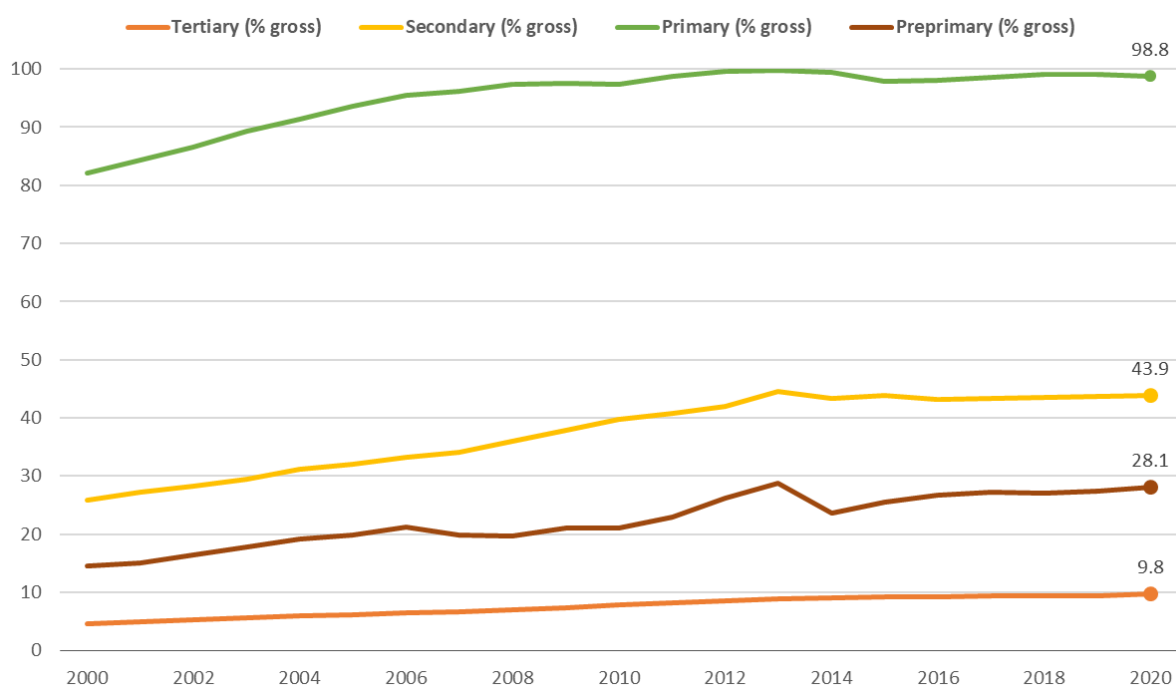


Figure 6: Trends in gross enrolment for education in sub-Saharan Africa

**Innovative alternatives that leverage hybrid/blended learning and fully online delivery models are being created to address the acute shortage of skills needed by the market.** Using traditional approaches to learning in most of Africa's HEIs would require a revamping of curricula and the development of necessary skills among faculty, which is a long-term process on a continent-wide level. Additional postgraduate training is an entry point for acquiring specific skills that would add value to participants' work in the current environment.

**There are numerous examples that confirm the increasing significance of distance and online learning in Africa, especially the opportunity it provides for greater access to higher education, particularly in technical fields.** Africa has a rich history of using distance education as a means to expand access to higher education. The region has employed a range of technologies for distance education, including mail or correspondence in the early days, broadcast radio and television, teleconferencing and, more recently, the Internet (Mkonongwa & Komba, 2018). The University of South Africa (UNISA), which began providing distance education in 1946, now enrolls approximately 370,000 students annually.<sup>5</sup> The National Open University of Nigeria, founded in 1983, has over 110,000 active students.<sup>6</sup> In 2021, 3 million learners from Africa registered for 5 million courses on Coursera. Moreover, Africa recorded the highest growth in student registrations (up by 43%) and course enrolments (up by 50%). Egypt, with 1.6 million learners, had the largest number of learners in Africa, followed by South Africa, with

<sup>5</sup> <https://www.unisa.ac.za/sites/corporate/default/About/Facts-&-figures/Student-enrolments>

<sup>6</sup> <https://nou.edu.ng/wp-content/uploads/2023/03/NOUN-At-A-Glance.pdf>

approximately 600,000 learners. In terms of learner growth on the platform, Kenya (61%), Ethiopia (60%) and Rwanda (57%) were among the top 10 countries globally (Coursera, 2022).

**According to respondent interviews,<sup>7</sup> COVID-19 increased the appreciation for online learning, reinforced purely online courses that were already in existence before the pandemic and prompted the adoption of blended learning approaches.** Most of the courses that are now offered partially or completely online initially started as face-to-face courses but were compelled to switch to online mode due to the COVID-19 pandemic.

### 3.1.2 Digital Skills and Digital Divide Issues

**While online learning initiatives present new opportunities for accessing quality education, they simultaneously exacerbate the digital divide, which should be addressed as part of the delivery design.** The literature (Deacon et al., 2019; Grönlund et al., 2010; Lembani et al., 2020; Mnyanyi et al., 2010) shows that the transition to digital technology for education has magnified various dimensions of the rural-urban divide due to inadequate physical infrastructure and a shortage of qualified teachers. According to Lembani et al. (2019), South African students with good ICT access in urban areas have a significantly better online educational experience when compared to their counterparts in urban, peri-urban and rural areas with poor ICT access. The study found that students aged 28 years or older or those whose parents attended university education were more likely to have a computer and Internet at home, both of which they considered as ideal for online learning. Additionally, Mässing (2017) reported on the Centre for Open, Distance, and eLearning (CODEL) at the University of Namibia, which uniquely provided all registered distance students with free wireless modem dongles with rationed data bundles to acknowledge the importance of connectivity.

**Two-thirds of the African population still resides in rural areas, where the physical infrastructure, including ICT, continues to remain inadequate. This inadequacy hinders usage (Deacon et al., 2019).** High costs relative to income limit most students' access to computers, making it difficult for them to access quality audio-visual course materials. Access challenges persist due to the high costs of Internet bundles and slow broadband speeds (Mtebe & Raisamo, 2014; Sinha & Bagarukayo, 2019). As per Henaku's report (2020), college students in Ghana experience online learning disruptions attributed to network issues and the high cost of mobile data bundles. A survey by Pather and Boo (2020) during COVID-19 lockdowns revealed challenges encountered by South African university students. Over half reported inadequate and expensive Internet access, thereby hindering online learning activities. Similar challenges were expressed in Nigeria (Abdulmajeed et al., 2020; Adeoye et al., 2020; Ochionuoha, 2023) and Tanzania (Mtebe & Raisamo, 2014).

**From the respondent interviews, the need to shift to online learning during the**

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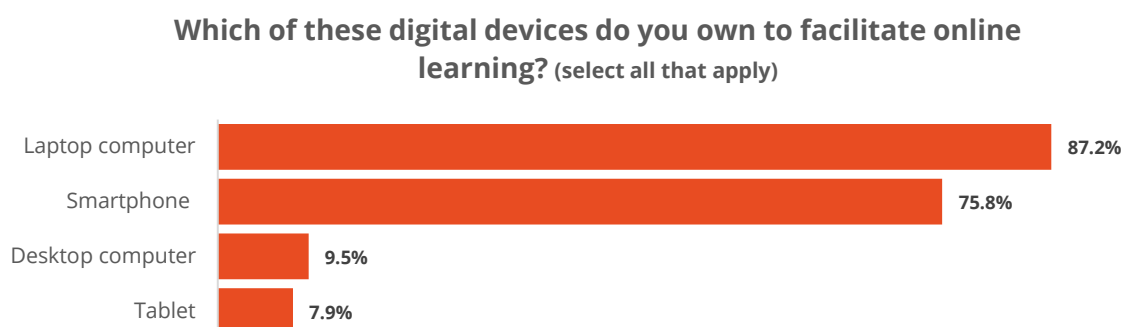
<sup>7</sup> Respondent interviews

**COVID-19 lockdowns further compounded the digital divide.**<sup>8</sup> In order to implement online learning, institutions had to improve their technological infrastructure, including Internet connectivity; equip staff and students with digital devices; and train and support staff in online teaching skills. However, this did not resolve the challenges of availability, quality and cost of connectivity, which led to complete exclusion from education for those living in predominantly rural areas or from economically disadvantaged backgrounds in both urban and rural areas during the lockdowns.

**Many students also lack the necessary digital skills to effectively use online learning resources and platforms provided for an online program (Regmi & Jones, 2020).** Mayrath et al. (2019) found that while students in Kenya had upbeat attitudes toward online programs, they faced challenges in participating in online-only higher education programs due to inadequate digital skills. To overcome the skills gap, they implemented a two-week face-to-face intervention to onboard students and equip them with the essential digital skills required to participate in the online-only program.

**For inclusivity, the design of online content needs to consider the needs of especially that group of students who will be most marginalized in terms having compatible access devices and access to broadband and the affordability of broadband.** The following findings from the online survey illustrate the challenges such students will face.

All the students who responded to the survey had access to some form of digital device that could be used to facilitate learning online. Four out of five respondents (87.2%) had access to a laptop. This was followed by access to a smartphone (75.8%), as shown in Figure 7. In total, one in 10 respondents (11.8%) said that they did not have their own computer (either a desktop or a laptop). However, 74.1% of these respondents said that they had access to a computer (desktop or laptop) through a friend or family member.

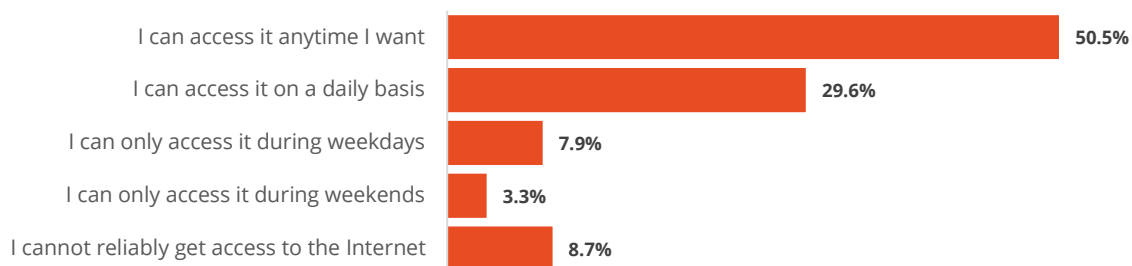


*Figure 7: Proportion of respondents by ownership of different types of digital devices*

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<sup>8</sup> Respondent interviews during this study.

**How easy is it for you to connect to the Internet to access your online coursework and materials? (select one option)**



*Figure 8: Proportion of respondents by frequency of Internet access*

Internet access has several dimensions — frequency of access, quality of Internet and affordability. With respect to frequency of access, 80.1% of the respondents reported having access to the Internet either all the time (50.5%) or every day (29.6%), which is ideal for online learning, as shown in Figure 8. However, 8.7% of the respondents reported lacking reliable access to the Internet, something that would significantly impact their online learning experience. With respect to quality of access, only half of the respondents (54.8%) with reliable Internet access (excluding those without reliable Internet access) had smooth and uninterrupted access to video content. Broadband download speeds are another indicator used to gauge the quality of Internet access in different countries. Table 54 presents a comparison of broadband download speeds from cable.co.uk and indicates that the average broadband download speeds in the participating countries are reasonable and higher than the African average (8.72 Mbps) except in Benin and Ethiopia.

*Table 4: Comparison of broadband download speeds*

Country	Mean download speed (Mbps)	Unique IPs tested	Total tests	Time to download a 5GB movie (HH:MM:SS)	Rank in Africa
Benin	3.14	1,682	17,963	03:37:25	45
Cabo Verde	9.08	1,607	3,146	01:15:11	18
Ethiopia	1.68	21,441	222,765	06:46:21	51
Kenya	12.42	426,705	6,432,698	00:54:58	10
Nigeria	15.37	114,652	1,120,626	00:44:25	5
Rwanda	52.17	2,555	14,964	00:13:05	1
Uganda	11.01	42,487	526,388	01:02:00	12

Source: <https://www.cable.co.uk/broadband/speed/worldwide-speed-league/>

With respect to affordability, individuals in Africa spend 5.1% of their average monthly income on a 2GB mobile data bundle per month. All countries are still significantly higher

than the affordability target of 2% set by the Broadband Commission.<sup>9</sup> In order to participate in an online course, a larger bundle of approximately 20GB would be more suitable. According to the data presented in Table 5 from Research ICT Solutions, learners from Benin would spend the highest proportion of their income on a 20GB bundle of mobile broadband in comparison to the other participating countries.<sup>10</sup>

*Table 5: Affordability of broadband access*

Country	300 MB prepaid monthly use			20 GB prepaid monthly use		
	Price (USD)	Monthly GNI per capita (%)	Africa rank	Price (USD)	Monthly GNI per capita (%)	Africa rank
Benin	4.98	4.3	45	25.76	22.1	38
Cabo Verde	4.94	1.4	25	19.76	5.7	17
Ethiopia	0.37	0.4	8	10.08	11.9	28
Kenya	1.11	0.6	14	7.37	4.1	14
Nigeria	1.02	0.6	12	10.24	5.7	18
Rwanda	1.78	2.3	34	8.90	11.5	27
Uganda	1.15	1.5	26	2.68	3.5	12

Source: RIS ICT Evidence Portal (2023)

Subsidizing the cost of Internet access is a potential area that CMU-Africa can explore to ensure wider access to online programs for students in different African countries. This is already being done by some institutions, such as the Distance Learning Institute at the University of Lagos.

### 3.1.3 Learning and Assessment Challenges

**Online classes offer limited interaction with both lecturers and peers compared to in-person classes, which provide space and opportunity for active engagement (Khetan & Gupta, 2013).** This can make it difficult for students to ask questions, seek feedback and collaborate with peers (Kibuku et al., 2020). Learners may also struggle to build meaningful relationships with their peers because the online platforms do not provide adequate interaction, communication and collaboration opportunities, leading to a lack of social support and motivation (Tan, 2017). This is backed up by the experience of respondents<sup>11</sup> who indicated that a blended approach that combines synchronous and asynchronous learning, virtual and physical engagement, and opportunities for students in the same country to meet physically (for those situations where all engagement with lecturers is virtual) may provide the best balance. It was interesting to note that many respondents felt that a blended learning approach was best as there are aspects that are

<sup>9</sup> ITU Digital Development Dashboard 2022

<sup>10</sup> RIS ICT Evidence Portal, 2023, [https://researchichtsolutions.com/ict-evidence-portal-africa/ict\\_evidence\\_portal\\_africa.php](https://researchichtsolutions.com/ict-evidence-portal-africa/ict_evidence_portal_africa.php)

<sup>11</sup> Respondent interviews during this study

difficult to replicate in an online environment. It is impossible to decide, without a much more in-depth assessment, which is beyond the scope of this study, whether the preference of many for face-to-face is a cultural one or a real assessment of value, but there was a consensus among respondents of the following:

- i. Asynchronous access to learning materials offers great convenience for learners.
- ii. Synchronous engagement enhances interaction and learning.
- iii. Opportunities for face-to-face meetings, especially at learner level, add value.

As one respondent put it: *“Some magic is hard to replicate using online systems.”*

**A challenge to online assessment was indicated by Nwosu and Chukwuere (2020), who identify South African students’ attitudes to plagiarism in online learning and recommend that institutions should provide a mandatory module that teaches students and other content creators about plagiarism and how to reference external work done by others, develop and implement plagiarism policies and implement technical platforms to deter the vice.** While academic dishonesty and trustworthy issues are present in traditional on-campus programs, they can become rampant in the context of online programs. Issues such as plagiarism, cheating, collusion and impersonation or using other people to complete your assignments are exacerbated by factors brought about by working online and remotely, such as the reduced ability to observe students and increased ease of access to information (Surahman & Wang, 2022).

According to the respondent interviews, some of the institutions still require the students to appear in person for physically supervised examinations. Some, however, have gone beyond this: UNISA, for example, offers online examinations<sup>12</sup> prefaced by a training module on taking the online examinations. This examination requires stable Internet, the availability of power throughout the examination session and a computer or laptop with a camera.

Another example is the University of South Australia, which contracts out supervision services to centers within and outside Australia where students are required to appear in person.<sup>13</sup>

### 3.1.4 Summary

- i. **Addressing the need and demand for higher education in Africa:** While higher education plays a critical role in training a skilled workforce, conducting research and building the knowledge base and the human capital necessary for Africa’s transition to digital economies, the GER for higher education was only 9.4% in 2020, underscoring the need for innovative approaches to address the gap.

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<sup>12</sup> <https://www.unisa.ac.za/sites/myunisa/default/Announcements/Step-by-step-guide-to-preparing-for-the-MayJune-2023-Online-Examinations#:~:text=It%20is%20that%20time%20of,May%2FJune%202023%20online%20examinations.>

<sup>13</sup> <https://i.unisa.edu.au/sas/Exams-Results-and-Scholarships/Examinations/External-exam-centres-private-invigilator-resources/>

Addressing the acute shortage of skills needed by the market drives innovative alternatives that leverage hybrid/blended learning and fully online delivery models to bridge the gap.

- ii. **Digital skills and digital divide issues:** While online learning initiatives create new opportunities to access quality education, they simultaneously compound the digital divide, which needs to be addressed as part of the delivery design. Many students lack or have inadequate digital skills, which can impede their ability to navigate and interact with the platform and learning resources provided for an online program. This is compounded by the fact that two-thirds of the population in Africa still lives in rural areas, and the physical infrastructure, including ICT, is poor, and this constrains both access and usage. There is also a local dimension with respect to devices, access, quality of access and affordability. Programs based on online learning need to factor these realities into program design: This will apply to both the nature of the online content and supportive interventions (financing mechanisms for devices and/or cost of access).
- iii. **Learning and assessment challenges:** While the benefits of online learning are recognized, programs also need to recognize and address the limited interaction with both lecturers and peers compared to in-person classes, which provide space and opportunity for active engagement. The creation of opportunities for face-to-face meetings especially at learner level and, where possible, the presence of local expertise to complement the main online learning should be considered.

Attitudes to plagiarism in online learning and assessment also present challenges. Addressing plagiarism starts with creating awareness among the learners, followed by developing and implementing plagiarism policies along with technical platforms to deter the vice. Where weight is placed on examinations, both online platforms and tools, or examination centers located for the convenience of students, can offer assurance of process integrity.

## 3.2 What Motivates Learners To Opt for Online Programs?

The key factors that motivate learners to opt for specific online programs tend to act in combination with each other rather than in isolation. The decision at the individual level involves weighing online courses against the alternatives available locally for in-person learning. Questions posed include the following:

- i. Does the program offer the content I am looking for?
- ii. Does the program provide the flexibility that enables me to fit it in with my other schedules?
- iii. Will I get the required skills and/or recognized certificate credential to enable me to move up the career ladder?
- iv. Can I afford it? Is any financial support provided if I cannot?



- v. Will it provide opportunities for building my networks?

These key factors are discussed below.

### 3.2.1 Content

**African students in online programs are biased toward digital technology skills (Cagiltay et al., 2020).** Most students express interest in the following emerging jobs: data scientist, data analyst, software engineer, ML engineer and marketing specialist. By country, the top jobs by student demand in Egypt were software engineer, data scientist and ML engineer. On the other hand, data scientists, software engineers and data analysts were in demand in South Africa (Coursera, 2023).

In the online survey of potential students, respondents were asked about other topics/areas that they would be interested in studying in online certificate programs. As shown in the word cloud (the size of each word increases with the number of times it is mentioned) in Figure 9, data-related topics and cybersecurity were some of the most frequently mentioned areas. These preferences should be qualified by the fact that the targeted respondents were in or from faculties where such interest would be expected.

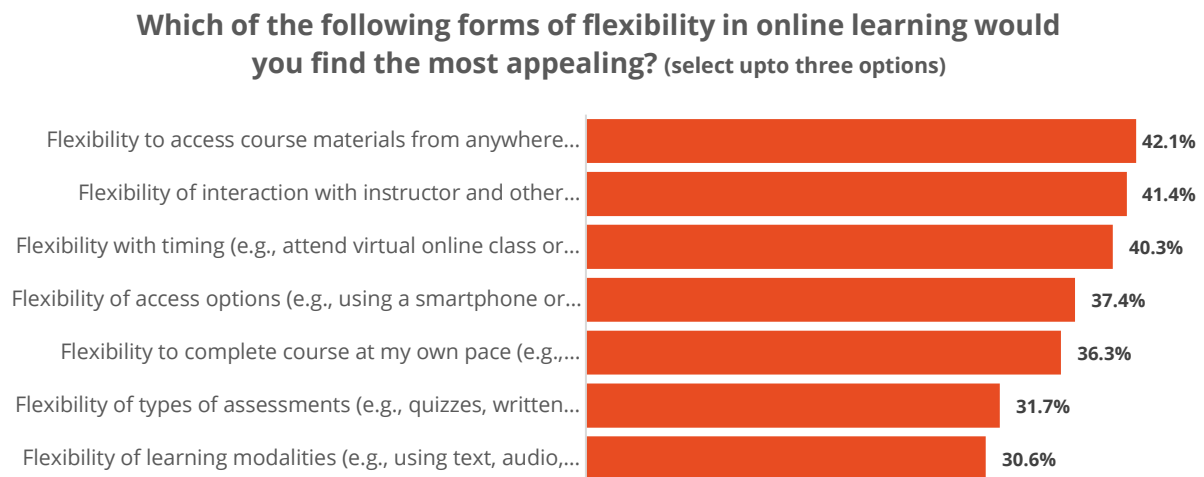


Figure 9: Word cloud showing learning areas of interest to respondents

### 3.2.2 Flexibility

**Online learning allows for flexible scheduling and pacing, removing the constraints of location.** This convenience can be particularly attractive to busy professionals who find it challenging to juggle work, family and other responsibilities and value the

opportunity to learn independently and at their own pace (Forson & Vuopala, 2019; Mathew & Ebele-Iloanya, 2016). The survey further investigated the importance of flexibility in achieving success in online learning by asking respondents about various forms of flexibility and what features of online courses or programs were most appealing to them. According to the results (Figure 10), two-fifths of the respondents (42.1%) found the ability to access course materials from anywhere to be the most attractive feature, closely followed by flexible timing (41.4%).



*Figure 10: Proportion of respondents by different forms of program flexibility*

**It should, however, be noted that providing purely online learning is at the expense of the benefits of human engagement in face-to-face interactions.** The findings from the Final Evaluation of the International Training Program in ICT Regulation — Policy and Practice (KCL, 2021) contrasting training before COVID-19 that included face-to-face interaction and training that was fully online during lockdowns brought into focus the importance of physical meetings, particularly at the start of the program, to help the participants meet one another both formally and informally and to build relationships that would last beyond the program.

### 3.2.3 Career Progression

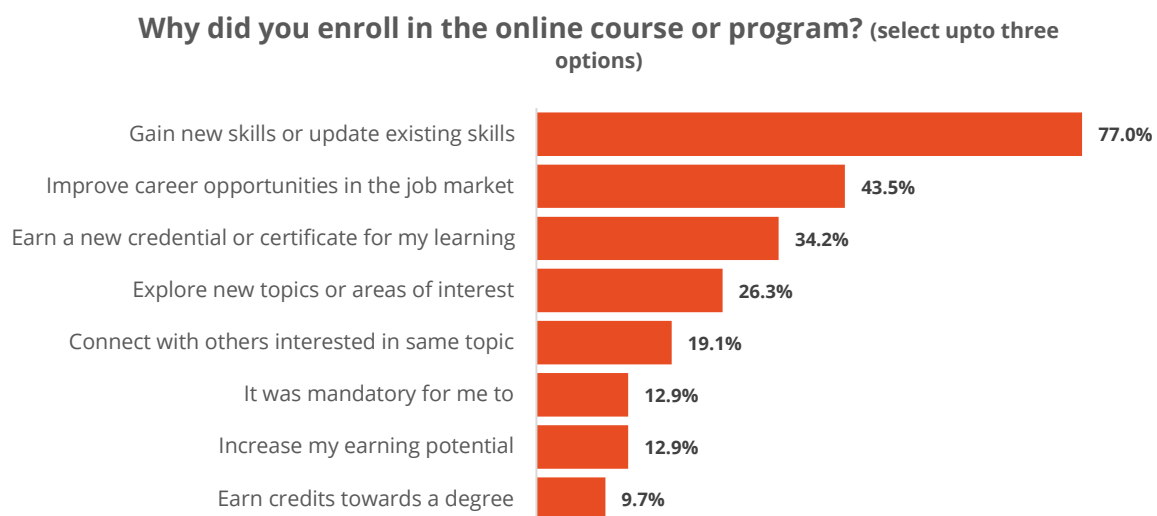
**Among African students, career progression emerged among the top three motivating reasons, along with affordability and convenience, for taking online courses.** These aspects emerged from a UNICAF survey of some of its students on their motivation for studying online. Motivation plays a key role in learners' engagement in and successful completion of online programs.<sup>14</sup> Many learners enroll in online certificate programs to enhance their skills and knowledge to advance their careers or pursue new job opportunities. Ng'ambi (2016) found that learners may be motivated to acquire new

<sup>14</sup> CDC Impact Study: What's the impact of online higher education in Africa? <https://assets.cdcgroup.com/wp-content/uploads/2020/06/23115436/Whats-the-impact-of-online-higher-education-in-Africa.pdf>

skills and knowledge relevant to current and emerging job markets to stay competitive and relevant in their fields and increase their employability.

**The survey carried out as part of this study also confirmed that career progression (which includes acquiring new skills, updating existing skills, improving career prospects and obtaining new credential/certificate) was a key motivator for respondents** (see Figure 11). It was found that students' enrolment in online courses or programs was overwhelmingly driven by the desire to acquire new skills or update existing ones (77%), followed by the desire to improve their career prospects in the labor market (43.5%). There were no significant differences between men and women. The ranking of motivations for women was the same as for the general population of respondents. Among men, slightly more men were motivated by the earning potential (14.3%) than by the obligation to enroll in an online course (13.3%). There were also no major differences by age group. The ranking of motivators for 18–24-year-olds was similar to that of the general population of respondents. Among 25–34-year-olds, slightly more were motivated by exploring new subjects or areas of interest (27.8%) than by gaining a new qualification or certificate (25.9%).

Most respondents (75.5%) had previously enrolled or participated in an online course or program. Of these, 85.6% had successfully completed one or more online courses or programs.



*Figure 11: Proportion of respondents by motivation for enrolment in online course or program*

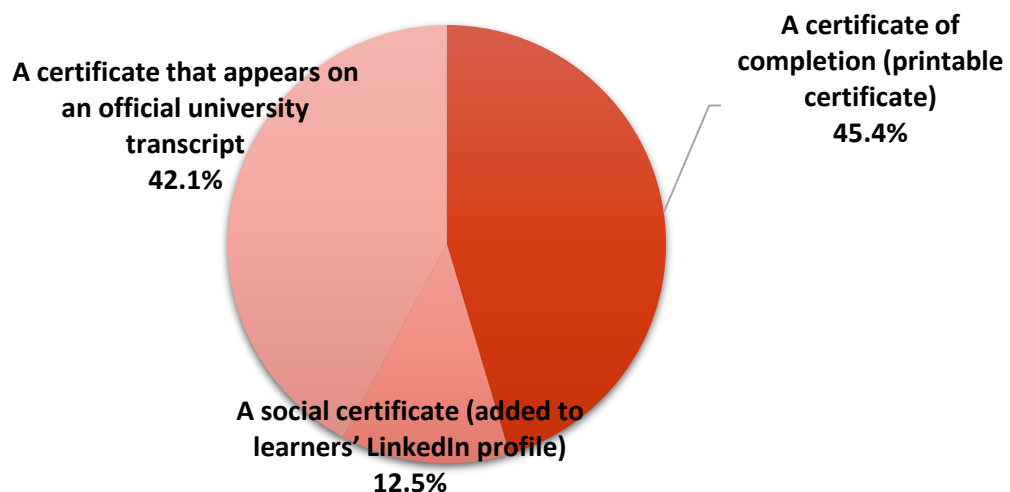
**Exploring new topics or areas of interest also emerged as significant (at 26%) for potential learners.** Indeed, from the literature, learners also engage in online programs for personal growth and development, such as learning a new language, developing a new hobby or gaining knowledge on a specific topic (Song & Bonk, 2016).

**The need for recognition, coupled with the growing interest in micro-credentials and alternative credentials (Ahsan et al., 2023), should be considered in the design of certificate programs.** Jobe (2014) found that Kenyan learners highly valued online

badges and certificates. They felt that certificates from reputable online programs were useful when applying for jobs as they demonstrated their expertise and credibility to potential employers. Gauthier (2020) points out that employees like micro-credentials because they provide a good mechanism for articulating their competency. Employers like them because they provide a good way of certifying candidates' skills. Brown et al. (2021) document the growing global interest in micro-credentials driven by industry and their relationship to lifelong learning, employment and emerging digital education models. They conclude that as demand for micro-credentials grows, governments will align micro-credentials with their national qualifications frameworks, creating new opportunities for HEIs. Kato et al. (2020) provide guidance to policymakers across the Organization for Economic Co-operation and Development (OECD) by defining terminology, identifying characteristics of micro-credentials, looking at providers and learners of these credentials and examining how employers and governments perceive these credentials.

The survey asked respondents about the type of certificate they would like to receive upon successful completion of an online course or program given the importance of certificates as proof of having acquired certain knowledge and experience or even when applying for a job. Two out of five students preferred to receive a printable certificate of completion (45.4%) or a certificate that would appear on an official university transcript (42.1%). Highlighting the growing importance of digital credentials in an increasingly digital workplace, a smaller proportion (12.5%) preferred a digital certificate that they could add to their LinkedIn profile, as shown in Figure 12.

**What type of certificate would you like to get after successfully completing the program?**



*Figure 12: Proportion of respondents by certificate type*

**Williams et al. (2018) found that Science, Technology, Engineering and Mathematics (STEM) students were more motivated to take a course for a credit or placement exam or to use what they learned in their studies or career than humanities/liberal**

**arts (HLA) students.** They examined the relationship between demographic student characteristics and self-reported learner goals among 15,655 edX users across eight UTAustinX MOOC courses categorized as either HLA or STEM. The learner goals included (i) personal interest and lifelong learning, (ii) learning more about online learning, (iii) preparing for a credit/placement exam, (iv) using course knowledge in an area of study or career, (v) taking a course from particular university/specific professor, (vi) connecting with others interested in this topic and (vii) other.

**Walsh et al. (2018) found that relevance to the local contexts can also motivate African learners to engage in online programs.** Learners were more likely to engage in a program they deemed relevant to their community or country or one that addressed issues that they deemed important (Mittelmeier et al., 2018). This theme also emerged from the Interview phase of this work, where respondents underscored, among other things, checking that the proposed course materials are locally relevant along with use cases from the local environment; motivating students to solve their own problems or problems present in their local context; and incorporating an entrepreneurship module, which is currently very popular in Africa.

### 3.2.4 Affordability

**Cost is another important factor motivating African learners to enroll in online programs.** Education in Africa consumes a large proportion of average household incomes,<sup>15</sup> and the rising cost of higher education threatens an even bigger proportion. The jump in prices for higher education is driven largely by dwindling government funding over the last two decades coinciding with the growing interest in online learning as a more cost-effective and accessible option compared to traditional in-class programs (Bowen, 2015; Calitz & Fourie, 2016; Oketch, 2016). Cost as an important factor in enrolling in an online program, with one in two (53.3%) choosing availability of scholarships as the most important factor and one in three (31.8%) selecting affordability (Figure 14). Alongside this were the quality of the teaching staff, the flexibility of the program and the reputation of the university.

The survey asked respondents interested in the AI/ML certificate how much they would be willing to pay/receive to complete the program. The largest number of respondents (43.4%) preferred to receive a \$100 credit toward other online programs. This was followed by those willing to pay up to \$100 for the entire program (31.3%). In addition, one in two respondents (54.3%) preferred a flexible payment plan that would allow them to pay as and when they received the money as long as they managed to pay the full amount before the program ended.

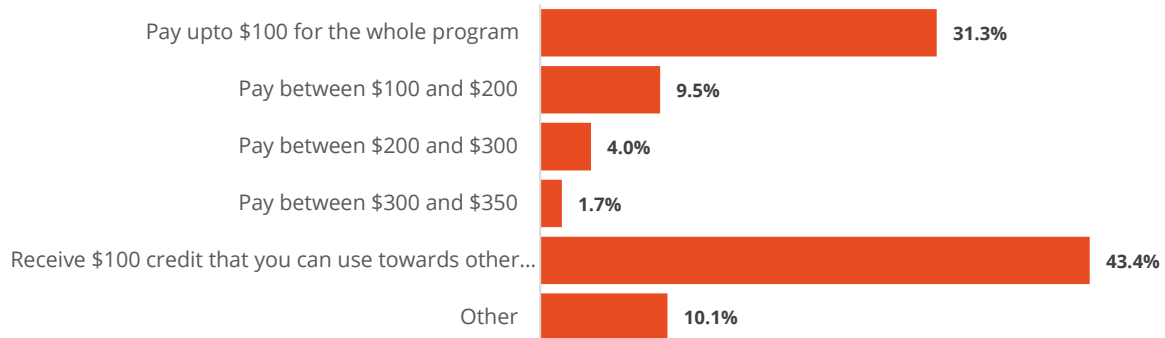
It is also clear that many students would benefit from additional financial support. Although it was not an aspect of this survey, the consultants know from experience that while many family groups will support the first degree, their general feeling is likely to be

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<sup>15</sup> <https://www.thinkglobalhealth.org/article/steep-price-education-africa>

that the graduate is now able to fund their own higher education. The aspect of equity for these may create the need for different levels of financial support. This highlights the need for CMU-Africa to consider offering scholarships to online students as it is already doing for traditional campus-based students.

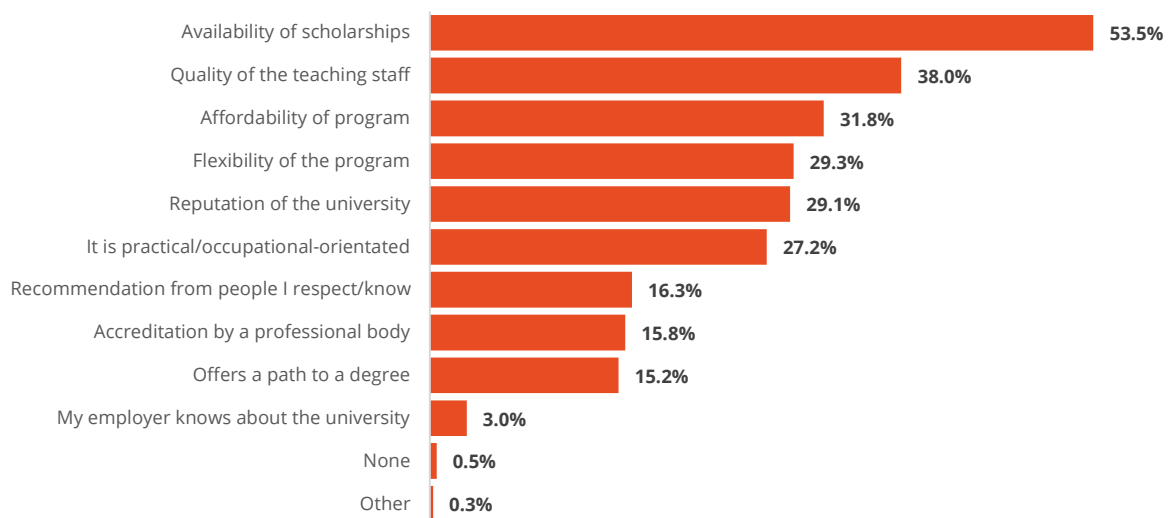
**How much would you be willing to pay/receive for the online certificate in artificial intelligence and machine learning?  
(select one option)**



*Figure 13: Proportion of respondents by what they are willing to pay for AI/ML certificate program*

Other important factors include the quality of the teaching staff, cited by one in three respondents (38%), the flexibility of the program (29.3%) and the reputation of the university (29.1%) as key factors that would influence their choice of university for an online course or program.

**What factors can influence your selection of a University to study an online certificate program? (select upto three options)**



*Figure 14: Proportion of respondents by university selection influence factor for online courses*

**There were some differences with respect to the main influencing factors by gender and age group, as indicated in Table 6.** After the top two factors, which cut across groups and the general population of respondents, more women were influenced by the flexibility (31.9%) compared to the affordability (27.7%) of the program. For men, affordability (33.2%) still ranked third, but flexibility (28.5%) dropped down to sixth in favor of a more practical or occupational-oriented program (29.2%). Among age groups, the factors for 18–24-year-olds were similar to the general population of respondents. More 25–34-year-olds were influenced by flexibility (30.8%) and the practical or occupational-oriented program (29.5%) compared to the affordability (17.9%) of the program.

The program should also factor in nuances such as the fact that women rank flexibility of the program higher than affordability, while for men, this is the opposite, both in design and messaging for the new online program.

*Table 6: Ranking of different influence factors for online courses by gender and age group*

Influencing Factor	Ranking				
	General	Female	Male	18–24 years	25–34 years
Availability of scholarships	1	1	1	1	1
<b>Quality of the teaching staff</b>	2	2	2	2	2
<b>Affordability of program</b>	3	4	3	3	6
Flexibility of the program	4	3	6	4	3
<b>Reputation of the university</b>	5	5	4	5	5
<b>It is practical/occupational-orientated</b>	6	6	5	6	4

As a leading global university, CMU-Africa should communicate its global rankings, accreditations and reviews to promote the online certificate as a credential that can help successful learners stand out in a crowded job market.

### 3.2.5 Collaborative Learning and Networking Opportunities

**Networking opportunities can also motivate online learners in Africa to engage in online programs, where social and academic integration creates strong interpersonal relationships (Hadullo et al., 2018).** Online certificate programs can help learners build their professional networks and access new opportunities by allowing them to connect with other learners from around the continent and beyond and to engage in discussions and collaborations that broaden their perspectives and knowledge.

Dumford and Miller (2018) further note that the quality of interactions with students and staff and the overall perception of a supportive environment contribute to student engagement. Martin and Bolliger (2018) investigated student perceptions of various learner-to-learner interactions in an online class via a survey using a 5-point Likert scale (ranging from 1 [very unimportant] to 5 [very important]). Online students selected using



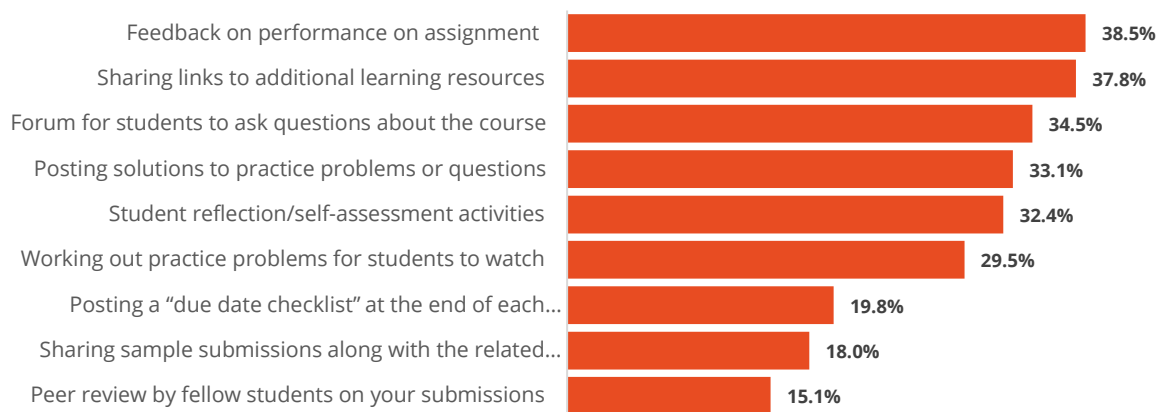
an icebreaker discussion for introductions as the most important interaction strategy and using a virtual lounge as the least important, as shown in Table 7.

**Table 7: Learner-to-learner interactions (ranked by mean score on 5-point Likert scale)**

Interaction	Mean	Standard deviation
Students introduce themselves using an icebreaker discussion.	4.08	0.93
Students work collaboratively using online communication tools to complete case studies, projects, reports, etc.	3.94	1.07
Students interact with peers through student presentations (asynchronously or synchronously).	3.89	0.93
Students have choices in the selection of readings (articles, books) that drive discussion group formation.	3.78	0.95
Students peer-review classmates' work.	3.66	1.09
Students post audio and/or video files in threaded discussions instead of only written responses.	3.60	0.92
Students moderate discussions.	3.55	0.93
Students complete an integrated profile on the learning management system that is accessible in all courses.	3.45	0.97
Students are required to rate the individual performance of team members on projects.	3.38	1.13
Students use a virtual lounge where they can meet informally to share common interests.	3.03	1.17

Source: modified from Table 1 in Martin and Bolliger (2018)

**Which of the following types of feedback would you find most useful for online learning? (select upto three options)**



**Figure 15: Proportion of respondents by feedback type**

Feedback enables students to assess their progress and identify potential areas for self-improvement. The survey asked students, based on a short list drawn from the literature, which types of feedback they found most useful when enrolled in an online program or course. One out of three students (38.5%) reported that feedback on performance on assignments was the most useful type of feedback, followed by sharing links to additional



learning resources (37.8%) and the use of forums to ask questions about the course (34.5%), as shown in Figure 15.

The most useful type of feedback differed by age group. Most 18–24-year-olds (39.7%) preferred feedback on performance on assignment, while most 25–34-year-olds (42.6%) preferred using a forum for students to ask questions about the course.

To communicate with instructors and fellow learners in an online course, respondents ranked different channels similarly. Most respondents preferred to communicate with instructors (48.9%) and fellow students (37.2%) face to face but using virtual tools such as video conferencing tools, followed by instant messaging applications.

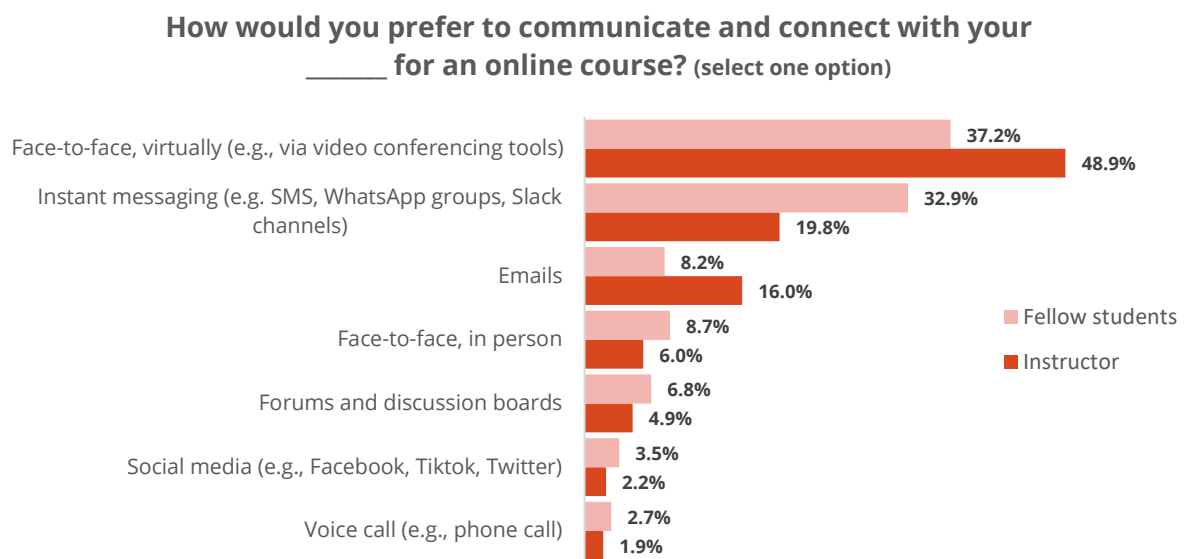


Figure 16: Proportion of respondents by communication preference

### 3.2.6 Summary

Understanding these factors can influence the design of online certificate programs targeting African learners in various ways:

- i. **Content:** African students in online programs are biased toward digital technology skills. Local context and relevance are important additional considerations. Programs need to address local challenges and issues important to African learners. For example, Africa faces a myriad of problems in agriculture, which is the backbone of most countries. The program can include relevant case studies and assignments that illustrate how AI/ML can help optimize agricultural production and improve food security. Similarly, AI/ML can help improve health outcomes by enhancing disease diagnosis, treatment and management or improve financial inclusion by providing insights into customer behavior and managing risks. In addition, programs must acknowledge and consider the

diversity of learners across Africa and incorporate culturally appropriate examples, cases and scenarios into the curriculum.

- ii. **Flexibility:** Online learning needs to provide the flexibility of schedules and pace through different delivery modes, eliminating location and time barriers, which is particularly important for students in employment and/or having social obligations that make it difficult to attend full-time in-person training. Female respondents to the online survey placed flexibility at a higher priority than male respondents, and this needs to be borne in mind in addressing gender inequity.
- iii. **Career progression:** Among African students, career progression emerged among the top three reasons motivating student enrolment. Programs should offer the latest skills and knowledge relevant to current and emerging job markets across the continent. An example is recognizing the opportunities the growth in global outsourcing brings to developing countries and the higher-level specialist skills that are increasingly needed. Institutions offering online certificate programs need to partner or be affiliated with an accredited and reputable local or foreign university to signal quality to potential students and employers. Beyond career progression, this can provide learners with a sense of accomplishment and serve as a motivator for further study.
- iv. **Affordability:** Online programs must be affordable and should generally cost much less than in-person campus-based programs. Partial or full scholarships as well as other financial and non-financial incentives will expand catchment and reduce inequity.
- v. **Collaborative learning and networking opportunities:** Programs need to provide opportunities for collaborative learning, where learners work together to solve problems, share knowledge and experiences and build relationships. In addition, programs should offer learners opportunities to connect with colleagues from around the continent and beyond to engage in discussions and collaborations that help broaden their perspectives and knowledge. Occasional physical meetings that bring together students in the African sub-regions or beyond, if these can be arranged as part of the study, would be a great benefit.

### 3.3 What Predicts Student Success in Online Programs?

**Understanding the key characteristics that can be used to build the profile of a successful online learner is essential for educators to design effective online learning experiences that meet the diverse needs of their students.** The success predictors fall into four main categories: demographics, motivation, digital skills and self-regulation skills. By complementing these with external factors such as instructors with the appropriate competencies required for online teaching success (Martin et al., 2019) and a variety of appropriate learner support services (Babacan & Thurgood, 2022),

institutions can improve student engagement and motivation. This will ensure that students can successfully attain learning outcomes in online learning environments.

### 3.3.1 Demographics

**Demographic characteristics such as age, gender and educational level can play a role in predicting student success in online programs, but research findings are still mixed.** Williams et al. (2018) found that as student age increased, students were much more likely to continue with coursework in both HLA and STEM courses. Glazier et al. (2020) discovered that student success varied with the specific mix of course delivery (entirely online vs. entirely face to face vs. hybrid), with younger female students doing well with any mix of course modalities, while older male students were less successful as they increased the proportion of their online courses. Lembani et al. (2019) found that mature students (28 years or older) and students whose parents had a university education were more likely to have computer and Internet access at home compared to younger students and those whose parents lacked a university education.

As shown in Table 8, the survey results reveal differences in enrolment in and the successful completion of online courses or programs by gender and age group. A higher proportion of women (79.8%) reported having enrolled or participated in an online course or program compared with men (74.1%), with a slight difference in the rates of successful completion. Similarly, a higher proportion of those aged 18–24 (77.7%) reported having enrolled or participated in an online course or program compared with those aged 25–34 (69.2%), but the proportion of successful completions was reversed (90.7% vs. 84%).

*Table 8: Proportion of students enrolled and successfully completing online program by age and gender*

Demographic characteristic	Proportion enrolled in online course/program (%)	Proportion that successfully completed online course/program (%)
<b>Gender</b>		
Female	79.8	86.7
Male	74.1	85.2
<b>Age group</b>		
18–24 years old	77.7	84.0
25–34 years old	69.2	90.7

### 3.3.2 Motivation

**Successful online students have good self-motivation to help them stay on track with their coursework and complete assignments on time even with competing work, family and personal obligations (Kauffman, 2015; Ugwuanyi, 2020).** They must be able to do this without the usual help of the synchronous scaffolding provided by a

traditional on-campus program that comes with the schedule of a physical classroom setting and timetable.

**The literature also proposes recruiting more competent and motivated students as key to improving retention and consequently ensuring successful completion of online learning programs (Seery et al., 2021).** To address the gap between the growing popularity of online learning and the poor completion rates, Muljana and Luo (2019) investigated various factors influencing online student retention at the institutional, instructor and student levels. They found that institutional support, such as online course orientation, student support services and technology support services, were essential to improving student retention for online learning. Instructors need to plan and to leverage online pedagogy to identify potential dropouts that largely happen at the beginning of the course and support such students to remain. Table 9 provides an overview of the most common retention strategies mentioned in the literature published between 2015 and 2019 (Seery et al., 2021). Good retention strategies increase the motivation of students to stay and complete the course.

*Table 9: Types of online student retention strategies found in the literature*

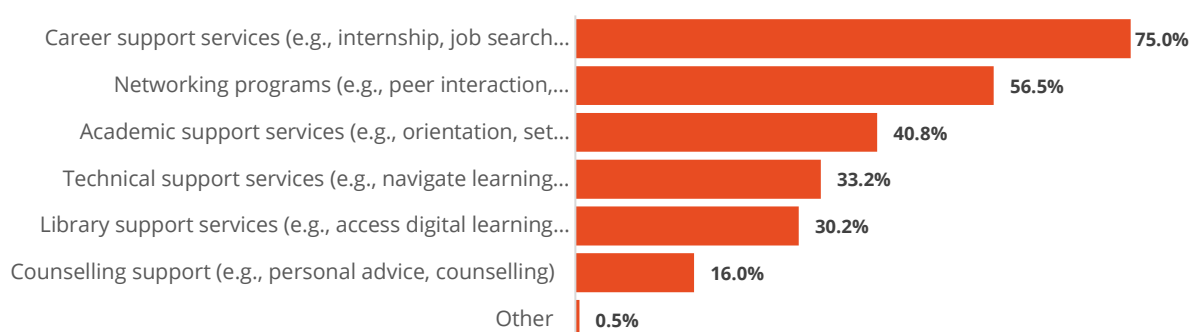
<b>Types of Strategy</b>	<b>Strategy Details</b>
Course development strategies	Creating effective assessment procedures; offering feedback; utilizing video lectures, case studies and multimedia resources; encouraging cognitive engagement; and connecting curriculum to past experiences and future learning goals are common course development strategies.
Student success support strategies	Providing student services, offering student support, making orientation program mandatory, creating student success courses, developing academic skills and recognizing the importance of the diversity each student brings to the classroom help support student success.
Faculty involvement strategies	Enhancing faculty training and support, developing lecturers' online presence, encouraging the quality of faculty and student interactions and providing opportunities for collaborative engagement support faculty involvement.
Social engagement strategies	Providing opportunities for social interaction (blogs, chat rooms, wikis and forums), building community, creating a sense of belonging and establishing trust help satisfy the need for social engagement.
Emotional engagement strategies	Managing expectations, articulating assumptions, recognizing motivations, committing to learning and student self-discipline influence emotional engagement.
Understanding the profile of online student dropouts	Understanding the profile of students with high chances of dropping out is important to design a retention and support program.
Comprehensive student integration	Students from different cultural backgrounds may feel unrepresented and less integrated. Strategies to involve these specific groups and motivate them to increase their intentions to continue their studies will increase retention rates.
Course development	The development of a course design that may involve students with different learning modes and specific demands might motivate students to continue their studies.
Rethinking the retention process	Rethinking the characteristics of distance learning students and their specific characteristics provides institutions alternatives to retain learners

with different demands, such as access to scholarships, loans and financial incentives to continue their studies.

Source: Modified from Table 7 in Seery et al. (2021)

The survey asked potential students about the type of support services they would like to see to ensure successful completion of online programs. The range of support options was based on those often available to students attending programs on a physical campus. Three out of four respondents (75%) mentioned career support services, followed by networking programs (56.5%) and academic support services (40.8%), as shown in Figure 17.

**Which kind of support services would you like CMU-Africa to provide you to ensure successful completion of the online certificate program? (select upto three options)**



**Figure 17: Proportion of respondents by support services required**

The interview respondents echoed some or parts of the findings from the literature and the student survey as follows:

- i. Delivery methodologies and techniques that provide flexibility to accommodate learners' work, family and social circumstances while at the same time creating opportunities for learners to interact on a peer-to-peer basis.
- ii. Consideration of technological challenges (connectivity and access to appropriate devices) when planning delivery.
- iii. Regular and timely feedback on learner progress via email, LMS, classroom platforms, course platforms.
- iv. Providing robust support for learners, including technology, academic and course advisors, e-tutors, counseling and a 24-hour helpdesk.
- v. Providing financial support where needed.

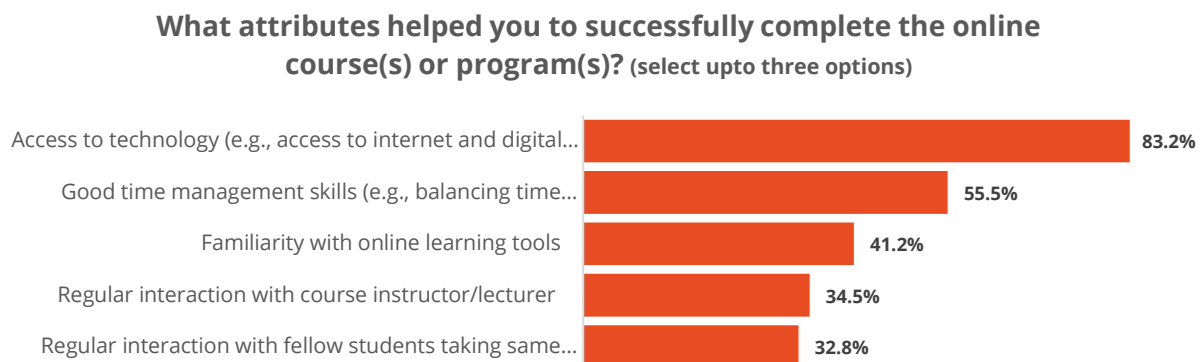
### 3.3.3 Digital Skills and Infrastructure

**Online students need good technical skills or digital competencies for success because they must rely on various technologies to access course materials, find learning resources, communicate with the instructor and their peers and submit assignments (Cabero-Almenara et al., 2023; Lembani et al., 2020).** Students with good

technical skills use technology more easily, such as learning management systems and video conferencing platforms. A successful online program must audit and ensure that all enrolled students have the basic technical skills they need to complete the program (Adarkwah, 2021; Tarus, 2015).

In the survey, learners who had successfully completed an online course or program identified access to technology as the most important characteristic (83.2%) contributing to their success, followed by good time management skills (55.5%) and familiarity with online learning tools (41.2%), as indicated in Figure 18.

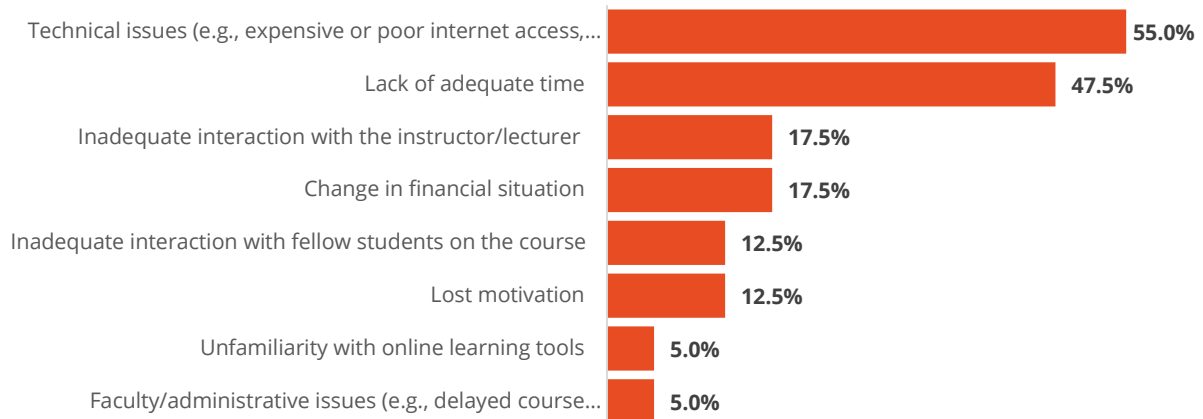
While men, 18–24-year-olds and 25–34-year-olds ranked the factors that helped them successfully complete an online course or program similarly to the overall population, women bucked the trend, ranking regular interaction with fellow students (36.9%) higher than familiarity with learning tools (35.4%) and regular interaction with the course instructor (30.8%).



*Figure 18: Proportion of respondents by attribute for successful completion of online course or program*

The main reasons given by learners for not completing an online course or program were technical problems such as expensive or poor Internet access and access to digital devices (55%) and lack of adequate time (47.5%).

**Why did you fail to complete the online course or program?**  
(select upto three options)



*Figure 19: Proportion of respondents by reason for failure to complete online course or program*

### 3.3.4 Self-regulation Skills

**Studies also show that online students need adequate self-regulation skills for success (Delen & Liew, 2016; Inan et al., 2017; Kauffman, 2015).** For example, Inan et al. (2017) explored the four sub-components of self-regulation — planning, time management, help-seeking and self-evaluation — and found that self-regulation, specifically planning, was an important factor for explaining student success and satisfaction in an online course. Kauffman (2015) found that having good time management skills and motivation were significant predictors of success in and satisfaction with an online course, with less importance tagged to good technical skills.

### 3.3.5 Summary

**In summary, student backgrounds and characteristics are success predictors, and profiling students right after admission will guide in the selection of the best mix of instructional methodologies and other support to maximize the likelihood of successful completion for each student category.** For clarity and emphasis, beyond the basic entry requirements, pre-admission profiling should never be carried out as this could become or be perceived as a means of exclusion.

- i. **Student demographics:** Demographics, particularly age, tend to have a correlation with access to resources such as a laptop or computer and a good Internet connection, which are necessary to harness the flexibility afforded by online learning. Students 25 years old and below (traditional age of undergraduate study at university) tend to have less access to computers and the Internet at home compared to older students. Male students tend to use public ICT facilities more compared to female students. Imbalances in terms of access to opportunities such as education, income and infrastructure between urban and rural areas do have an impact on students living in these areas, usually to the

detriment of those living in rural areas.

- ii. **Student motivation:** For each new student, the main motivation for joining the program needs to be established. This also leads into self-motivation: Do they need the qualification strongly enough to make sacrifices to achieve success?
- iii. **Student digital skills:** Online students may withdraw from online programs when they encounter technical obstacles or lack the technical skills to thrive in the program. A successful online program needs to make plans for improving the technical skills among enrolled students to ensure that they have the basic technical skills they need to complete the program. In addition, there is a need to provide technical support and to inform students about who to contact for support when they experience technical issues during the course.
- iv. **Student self-regulation skills:** These skills have been found to greatly impact student success, self-discipline and satisfaction in online learning because this mode of learning places more responsibility on the student to learn independently compared to traditional on-campus in-class learning. The design of the course needs to integrate strategies that facilitate different self-regulation skills, such as planning, being organized, time management, seeking help where necessary and self-evaluation within the course. Student performance needs to be continuously monitored so that students are given prompt feedback and encouraged to interact with their peers and instructors.

While recruiting motivated and competent students is a good first step toward improving retention, CMU-Africa needs to have a robust retention plan for online students that encompasses a wide range of strategies from better online course development to better online student support.

### 3.4 The How of Online Student Engagement

**The process of student engagement, or active participation and involvement in learning, has been identified as critical to the successful completion of online learning programs.** Successful students engage through their behaviors, emotions and cognition, which can be enhanced through digital technology, careful planning and sound pedagogy (Bond et al., 2020; Malan, 2020).

Both the literature and the respondent interviews highlighted several factors that affect student engagement. Along with effective approaches to engagement, understanding these factors helps in improving student engagement and completion rates. There are also approaches that specifically target improving course completion.

All these are discussed under the following sub-headings:

- i. Learner characteristics
- ii. Engagement approaches
- iii. Technology and platforms



### 3.4.1 Learner Characteristics

**Whether or not students are auditory or visual learners will impact the choice of interaction methods.** Chieke et al. (2017) identified auditory and visual learner profiles in adult learners in Nigeria. The study stresses that auditory learners process information when spoken and benefit best from lectures, podcasts and other audio-based resources. In contrast, visual learners acquire knowledge by seeing objects, with learning happening when ideas, concepts, data and other information are processed with images and visual techniques. Chen (2019) found that auditory learners acquire information with improved performance when they listen to or read the materials. R.A and Indriani (2020) note that visual learners are driven to absorb data visually before understanding and conceptualizing the information they are presented with.

### 3.4.2 Engagement Approaches

In a survey motivated by the need to improve engagement (Martin & Bolliger, 2018), students rated sending regular announcements and email reminders as the most important learner-to-instructor strategy (Table 10) and working on realistic scenarios as the most beneficial learner-to-content interaction strategy (Table 11). The survey used a 5-point Likert scale (ranging from 1 [very unimportant] to 5 [very important]).

*Table 10: Learner-to-instructor interactions (ranked by mean score on 5-point Likert scale)*

Interaction	Mean	Standard deviation
The instructor sends/posts regular announcements or email reminders.	4.53	0.67
The instructor posts grading rubrics for all assignments.	4.41	0.79
The instructor creates a forum for students to contact the instructor with questions about the course.	4.36	0.81
The instructor posts a “due date checklist” at the end of each instructional unit.	4.33	0.89
The instructor refers to students by name in discussion forums.	4.13	0.87
The instructor creates a course orientation for students.	4.10	0.92
The instructor provides feedback using various modalities (e.g., text, audio, video and visuals).	4.05	0.88
The instructor creates short videos to increase instructor presence in the course.	4.04	0.98
The instructor uses various features in synchronous sessions to interact with students (e.g., polls, emoticons, whiteboard, text or audio and video chat).	3.85	0.88
The instructor provides students with an opportunity to reflect (e.g., via a journal or surveys).	3.67	0.99

Source: modified from Table 2 in Martin and Bolliger (2018)

**Table 11: Learner-to-content interactions (ranked by mean score on 5-point Likert scale)**

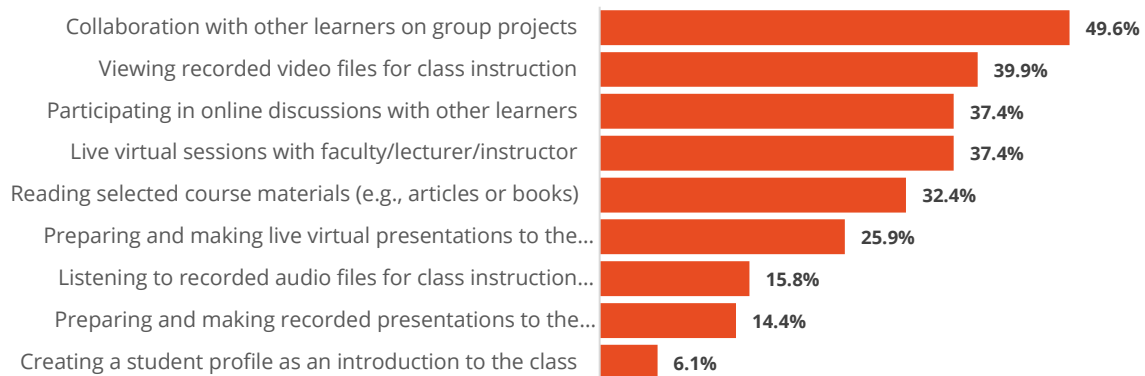
<b>Interaction</b>	<b>Mean</b>	<b>Standard deviation</b>
Students work on realistic scenarios to apply content (e.g., case studies, reports, research papers, presentations, client projects).	4.40	0.65
Discussions are structured with guiding questions and/or prompts to deepen students' understanding of the content.	4.39	0.66
Students interact with content in more than one format (e.g., text, video, audio, interactive games or simulations).	4.17	0.81
Students use optional online resources to explore topics in more depth.	4.09	0.72
Students have an opportunity to reflect on important elements of the course (e.g., use of communication tools, their learning, team projects and community).	4.00	0.81
Students research an approved topic and present their findings in a delivery method of their choice (e.g., discussions forum, chat, web conference, multimedia presentation).	3.97	0.82
Students search for and select applicable materials (e.g., articles, books) based on their interests.	3.97	0.81
Students use self-tests to check their understanding of materials.	3.54	0.98
Students experience live, synchronous web conferencing for class events and/or guest talks.	3.40	1.06

Source: modified from Table 3 in Martin and Bolliger (2018)

**Williams et al. (2018) found that the following three out of seven learner goals had a significant positive impact on student engagement: (i) using course knowledge in a current or future career (career advancement), (ii) learning more about a topic in which they are personally interested (personal growth) and (iii) connecting with others interested in the course (networking opportunities).** Course engagement was significantly higher for male students and students enrolled in STEM courses. Course engagement also increased with participant age.

In the survey, all students who had enrolled in an online course or program were asked which learning activities they had found most useful in their experience. These were chosen from a short list derived from the literature. One in two students (49.6%) felt that working with other learners on group projects was the most useful learning activity, closely followed by the use of recorded video files for classroom instruction (39.9%).

**Which of the following learning activities do you find most engaging for online learning? (select upto three options)**



*Figure 20: Proportion of respondents by most engaging online learning activity*

**Respondents interviewed as part of this study emphasized that whether learning used synchronous or asynchronous approaches, the traditional lecture mode of the “talking head” should be avoided and replaced by approaches that encourage student-to-student interactions.** This goes hand in hand with interactive learning content, practical work, assignments, quizzes of various types, gamified learning and group project work, which were said to improve engagement and learning. The need for labs points to collaboration with local institutions or access to e-labs. For example, the ADDA program uses computer labs at the Malawi University of Science and Technology, while the distance learning programs at Addis Ababa University, the University of Rwanda and the Distance Learning Institute of the University of Lagos provide on-campus computer labs for regular use by distance learners.

**In terms of assessment methods, three out of five students (59.4%) found group projects most useful.** This was closely followed by online quizzes (50.7%). The least useful assessment methods, according to students, were contributions to forums or online discussions (15.5%) and written essays (10.1%).

### Which of the following assessment methods do you find most useful for online learning? (select upto three options)

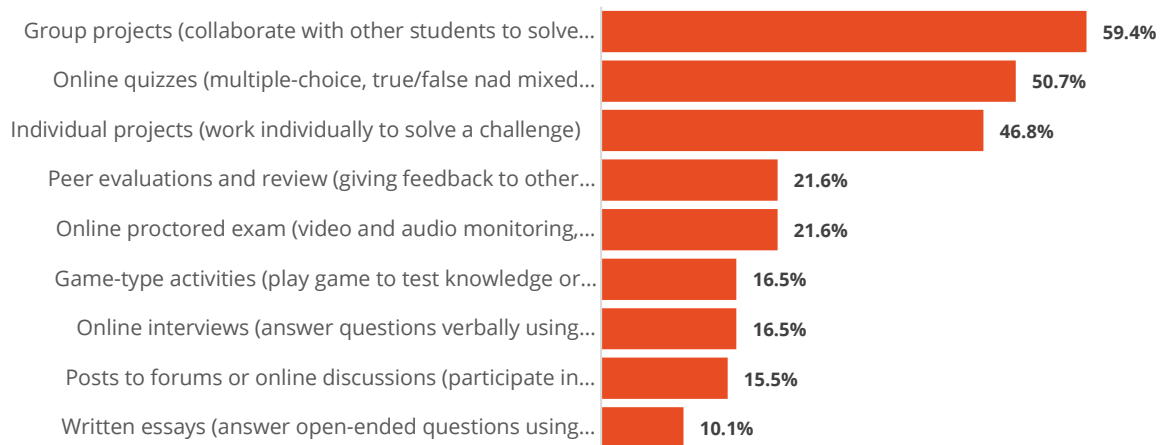


Figure 21: Proportion of respondents by most useful assessment method for online learning

### 3.4.3 Delivery Models and Platforms

**Technology can be used to build better engagement with students in online programs, but technology can also cause disengagement.** Bond et al. (2020) conducted an extensive review of the literature on the nexus of student engagement and digital technology used to support learning in higher education; they identified a wide range of indicators that have been used to measure student engagement and disengagement. The top five most frequently used indicators to measure student engagement were participation, achievement, positive interaction with teachers and peers, enjoyment and learning from peers. Based on the review findings, they encourage HEIs to use text-based tools and multi-modal production tools to support learning. In addition, there is a need to be careful when using website creation tools (e.g., blogs and eportfolios), social networking tools (some students found it difficult to express themselves in short posts, and others disliked mixing personal and academic spaces, while yet others felt the conversations lacked authenticity) and assessment tools (some students found timed assessments stressful, particularly when trying to complete complex mathematical solutions as well as quizzes given at the end of lectures instead of allowing time to understand and reflect on the content first), which were found to be disengaging in the review when not employed effectively.

**The Cyprus-based UNICAF, founded in 2012,<sup>16</sup> uses a platform that combines elements of an online program management (OPM) company by packaging programs from partner universities in the U.S. and U.K. and offering these directly to Africans on the continent (in English and French) at a much lower price via the**

<sup>16</sup> <https://www.nytimes.com/2019/06/07/education/learning/online-higher-education-opportunities-africa.html>

**online UNICAF University<sup>17</sup> as well as short courses (ranging from several hours to weeks) targeted at working professionals via their dot org website.<sup>18</sup>** A typical degree costs \$4,000 and may be complemented by scholarships, while short courses cost less than \$50 each. UNICAF runs campuses in Malawi and Zambia, where it appears to rely on external accreditation from the British Accreditation Council for the different programs offered by the local campuses.<sup>19</sup> In Uganda, UNICAF has a provisional license to operate as a university.<sup>20</sup> In contrast, it operates local support centers in the Democratic Republic of the Congo, Egypt, Ghana, Kenya, Morocco, Nigeria, South Africa and Zimbabwe.<sup>21</sup> While CMU has a reputation and has added the unique factor of tailoring online courses to the African market, other aspects, such as providing a local support infrastructure that may boost effectiveness and quality, must be considered.

**Another emerging model is where private sector companies partner with governments and global professional development platforms, such as Coursera and edX, to offer short courses and full programs to upskill their employees in a defined location.** For example, Coursera, edX and Udacity have partnered with the Egyptian government and private sector companies to implement the Next Technology Leaders (NTL) program, which offers a wide range of courses from international universities and industry organizations to qualified young Egyptian professionals to prepare them for jobs in technology and entrepreneurship.<sup>22</sup> These partnerships usually require content from renowned universities on the global development platforms, making it difficult for African universities that lack sufficient human and financial resources to compete with universities in the Western world.

**From respondent interviews, learning platforms are generally chosen to ensure that planned learning activities can be carried out online.** Moodle appears to be the most used online course management and learning platform among the respondents' home institutions, possibly due to its open-source nature and supportive community. Synchronous online learning is conducted through Zoom and Google Meet, while asynchronous learning commonly takes place through YouTube. Other platforms and general applications mentioned included Coursera, Carousel, Torus, Canvas, Storyline and WhatsApp.

### 3.4.4 Course Completion

**Getting students to enroll for online courses is comparatively easy, but it is more difficult to get them to start the course and even more difficult to get them to complete it.** Cagiltay et al. (2020) examined 122 Massachusetts Institute of Technology

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<sup>17</sup> UNICAF offers online degree programs via <https://unicafuniversity.com>

<sup>18</sup> UNICAF offers short courses via <https://www.unicaf.org/>

<sup>19</sup> <https://www.the-bac.org/directory/19213/unicaf-university/>

<sup>20</sup> <https://unche.or.ug/institutions/>

<sup>21</sup> UNICAF support centers: <https://www.unicaf.org/discover/support/support-centres/>

<sup>22</sup> <https://techleaders.eg/>

MOOCs (MITx) on the edX platform with data for about 2.8 million participants registered between 2012 and 2016. Among all enrolled students for courses, only 50–62% ever started their course, 5–15% of the students completed half their course, while only 2–4% completed their full course. Cohen et al. (2019) reported that only 50% of registered learners on a MOOC offered by a large university through Coursera started the course. Among the MOOC and learner characteristics investigated by Cagiltay et al. (2020), the number of average chapters completed by students in a course, the total forum messages posted by students and the mean age of students taking a course positively predicted course certification rates. Cohen et al. (2019) also found a strong correlation between learners' course completion status and their activity in course forums.

**Rodríguez et al. (2022) found that the dropout rate for learners who received nudges was lower than the average.** The nudges were automated and personalized based on learners' risk level and profile and were either informational, reminders or provided feedback. They tested different types of nudges (personalized messages) for online learners supported by an AI early warning system that detected learners' risk of failing or dropping out of a course based on their grades in continuous assessment activities. The nudges were sent to students enrolled in a first-year Computer Fundamentals course with a low completion rate (40–50% from enrolment). The dropout rate was higher for learners who received no nudges, with more than 50% dropping out by the end of the semester compared to the course average dropout rate of 35%.

**Delnoij et al. (2020) discovered that coaching, remedial teaching on basic competencies such as mathematics and writing skills and peer mentoring significantly increased higher education completion rates.** They explored modifiable predictors of non-completion in online higher education and investigated different characteristics of effective interventions to reduce non-completion. Based on 10 review studies, study/learning strategies or skills, academic self-efficacy, academic goals and intentions, academic adjustment-adaptation and involvement were the most effective modifiable predictors for non-completion.

**Malan (2020) found that purposefully incorporating different forms of engagement into a module of a fully online accounting degree program in South Africa was positively received by students and resulted in more students completing the module.** The lecturer used email to prod inactive students at the start of the course and used multiple communication channels, including announcements, emails and social media posts, to a private group to stay connected with students. They also noted that students appreciated the power of working on assignments as a group, even among students who preferred working independently. They discovered that giving students multiple options to select the medium or format to submit group assignments was empowering.

Those interviewed<sup>23</sup> provided largely anecdotal information about what they considered to be key considerations for maximizing success under three major themes: learner readiness, delivery methodology and techniques and student support. The information is anecdotal because it emerged that most were actually either not tracking completion or had left it to the academic management line departments. These included the following:

***Learner readiness:***

- i. Pre-screening to admit high quality students.
- ii. One respondent noted that completion rates were higher for students over the age of 30.

***Delivery methodology and techniques:***

- iii. Using blended learning wherever possible and, as a minimum, creating opportunities for learners to interact on a peer-to-peer basis.
- iv. Flexibility to accommodate learners' work, family and social circumstances.
- v. Consideration of technological challenges (connectivity and access to appropriate devices) when planning delivery.
- vi. Regular and timely feedback on learner progress via email, LMS, classroom platforms and course platforms.

***Student support:***

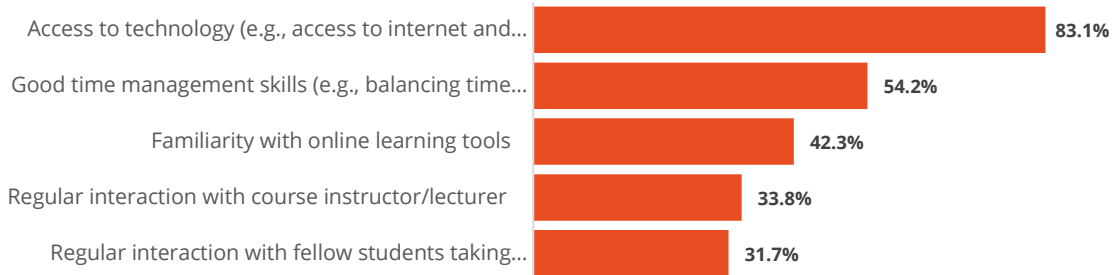
- vii. Financial support where needed. For example, ADDA provides \$100 per learner to support the cost of data packages as does the Distance Learning Institute of the University of Lagos. One institution offers a partial refund of fees upon successful completion.
- viii. Providing robust support for learners, including technology, academic and course advisors, e-tutors, counselling and a 24-hour helpdesk.

**The online survey of potential learners who had registered for online courses before added useful perspectives as to what they thought had enabled or impeded their successful completion — access to technology and good time management being positive and technology barriers and time-constraints being negative.** From the survey of potential learners under this study, those who had successfully completed an online course or program identified access to technology (such as access to the Internet and digital devices) as the most important characteristic (83.1%) that contributed to their success, followed by good time management skills (54.2%), and familiarity with online learning tools (Figure 22).

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<sup>23</sup> From respondent interviews conducted as part of this study.

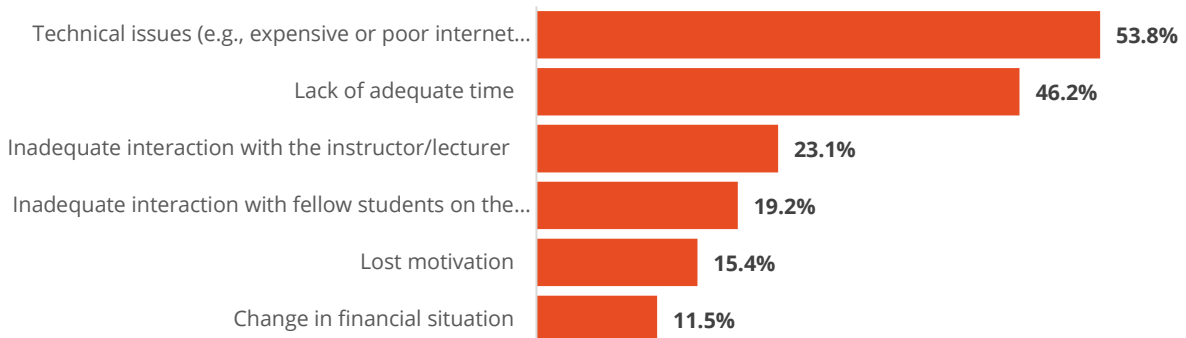
**What attributes helped you to successfully complete the online course(s) or program(s)? (select upto three options)**



*Figure 22: Proportion of respondents by attribute for successful completion of online course or program*

The main reasons given by learners for not completing an online course or program were technical problems such as expensive or poor Internet access and access to digital devices (52.8%) and lack of time (46.2%) (Figure 23).

**Why did you fail to complete the online course or program? (select upto three options)**



*Figure 23: Proportion of respondents by reason for failure to complete online course or program*

### 3.4.5 Summary

The above findings suggest the following strategies that online program designers can consider to ensure higher enrolment and more successful completion of online courses:

- i. **Learner characteristics:** Consider learner characteristics based on analysis to guide on the right choice of methods to maximize the likelihood of completion for all students.
- ii. **Engagement approaches:** Provide regular feedback and nudges. The AI/ML online course should include mechanisms to provide automated and personalized feedback to students on an ongoing basis. Examples may include regular reminders to nudge students along the different course chapters (the more



chapters a student completes, the more likely they are to complete and receive a certificate) and to engage in social interaction in online student groups dedicated to different aspects of the course. Such feedback can also direct students to appropriate online resources to fill gaps in their knowledge or to contact tutors for clarification and further guidance.

Interviewees in this study emphasized that no matter whether the learning is synchronous or asynchronous, the traditional “talking head” lecture mode should be avoided and replaced by approaches that encourage student-to-student interaction. Interactive learning content, practical work, assignments, quizzes of various types, game-based learning and group project work were said to improve engagement and learning.

- iii. **Delivery models and platforms:** Even if the courses are designed for online delivery, the benefits of a local presence should be considered, enabling face-to-face engagements between students and, through local collaborating institutions, the availability of local expertise. Collaborative arrangements with in-country institutions should be explored, whether to meet the need for local expertise, support access to content, or local licensing.
- iv. **Technical challenges:** Interventions should ensure that students are comfortable with the technological aspects of the learning environment and can access content even where quality of connectivity is not very good.
- v. **Student support:** Student support ranges from addressing generic challenges such as affordability, requiring financial support, to social challenges, requiring counseling, and situational challenges that limit available study time, requiring guidance in creating personal efficiency and improving time management.

## 3.5 Monitoring, Evaluation and Scaling

*"We are wrestling with the question of scaling a lot, but there are no good solutions yet."  
(Respondent)*

**Only two of the respondents were able to take up the conversation about monitoring, evaluation and scaling, and neither had specific answers as to how this was being approached.** One of them indicated that they were thinking about evaluation and scaling, but how to evaluate as a basis for scaling and how to scale were not yet clear. The other respondent raised reflective questions and comments on evaluation (paraphrased here for clarity):

- i. Is success about the pass rate at the end of the course or an assessment of what knowledge the learners acquire?
- ii. Is success evaluated based on what students do after the certificate? Maybe a tracer survey should be conducted after certification to see what students do after completion, for example taking up a new job, joining graduate school, etc.
- iii. Should evaluation look for evidence that those who had gone through the course were taking up roles formerly held by foreigners?
- iv. Long-term sustainability is still a problem.

Monitoring and evaluation are integral aspects that need to be addressed by CMU-Africa in rolling out continent-wide certificate programs.

## 3.6 Typology of Learners with Specific Focus on AI and ML

The survey asked respondents about their perceptions and attitudes in relation to online programs using a 7-point Likert scale (1 = not at all true of me, 7 = very true of me) using a list of 10 questions adopted from the self-regulation for learning online (SRL-O) questionnaire, which is used to measure the frequency and quality of learning strategies when applied to online or blended or hybrid environments (Broadbent et al., 2023). The results are summarized in Table 12 and Figure 24. These provide insight into the study habits, learning skills and motivation of potential students and are used to organize the students in different personas.

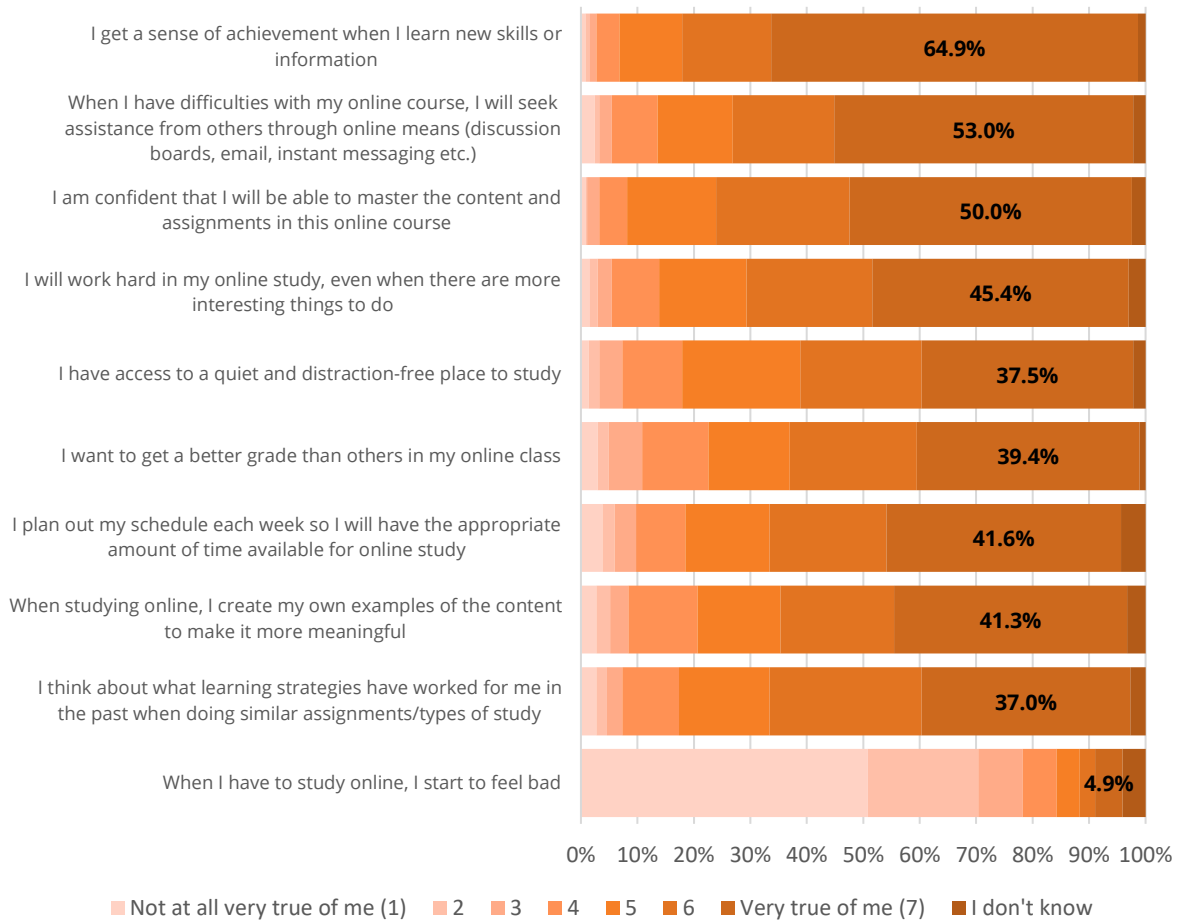
*Table 12: List of questions with their means and SDs across all respondents*

	<b>Question</b>	<b>Mean</b>	<b>SD</b>
<b>1</b>	I am confident that I will be able to master the content and assignments in this online course.	6.13	1.15
<b>2</b>	I get a sense of achievement when I learn new skills or information.	6.36	1.12
<b>3</b>	I want to get a better grade than others in my online class.	5.69	1.61
<b>4</b>	When I have to study online, I start to feel bad.	2.17	1.72
<b>5</b>	I plan out my schedule each week so that I will have the appropriate amount of time available for online study.	5.68	1.55
<b>6</b>	I think about what learning strategies have worked for me in the past when doing similar assignments/types of study.	5.71	1.46
<b>7</b>	I have access to a quiet and distraction-free place to study.	5.61	1.57
<b>8</b>	I will work hard in my online study even when there are more interesting things to do.	5.92	1.36
<b>9</b>	When I have difficulties with my online course, I will seek assistance from others through online means.	6.01	1.41
<b>10</b>	When studying online, I create my own examples of the content to make it more meaningful.	5.68	1.40

*Note: Scale ranging from 1 ("not at all true of me") to 7 ("very true of me")*

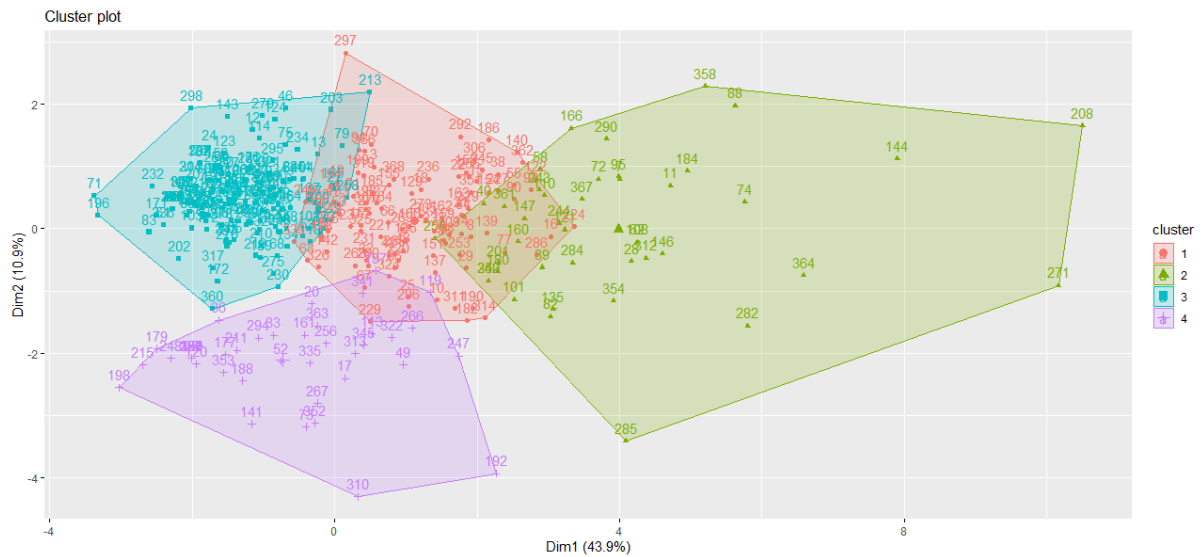
Four out of five respondents (80.7%) agreed it was true or very true that they get a sense of achievement when they learn new skills or information (question 2). This item had the highest mean score (see Table 12). Questions 3, 5, 7 and 10 had the lowest mean scores. Responses to question 3 indicate that respondents are more interested in personal growth and learning as opposed to comparing themselves to their peers. Question 5 indicates uncertainty among respondents about having sufficient time for the online course, reinforcing the need for flexibility. Question 7 highlights that access to a quiet and distraction-free place for learning is an issue that may require intervention down the line.

**Imagine that you were pursuing the AI/ML online certificate. How would you rate yourself on the following measures (ranked by very true of me)**



**Figure 24: Proportion of respondents and their Likert responses for different questions**

Using K-means clustering (Steinley & Brusco, 2007), KCL identified clusters or groups of students (referred to as personas) that have similar study skills and motivation. We explored their different attributes with a view to how likely they were to pursue and successfully complete the online AI/ML certificate program and other future online programs offered by CMU-Africa for the African context. Students within each cluster are quite similar to one another, while students in different clusters are quite different from one another.



**Figure 25: Scatterplot showing the four different cluster/personas emerging from the survey data**

Using these clusters, we have developed four personas, which we briefly summarize in the following sections:

- i. Persona 1 represents 28.3% of the total sample.
- ii. Persona 2 represents 11.7% of the total sample.
- iii. Persona 3 represents 48.4% of the total sample.
- iv. Persona 4 represents 11.7% of the total sample.

### 3.6.1 Persona 1



*Figure 26: Image by Bakari M. Saidi from Pixabay*

Name: Timothy

Timothy is 24 years old, unemployed and seeking a job with no dependents. He has a tertiary diploma in computer science and is currently enrolled in a degree program in information technology at university. He paid for his post-secondary via family contribution. He is interested in pursuing the AI/ML certification program and would like to be contacted when the program starts.

Timothy owns a smartphone and a laptop that he uses to facilitate online learning. He can connect to the Internet almost always, accessing video content with few

outages. Timothy is active on WhatsApp, Facebook and Twitter, with WhatsApp being his favorite social media application.

He has enrolled and successfully completed an online course before. Timothy finds collaborating with other learners on group projects to solve a challenge and live virtual sessions with the instructor as the most engaging online learning activities. He finds online quizzes and group projects as the most useful assessment methods with regular and prompt feedback on assignment performance as the most useful feedback for online learning.

Besides the availability of scholarships, Timothy prioritizes the quality of teaching staff above the affordability of the online program when it comes to selecting a university for an online program. Other factors he would consider include the flexibility of the program and its practical/occupational-orientated nature.

He believes that the online certificate program should ideally be completed in five months. In addition to technical content and skills, Timothy would like to develop his problem-solving and analytical-thinking skills during the certificate program.

In terms of support services, he would like CMU-Africa to provide career-support services, such as internships, job search strategies and job opportunities; networking programs, such as peer interaction and professional mentors; and academic support services, such as orientation, set learning goals and tutoring.

Timothy gets a sense of achievement when he learns new skills or information and wants to get a better grade than others in his online class. He is confident that he will be able to master the content and assignments in the online course and plans to seek out assistance among classmates through online means (e.g., discussion boards, email, instant messaging) when he gets into difficulties with the online course.

### 3.6.2 Persona 2



*Figure 27: Image by Mircea from Pixabay*

Name: Sarah

Sarah is 23 years old and a full-time employee with dependents that she takes care of. She holds a master's degree in software engineering that she paid for using a bursary and is interested in pursuing the AI/ML certification program when it commences.

She owns both a laptop computer and a smartphone and can reliably get access to quality Internet anytime she wants. Sarah is active on WhatsApp, LinkedIn and YouTube — her favorite social media network. She has a quiet office place erected in the corner of her living room free of distractions, where she can study an online course.

She likes online learning because of the flexibility it affords her to access course materials from anywhere, such as home, work and public transport. While she values the availability of scholarships in selecting a university to study an online certificate program, Sarah prioritizes the flexibility and affordability of the online program. Other factors include the reputation of the university offering the online program and the quality of the teaching staff.

Sarah gets a sense of achievement when she learns new skills or information. She is confident that she will be able to master the content and assignments in the AI/ML online course by planning out her schedule each week so that she has the appropriate amount of time available for online study. When studying online, she creates her own examples of the content to make it more meaningful. She would like to get a printable certificate of completion that appears on an official university transcript upon successful completion of the online program.

Besides technical content and skills, Sarah would also like to develop her problem-solving, analytical-thinking and critical-thinking skills through participation in the online certificate program. In terms of support services, she would like CMU-Africa to provide career support services, such as internships, job search strategies and job opportunities; networking programs, such as peer interaction and professional mentors; and technical support services, such as how to navigate learning platforms. Sarah is comfortable interacting with an online application to get support or virtually with support staff.

Sarah finds viewing recorded video files for class interaction very engaging. Other engaging online learning activities that she likes include collaborating with other learners on group projects and participating in online discussions with other learners. For online assessment, Sarah prefers group projects and online quizzes. For feedback during online learning, she finds watching solutions to practice problems and student reflection/self-assessment activities to be the most useful types of feedback.



### 3.6.3 Persona 3



*Figure 28: Image by Lawrence Crayton from Pixabay*

Name: Seth

Seth is 32 years old and a full-time employee with two dependents, his daughter and ailing mother. He has a post graduate certificate in software engineering and is currently not enrolled in any degree program at university. He paid for his post-secondary education via government sponsorship. He is interested in pursuing the AI/ ML certification program and would like to be contacted when the program starts.

He owns a smartphone but no computer, though prefers to use the latter to facilitate his online learning. Seth can access a computer through his family or friends. He can connect to the Internet daily, accessing video content with few outages. He is active on social media, with WhatsApp being his favorite social media

application, followed by LinkedIn.

He has enrolled and successfully completed an online course/program before. He has previously taken an online course to acquire new skills, update existing skills, improve employability in the labor market or obtain a new qualification or certificate. He attributes his success in online courses to having access to appropriate technology, good time management skills and familiarity with online learning tools.

Seth indicates that the availability of scholarships would be the main factor in selecting a university to study an online certificate program. This would be followed by the quality of the teaching staff and the reputation of the university offering the online program. He can either receive a \$100 credit that he can use toward other programs at CMU-Africa upon successful completion of this course or pay up to \$100 for the whole program under a flexible payment arrangement whenever he gets some money and believes he can ensure all instalments are paid before course completion.

Besides the technical content and skills, Seth would like to develop his problem-solving, critical-thinking and analytical-thinking skills during the certificate program. Upon completion of the program, he would like to receive a certificate that appears on an official university transcript.

In terms of online learning activities, Seth finds collaboration with other learners on group projects the most engaging, followed by participating in online discussions with other

learners. In terms of assessment methods, Seth finds group projects to be most useful for online learning, followed by individual projects. In terms of feedback, Seth finds sharing links to additional learning resources to be most useful for online learning, followed by timely feedback on assignment performance. He would like CMU-Africa to provide career support services, networking programs and academic support services.

### 3.6.4 Persona 4



*Figure 29: Image by Maira Ali from Pixabay*

Name: Abdullah

Abdullah is 22 years old and a recent graduate with a bachelor's in mathematics. He is still unemployed and has no children nor dependents. He paid for his bachelor's degree through family contribution and is interested in pursuing a postgraduate diploma in telecommunications engineering. He is interested in the AI/ML online certificate and would like to be contacted when CMU-Africa launches the program.

He owns a smartphone but no computer. Nonetheless, should the need arise, he indicates that he can borrow/access one

through a friend or family member. He can connect to the Internet almost always, accessing video content with few outages. He is very active on social media, with WhatsApp being his favorite social media application, followed by Facebook.

Abdullah indicates that the availability of scholarships would be the main factor in selecting a university to study an online certificate program. This would be followed by the reputation of the university offering the program as well as affordability and recommendations from people that he knows. He is interested in receiving a \$100 credit that he can use toward other programs at CMU-Africa upon successful completion of this course. He is also willing to pay up to \$100 for the whole program.

Abdullah believes that he should be able to complete the online certificate program in six months. Aside from technical content and skills, he would also like to develop his problem-solving, analytical-thinking and critical-thinking skills.

He has previously enrolled in an online course or program to improve career opportunities in the job market and to earn a new credential or certificate. Abdullah successfully completed his online course and/or program and attributes his success to having access to technology to facilitate online learning and good time management skills.

Abdullah found viewing recorded video files for class instruction and collaborating with other learners on group projects as the most engaging online learning activities. For assessments, he preferred online quizzes and group projects, while he found sharing links to additional learning resources and watching solutions to practice problems to be the most useful types of feedback for online learning. He would like CMU-Africa to provide career support services, networking programs and academic support services.

Table 13 provides a summary of the key findings based on the collective responses of the respondents that make up each persona and the emerging themes that can be used to communicate to the persona.

*Table 13: Comparison of different persona preferences based on survey responses*

<b>Attribute</b>	<b>Persona 3 (48.4%)</b>	<b>Persona 1 (28.3%)</b>	<b>Persona 2 (11.7%)</b>	<b>Persona 4 (11.7%)</b>
<b>Motivation</b> (All want to gain new skills or update existing skills)	<ul style="list-style-type: none"> <li>Improve career opportunities in the job market</li> <li>Earn a new credential or certificate for my learning</li> </ul>	<ul style="list-style-type: none"> <li>Earn a new credential or certificate for my learning</li> <li>Improve career opportunities in the job market</li> </ul>	<ul style="list-style-type: none"> <li>Improve career opportunities in the job market</li> <li>Earn a new credential or certificate for my learning</li> </ul>	<ul style="list-style-type: none"> <li>Improve career opportunities in the job market</li> <li>Earn a new credential or certificate for my learning</li> </ul>
<b>Factors influencing selection of a university to study an online certificate program</b> (All want availability of scholarships)	<ul style="list-style-type: none"> <li>Quality of the teaching staff</li> <li>Reputation of the university</li> </ul>	<ul style="list-style-type: none"> <li>Quality of the teaching staff</li> <li>Affordability of program</li> </ul>	<ul style="list-style-type: none"> <li>Flexibility of the program</li> <li>Affordability of program</li> </ul>	<ul style="list-style-type: none"> <li>Reputation of the university</li> <li>Recommendations from people I respect/know</li> </ul>
<b>Most engaging online learning activities</b>	<ul style="list-style-type: none"> <li>Collaboration with other learners on group projects</li> <li>Participating in online discussions with other learners</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration with other learners on group projects</li> <li>Live virtual sessions with instructor</li> </ul>	<ul style="list-style-type: none"> <li>Viewing recorded video files for class instruction</li> <li>Collaboration with other learners on group projects</li> </ul>	<ul style="list-style-type: none"> <li>Collaboration with other learners on group projects</li> <li>Viewing recorded video files for class instruction</li> </ul>
<b>Most useful online learning assessment methods</b>	<ul style="list-style-type: none"> <li>Group projects</li> <li>Individual projects</li> </ul>	<ul style="list-style-type: none"> <li>Online quizzes</li> <li>Group projects</li> </ul>	<ul style="list-style-type: none"> <li>Group projects</li> <li>Online quizzes and individual projects</li> </ul>	<ul style="list-style-type: none"> <li>Online quizzes</li> <li>Group projects</li> </ul>
<b>Most useful types of feedback for online learning</b>	<ul style="list-style-type: none"> <li>Sharing links to additional learning resources</li> <li>Feedback on performance on assignment</li> </ul>	<ul style="list-style-type: none"> <li>Feedback on performance on assignment</li> <li>Forum for students to ask questions about the course</li> </ul>	<ul style="list-style-type: none"> <li>Watching solutions to practice problems</li> <li>Student reflection/self-assessment activities</li> </ul>	<ul style="list-style-type: none"> <li>Sharing links to additional learning resources</li> <li>Watching solutions to practice problems</li> </ul>
<b>• Messaging themes</b>	<ul style="list-style-type: none"> <li>Availability of scholarships and quality of university teaching staff are important</li> </ul>	<ul style="list-style-type: none"> <li>Availability of scholarships and affordability of the program are important</li> <li>Earning a new credential or certificate for participation</li> </ul>	<ul style="list-style-type: none"> <li>Availability of scholarships and flexibility of the program are important</li> <li>Career support services are important because I am</li> </ul>	<ul style="list-style-type: none"> <li>Availability of scholarships and reputation of the university are important</li> <li>WhatsApp is my favorite social media network by far</li> </ul>

	<ul style="list-style-type: none"> <li>• Career support services and networking programs are important because I look forward to starting a career after university</li> <li>• Beyond the technical skills to be acquired through the course, emphasize problem solving and critical thinking as other benefits</li> <li>• LinkedIn is my favorite social media network</li> </ul>	<p>and improving career opportunities in the job market appeal to me</p> <ul style="list-style-type: none"> <li>• With existing commitments, flexibility with timing and access to course materials are critical</li> <li>• WhatsApp is my favorite social media application, followed by LinkedIn</li> </ul>	<p>looking forward to starting a career after university</p> <ul style="list-style-type: none"> <li>• Beyond the technical skills to be acquired through the course, emphasize problem solving and analytical thinking as other benefits</li> <li>• WhatsApp is my favorite social media network, followed by LinkedIn</li> </ul>	
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# 4 Recommendations for CMU-Africa and Conclusion

**There is a high level of interest in improving skills in emerging technologies, such as AI/ML, and CMU-Africa must appreciate that they are competing with offerings from other universities on platforms such as Coursera.** Using the findings from the study, CMU-Africa will be able to target a large population of potentially qualified students, but getting them to apply for the program will require significant effort and resources. Getting students to enroll is only the first step in the journey. The next challenge will be to translate enrolment into actual program participation, an area where online programs have been shown to perform poorly.

**This section summarizes the key actions that CMU-Africa needs to take at each stage of the student journey to increase the likelihood of the success of the AI/ML postgraduate certificate program.** It should be noted that in addition to the findings from the study, these recommended actions are informed by the expertise and experiential knowledge of the consultants.

## 4.1 Communicating the Program in AI/ML

To attract applicants, CMU-Africa should consider the following findings from the survey as part of the communication and marketing plan.

- i. **It is important to clearly communicate the type of new skills that students can expect to gain from the new online certificate program.** Most potential students are largely motivated by wanting to learn new skills and get ahead in the job market. In addition to technical skills, it is important to communicate the non-technical skills that students can develop. These include problem-solving, analytical-thinking, critical-thinking and collaborative skills. The program does not yet have any testimonials or compelling stories to show that the certificate program will help students to start and develop their careers in a market that is becoming increasingly more competitive, but these should be planned for.
- ii. **The availability of scholarships, bursaries or other financial support for the online certificate emerged as a major factor.** Potential learners need to know how these can be accessed and the attendant conditions.
- iii. **Leverage the academic and professional reputation of CMU, the parent university (achievements, rankings, etc.) to attract applicants.** This should be combined with the expertise of the staff to ensure that CMU-Africa is seen as an enriched offering.
- iv. **Promise (and later deliver) an exciting customer experience.** Provided there are assurances about delivery, consider publicizing in advance the kind of support discussed under Learner Support (section 4.4 below), as well as the interactive and collaborative approaches to engagement.

- v. **Provide core information about how the course will be delivered.** The first cohort of students should be informed that they will be partners in testing and refining the whole program such that their experiences and feedback will be gathered from the outset and that, with their consent and cooperation, their career paths will be documented anonymously after completion.

## 4.2 Admission Process

**CMU-Africa should consider using a pre-admission screening process to ensure that those admitted have sufficient prior knowledge and motivation to complete the courses.** The results of the survey show that attributes such as academic background, age, motivation and socio-economic status are predictors of successful completion. Screening is not just about exclusion; it also helps to identify areas where remediation and support is needed or what aspects of the courses should be emphasized in the subsequent orientation process.

**While it was not an area of specific investigation in this study, it is important for equitable selection to be applied to groups that are often marginalized.** The study specifically brought out the high male vs. female gender imbalance among the likely applicants. Equitable admissions into the courses would require giving favored consideration to females. Based on institutional policy, this can extend to other normally marginalized categories, such as people with disabilities and refugees. All of these can be identified as part of the screening process.

## 4.3 Orientation

**In any learning environment, orientation plays an important role in helping students understand what is expected of them and the learning approaches that will be used.** In online courses, orientation also provides an important opportunity for learners to meet their remote peers, with whom they will be learning, and to begin to build connections and a sense of community, which is essential given their individual isolation.

**It is recommended that a remedial course be provided to bring all learners up to the minimum level of digital literacy required to participate effectively in learning activities.** This will provide an opportunity for students to familiarize themselves with the technology that will be used during the course and for those who may be unfamiliar with different technologies and applications to learn how to use them. During this phase, students should be given the opportunity to practice and become familiar with the technologies as well as information about who to contact for support if they experience technical problems during the course.

## 4.4 Learner Support

**It is important to establish channels through which personal challenges and other**

**limitations faced by learners can be communicated to guide CMU in either providing the necessary individual support and flexibility or in setting all-inclusive arrangements for all learners.** Likely scenarios to prepare for and which would guide the a-priori preparation of frequently asked questions (to be updated later based on actual needs as they arise) include the following:

- i. Female students face gender-specific challenges that exacerbate the more general challenges faced by all students.
- ii. While it was not part of the discussion in earlier sections of this report, there may be other normally marginalized groups, for example, people with specific disabilities for whom both content and means of engagement may need to be tailored.
- iii. Some students face financial challenges and therefore cannot afford laptops, tablets or decent smartphones — and where applicable, tuition. The cost of broadband data in many African countries is very high compared to developed regions, and this is compounded by much lower incomes. Grants, loans and subsidies may be needed either directly or in partnership with the private sector.
- iv. Limited access to broadband requires the minimization of heavy downloads and the avoidance of bandwidth-intensive applications. Tailored solutions may be required for students in some locations.
- v. Work demands and social challenges can limit learners' time flexibility, which may affect both participation and the submission of work. Arguments for self-paced learning approaches may be required in such cases and may indeed affect the duration of the course.
- vi. Limited familiarity with digital tools, compounded by technophobia and fear of embarrassment, especially among the older generation of learners, needs to be addressed.
- vii. There will often be a need for individual learning support — and this may extend to counseling in relation to challenges outside the program but which have a negative impact on learning — and all learners should know which channels to use.

**In addition to the individual support that may be needed as listed above, non-credit courses (e.g., entrepreneurship) that are needed by many students and other types of support should be considered.** For example, support could include access to internship opportunities and networking initiatives to connect students with industry experts, potential employers and alumni for mentoring and career guidance.



## 4.5 Learning Methodologies and Related Requirements

**Flexibility is a key factor in the delivery of the certificate program, which will bring on board learners, many of whom are employed or undertaking other postgraduate programs, with different motivations for enrolling for the certificate and with different learning characteristics and different family/work/study commitments.** This flexibility will be created by a program that, as far as possible, considers the following factors:

- i. **Create a mix that maximizes the opportunity for all learners to complete the certification.** This means a combination of synchronous and asynchronous methods.
- ii. **Provide opportunities for peer-to-peer collaboration.** This involves learners working in groups to achieve their learning objectives. The content design should include activities that require and support collaboration among learners so that they can share ideas and develop a common understanding of the course material rather than working in isolation.
- iii. **Ensure instructor presence and support.** The presence of the instructor is seen as a binding element in creating, supporting and sustaining a community of inquiry in the learning process. The instructor assumes a facilitator role, encouraging focused learning and facilitating constructive interaction and review among students during the learning process. Alongside the online approach, there is collaboration with in-country institutions and the creation of local trainer capacity to provide face-to-face tutoring and mentoring.
- iv. **Emphasize the use of examples relevant to the learner's local context and practical application in real-life situations through collaborative practical work focused on addressing local needs and challenges.** For example, many African countries face multiple problems in agriculture, their economic backbone. The program can use relevant case studies and challenges to illustrate how AI/ML can help optimize agricultural production and improve food security. Similarly, AI/ML can help improve health outcomes by improving disease diagnosis, treatment and management or financial inclusion by providing insights into customer behavior and risk management. Providing content and tools that tap into the unique cultural cues of different local contexts enables an inclusive online learning environment.
- v. **Raise awareness and train tutors in the pedagogical use of technology to support student learning.** It is a fundamental requirement to ensure that trainers have pedagogical competence, which embodies the ability to prepare and design course content to support student learning with or without technology; and understanding the integration of pedagogy and technology for learning to be effective in an online learning environment.

- vi. **Provide self-regulation tools as part of the learning platform.** Explore and use new interactive features in the online learning environments to help learners use self-regulation strategies and modify/improve their behavior accordingly. For example, the environment may include resources that encourage the learner to seek more information from other sources on shared concepts. There is also a need to provide learners with learning activities that facilitate a process of inquiry through which they can create and share knowledge.
- vii. **Provide timely feedback to learners.** Instructors and the tools used for the online course need to provide timely feedback. The longer it takes to provide feedback to students undermines the aim of shaping and supporting learning. However, a peer-review process can be introduced to reduce the workload of instructors of large classes. Students can simultaneously review, evaluate and give each other the timely feedback that is essential to support their learning and development. Students can reflect on their peers' and their own work, reinforcing key learning objectives and facilitating their understanding of what is needed to improve their performance.

## 4.6 Assessment

**Minimize or avoid the traditional approach based on high-stakes end-of-course exams and focus more on continuous assessment, including the kind of teamwork required in real working environments.** While not necessarily eliminating the final examination, overall assessment should place a lot of weight on continuous evaluation (group work, quizzes, individual assignments, quality of participation in discussion, etc.) throughout the duration of the training.

## 4.7 Monitoring, Evaluation and Scaling

**CMU-Africa needs to have a monitoring and evaluation plan in place from the outset with a view to scaling up, and the widely accepted OECD/DAC framework can provide a good basis.** Any initiative worth implementing should implicitly be scalable. This requires the use of a theory of change approach from the outset not only to identify and address logical gaps in the implementation plan but also to document assumptions and therefore risks that need to be managed. It also supports the development of a monitoring and evaluation plan that will later allow for evidence-based scaling. Very importantly, the key elements of the OECD/DAC evaluation parameters, including relevance, coherence, efficiency, effectiveness, impact and sustainability, would be built into the implementation plan.

**Ongoing analytics enable learning to be incorporated into monitoring and evaluation, and this should be planned for and incorporated from the start.** This enables both tactical (at the monitoring stage) and strategic (at the evaluation stage) adjustment or indeed radical change of both content learning methodologies.

## 4.8 Licensing and Credit Transfer

**While licensing may be an issue in some cases, this can be easily addressed by working through local partners.** By and large, CMU-Africa's direct online provision does not require local licensing. Accreditation by local professional bodies or for admission to subsequent postgraduate courses would depend on the credibility of CMU, which is generally very high. If it is envisaged that students will seek recognition of the certificates for subsequent postgraduate courses at other institutions, such assurance will need to be sought in advance, particularly from the major national universities.

## 4.9 Conclusion

**These recommendations have been addressed to CMU-Africa, but they have general applicability to any online program within the broad African context.** Neither the approach to the study nor the formulation of the recommendations are specific to AI and ML or to CMU-Africa. This, however, does not mean eliminating the important need to consider any contextual factors that depart radically from the general picture. The recommendations should therefore be used as a generic starting point rather than a blueprint.

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# Appendix B Outline of Interview Guide

CMU-Africa has developed and will roll out an online certification program in artificial intelligence (AI) and machine learning (ML) that targets African graduates with bachelor's degrees in engineering and/or ICT-related areas of study but who are not yet ready for full-time master's-level education. While the certificate program is designed to be part time, the admissions, teaching and assessment processes will be rigorous so that on successful completion, certificates may be used as credits toward future M.Sc. programs. CMU-Africa would like to seek your views about different aspects of the programs as input into the development of their marketing and rollout strategy.

Participation in this interview is voluntary. We do not anticipate that there are any risks associated with your participation, but you have the right to stop the interview at any time. All the information that you provide will remain strictly confidential, and your answers will never be uniquely identified.

Are you willing to participate in this interview?

## Participant-Level

1. Please tell us about yourself and the role that you/your department plays at your institution.

## Program-Level

2. What role does your department play in the design and successful implementation of the online courses or programs at your institution?
3. One of the benefits of attending on-campus programs are the connections and interactions that students develop. How does your institution help distance/online students develop similar kinds of connections if at all?
4. What kind of student assessment activities does your institution utilize in distance/online programs? Based on your observations or any analysis carried out: Which ones do students find most useful? Which ones do they find most interesting?
5. Does your institution provide any kind of learner support services or incentives to distance/online students to ensure they successfully complete programs?
6. Would you be interested in partnering with CMU-Africa to offer this AI/ML certificate program to students at your institutions? In your view, how do you think this partnership should be structured?
7. In your view, what are some of the potential constraints/challenges to successfully implementing distance/online programs at your institution?
8. Is there anything else you would like to share that you feel can help ensure a successful implementation of the online certificate program? Please elaborate.

# Appendix C Outline of Student Survey

**English Version (please note that this does not show the survey branch or skip logic. In addition, participants who selected “other” as an option were asked to “please specify other”)**

Carnegie Mellon University Africa (CMU-Africa) has developed and will roll out an online certification program in artificial intelligence (AI) and machine learning (ML) that targets potential students who already have, or will soon have, a bachelor’s degree in engineering, information technology, computer science or other related discipline. While the certificate program is designed to be part time, the admissions, teaching and assessment processes will be rigorous so that it can help better prepare students for further study at the master’s level at CMU-Africa or other universities and equip students with in-demand skills needed in today’s job market.

As a potential student, CMU-Africa would like to ask you a few questions about your educational background, motivations for graduate study and perceptions and attitudes toward online courses as well as access to and use of digital technology. The data that you provide will help CMU-Africa to better position the online certificate program and to identify support services to provide students with in order to ensure successful and timely completion of the online program.

Completing the survey will take 30 minutes. Participation in this survey is voluntary. We do not anticipate that there are any risks associated with your participation, but you have the right to stop the survey at any time. All the information that you provide will be treated as confidential and will only be used for research purposes. Your responses will not be identified as belonging to you; instead, they will be combined with those gathered from other survey participants and will be analyzed as part of a group. We would be happy to clarify any questions that you may have regarding the survey. If you do have any questions, please contact Ali Ndiwalana at ally@kcl.co.ug.

## **Informed Consent**

1. Do you consent to participate in the survey?
2. If not, why do you not consent to participate in the survey?

## **Participation in Online Program(s)**

In this section, we would like to know what you think about different components of an online course or program.

3. Have you ever enrolled or participated in an online course or program?
4. Why did you enroll in the online course or program?
5. Did you successfully complete any online course(s) or program(s)?
6. Why did you fail to complete the online course or program?
7. What attributes helped you to successfully complete the online course(s) or program(s)?

8. Which of the following learning activities do you find most engaging for online learning?
9. Which of the following assessment methods do you find most useful for online learning?
10. Which of the following types of feedback would you find most useful for online learning?
11. Which of the following forms of flexibility in online learning would you find the most appealing?
12. How would you prefer to communicate and connect with your instructor for an online course?
13. How would you prefer to interact and connect with fellow students in an online course?

### **Interest in the Artificial Intelligence/Machine Learning Online Certificate Program**

In this section, we would like to learn about your interest in the Artificial Intelligence and Machine Learning Online Certificate Program.

14. Are you interested in pursuing an online certificate program in artificial intelligence and machine learning?
15. In your view, how long should the online certificate program take to complete (in months)?
16. Besides the technical content and skills, what other skills would you like to develop through this course?
17. How much would you be willing to pay/receive for the online certificate in artificial intelligence and machine learning?
18. How would you prefer to pay for the online certificate program?
19. What other financing option would you consider to pursue the online certificate?
20. What other subjects/areas would you be interested in pursuing in online certificate programs?

### **Perceptions and Attitudes**

In this section, we would like to learn about your perceptions and attitudes in relation to online certificate programs.

21. What factors can influence your selection of a university to study an online certificate program?
22. What type of certificate would you like to get after successfully completing the program?
23. Which kind of support services would you like CMU-Africa to provide to ensure your successful completion of the online certificate program?
24. Which mode of engagement do you prefer for support services?
25. Imagine that you were pursuing the artificial intelligence and machine learning online certificate. How would you rate yourself on the following measures?
  - a. I am confident that I will be able to master the content and assignments in this online course.

- b. I get a sense of achievement when I learn new skills or information.
- c. I want to get a better grade than others in my online class.
- d. When I have to study online, I start to feel bad.
- e. I plan out my schedule each week so that I will have the appropriate amount of time available for online study.
- f. I think about what learning strategies have worked for me in the past when doing similar assignments/types of study.
- g. I have access to a quiet and distraction-free place to study.
- h. I will work hard in my online study even when there are more interesting things to do.
- i. When I have difficulties with my online course, I will seek assistance from others through online means (discussion boards, email, instant messaging, etc.).
- j. When studying online, I create my own examples of the content to make it more meaningful.

### **Access to Technology**

In this section, we would like to learn about your access to technology to facilitate online learning.

- 26. Which of these digital devices do you own to facilitate online learning?
- 27. If you do not own a computer, can you borrow or access one through a friend or family member?
- 28. How easy is it for you to connect to the Internet to access your online coursework and materials?
- 29. What is the quality of your typical Internet access?
- 30. Do you have access to a quiet space free of distractions that you can use to study an online course?
- 31. Do you have a profile on any social media network(s)?
- 32. Which of these is your favorite social media network?

### **Educational background**

In this section, we would like to know more about your educational background

- 33. What is the highest level of school you have completed?
- 34. Are you currently enrolled in any degree program at a university?
- 35. What degree did you obtain?
- 36. What degree are you pursuing?
- 37. What year will you graduate?
- 38. How have you paid or did you pay for your post-secondary education?
- 39. Would you like CMU-Africa to contact you when the online certificate program in artificial intelligence and machine learning is launched?
- 40. Please provide your email address.

## **Demographic information**

In this section, we would like to know more about your personal background. We understand that this is confidential and sensitive information. We use industry standard safeguards to protect your data.

41. Please select your country of residence.
42. What is your gender?
43. What is your age group?
44. What is your current employment status?
45. Do you have any children or dependents that you take care of?
46. Please share any additional information/comments that you feel can help ensure a successful implementation of the online certificate program.

Thank you for participating in the survey.