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Academic Success of Students and Educational Trajectories: Characteristics and Needs for a Digital Learning Environment at the University of Abomey-Calavi

Wilfrid Ahouansou

Fadhel Medard Salifou-Bio

Arnaud Dangbenon

University of Abomey-Calavi

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Wilfrid Ahouansou, African Leadership Academy (ALA), previously a member of the Mastercard Foundation Scholars Program team at the University of Abomey-Calavi (UAC)
ahouansouwilfrid@gmail.com

Fadhel Medard Salifou-Bio, Head of the Planning and Forecasting of the University of Abomey-Calavi, Head of the Monitoring and Evaluation Team of the Mastercard Foundation Scholars Program team at the University of Abomey-Calavi (UAC)
fadhy42@gmail.com

Arnaud Dangbenon, Coordinator of the Student Employability and Entrepreneurship Center at the University of Abomey-Calavi, Member of the Transition team of the Mastercard Foundation Scholars Program team at the University of Abomey-Calavi (UAC)
adangbenon@gmail.com

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Abstract

The upsurge of COVID-19 proved the need to improve higher education capabilities to continue training even during class discontinuity. In UAC's context, adopting e-learning is also a way to mitigate the significant number of students enrolled yearly (approximately 60.000) and provide quality education to all. Therefore, this research on students' success and needs aims to identify the optimal learning conditions conducive to academic and professional success. Targeting two schools of UAC, we investigated the online learning environment, considering material and virtual environments, as well as pedagogical support provided to students at UAC. We analyzed the choice made at UAC to promote blended learning. We conducted in-person interviews with students, faculty, and staff and held a focus group with selected students. We collected information about what is being done regarding e-learning and users' perceptions and requested their needs for an optimal learning environment. We found that UAC does not have optimal conditions to provide quality e-learning to students. Many do not have access to devices (laptops, smartphones, or tablets) or a quality Internet connection. Faculty members still seek training, even if some have received Instructional Design and Pedagogy training from Arizona State University. Students and faculty members also express a need to receive coaching, tutoring, and pedagogical support from the technical staff, which are in a low number (only 3 in charge of supporting e-learning at the whole university). Based on this, we recommended that UAC: 1) develop a better material learning environment for students, faculty members, and staff through the acquisition of devices and improvement of the Internet connection, 2) provide training to students on how to learn online, and 3) develop staff capabilities to coach, tutor and support students and faculty members on the integration of e-Learning in academic practices.

Keywords: Students Academic Success, e-Learning Challenges, Digital Learning Environments, target perception.

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Executive Summary

This research aims to identify the characteristics of the learning environment to be created as part of the e-learning adoption strategy to promote student success at UAC. To answer this question, we first reviewed the notions of academic success. From the literature, we identified many definitions of student success. However, for this research, we decided to consider academic success as the acquisition of skills and the ability of students to reinvest their skills in their daily lives.

Therefore, it was essential to investigate the learning environment as the optimal conditions in which students can learn and acquire new skills. As blended learning is the preferred online education system at UAC, the learning environment would then encompass the usability of the e-learning platform and the support provided on the ground to ensure that students have the best experience, whether they are taking online or in-person classes.

We formulated three hypotheses for this research. Considering both schools of focus of the study, we noted that with the data collected, there were insufficient material conditions to fulfill the e-learning requirements. Indeed, students and faculty members lack the minimum equipment required to give or receive online lessons. Students who had a better experience with e-learning are the Mastercard Foundation Scholars, who are provided a laptop and resources to cover their Internet connection costs. In addition, the e-learning website developed at UAC does not provide an easy and attractive learning environment as the Baobab platform can and, therefore, does not promote academic success.

Technical and pedagogical support needs to be improved, and faculty members are still seeking training and support to create online course content and integrate them into their courses. Because of these learning conditions, all the users interviewed favor adopting blended training at UAC. They have also proposed minimal requirements to create a learning environment conducive to academic success.

These are essentially the acquisition of computer equipment, the construction of digital classrooms, and the provision of a quality Internet connection within the university. In addition, despite the training already provided, there is an even greater need for faculty members and staff to be trained in the production and integration of online courses. Solving this need will contribute to the development of a learning environment adapted to the needs of students who want it to be simple, accessible with a low-speed connection, and which allows them to access online courses asynchronously.

Introduction

Project Background

The University of Abomey-Calavi (UAC) takes part in the implementation of the e-Learning Initiative of the Mastercard Foundation Scholars Program, which aims at supporting higher education institutions of the Program network to “develop capabilities to deliver high-quality and inclusive e-Learning and related support to enable Scholars and other students, including those facing additional barriers, to pursue their studies, anywhere successfully” (Mastercard Foundation Scholars Program e-Learning Initiative, 2020).

Created in 1970, UAC is the oldest and largest public university in Benin, with a population of around 69,624 students in 2022 and 40 training and research institutions. With such numbers, it would be hazardous to research common factors for students' academic success, whose training fields and learning conditions can vary considerably from one school to another. For example, monitoring student attendance in large schools (up to 5,000 students per class) may be difficult. In comparison, learner participation in class is more accessible to monitor in other schools (between 30 and 80 students per class).

The Institute of Training and Research in Computer Science (IFRI) is one of these schools with low student enrollment. With a dozen students at its creation in 2013, IFRI now has an enrollment of up to 800 students in all courses (Bachelor and Master). IFRI is also one of the host schools for Mastercard Foundation Scholars at UAC. Indeed, because of its training fields, IFRI had begun its e-learning experience even before the COVID-19 pandemic, with the development of a [local platform](#). In addition, the current Director of IFRI is also the Director of the African Virtual Campus (CVA), which can be considered the e-learning resource center of the UAC. The CVA has some recording and editing equipment and a technician to assist teachers in producing online course content. It has also developed [UAC's e-learning platform](#).

The Faculty of Agricultural Sciences (FSA) was officially created in 1977. It has contributed to the training of several generations of agronomists both in Benin and in the West African sub-region. Also host to Mastercard Foundation Scholars undergraduates, FSA offers a more traditional education, with less use of online teaching methods. IFRI, as a primary, and FSA, as a secondary, are the setting for our research in a comparative approach.

With the e-Learning Initiative, three faculty members at IFRI and four at FSA have been trained in Instructional Design and Pedagogy by Arizona State University. After the training, these e-Learning Champions were expected to develop online course content and commit to incorporating it into their school's course offering. Two technical staff members

have completed the training in instructional design and one in pedagogy. These staff and faculty are now considered the e-Learning Champions at UAC.

With the existence of an e-learning resource center and the training of e-learning Champions at UAC, one could consider that the university is well prepared to adopt e-learning and could facilitate students' academic success. Therefore, it is helpful to question the quality of the learning environment offered to students to achieve these results. According to Alladatin et al. (2020), digital learning environment is a "virtual environment easily accessible on the web through a cell phone, tablet, computer, etc. This environment is conducive to teaching because it combines course content with communication and interaction tools to promote self-directed learning".

This research investigates the characteristics of this learning environment at IFRI and FSA. We also analyzed the perceptions of different users, namely students, faculty members, and technical staff. The correlated perceptions of these three actors are intended to shed light on the elements that could be included in the optimal learning environment likely to foster students' academic success.

Problem Statement

In Benin, there is very little research on e-learning in higher education and its contribution to students' academic success. Even though there have been experiences of production and use of online education content in teaching practices, e-learning still needs to be at a stage of development and active adoption throughout the university system. The predominance of face-to-face training noted in Attenoukon (2011) has not changed more than a decade later.

However, the COVID-19 pandemic, which hit the world in 2020, revealed the limits of the all-presential approach and the absence of strategies to ensure the continuity of training. Indeed, as soon as the first announcements of the proliferation of the virus in the country were made, Beninese authorities decided to close schools and universities from March to May 2020 to limit the risks of mass contamination.

While in developed countries, pedagogical continuity generated many debates (Wagon, 2020), in middle-income countries such as Benin, it has revealed the unpreparedness of the education system to deal with a situation where the lecturer is no longer in front of the students. One solution proposed by the Beninese government to address the need to continue training at the university was the development of a [governmental e-learning platform](#), which was closed a few months later due to widespread student discontent.

Using this platform required several conditions for both learners and teachers, the most critical of which were having a computer or a smartphone and having access to an

internet connection. In addition to these two material conditions, a specific digital literacy could also be added to enable the mass of students to understand how to navigate the platform to access the notes uploaded by the teachers (in Word or PDF format), the use of a Webmail for communication between learners and the use of the Zoom videoconferencing platform to facilitate synchronous courses.

This online education model adopted by the Government of Benin to counter the expansion of COVID-19 soon revealed its limitations, despite the facilitating measures decided by the government, such as the zero-rating to allow students to access the online course platform without paying for an internet connection or the construction of 24 digital rooms, 14 postal multimedia centers or 40 Community Digital Points throughout the country accessible free of charge to all students. The closure of the e-learning platform a few months after its opening revealed the need to deepen the knowledge of students' needs for academic success in an online training context.

Context and Rationale

Abiding by the government's decision in 2020, UAC has proposed e-learning to all its students after discontinuing classes. This decision did not prosper as students complained about the way classes were organized and the impossibility for them to follow up. In this context, e-learning revolves only around course content sharing in Word or PDF format and synchronous classes through ZOOM.

The decision to go online was also crucial in UAC's context, where it is expected to have more than one hundred students in front of a lecturer in a single class. It was impossible to resume in-person classes to stop spreading the virus at that time. However, even without COVID-19, these conditions could not be considered optimal to provide quality training and support to every student.

Therefore, it was immediately noted that the university was unprepared to deploy online education on a large scale. Principal challenges encountered and reported by Alladatin et al. (2020) in a similar environment at the University of Parakou (a public university in the Northern region of the country) were related to the inadequate access to Internet connection by all students and faculty, the unpreparedness of some faculty to use the e-Learning platforms (not all of them have practical digital skills), or the lack of techno-pedagogical support to make sure that students understand their lessons and can pass their exams inequitable conditions.

This first large-scale adoption of e-learning in Benin also facilitated the understanding that a lack of preparation by higher education institutions will not promote students' academic success. In these conditions, success will not only be limited to having the average grade on

an examination, as when the technical conditions are not adapted, students can pass the exam online even if they have not developed specific professional skills.

Moreover, even if success rates in academic programs are not measured globally at UAC, it is not uncommon to meet students who, although they have obtained their degrees, are not able to tell with conviction what are their technical skills acquired at the end of their training, and the professional sectors in which they want to transition. When combining students' success with e-learning, the risk of training large-scale students who would manage to pass their exams (primarily if the learning platform does not provide any proctoring tools) without being able to demonstrate their skills in a professional sector is real.

The e-Learning Initiative and other partnerships made it possible to understand that the learning environment was essential in deploying online education platforms. In UAC's context, this learning environment must help ensure that students are well-trained and supported to have a positive result at the end of their training.

Research Questions

Considering the context at UAC and the preference for blended learning, we formulated the principal research question: What are the characteristics of the digital learning environment that can promote students' success at IFRI and FSA?

To answer this question, we investigated the knowledge and perception of students, faculty, and staff at IFRI and FSA. We inquired about their previous experience using the e-learning platform developed by the government and the one at UAC. We also asked about their experience using alternative e-learning platforms. They also expressed their views about the usability of the existing platforms at UAC and the services they expect to be provided to have a better learning experience.

Literature Review and Theoretical/Conceptual Framework

In the traditional university world, the modalities of knowledge transmission include lectures and tutorials. This traditional mode characterized higher education in Benin for a long time, as Attenoukon (2011) indicated when he wrote that knowledge in the university was transmitted orally. However, with the emergence of information and communication technologies, the methods of transmitting knowledge were expected to change. Faculty members initially integrated technological tools into the way they transmitted knowledge. This was referred to as techno-pedagogy and then pedagogical engineering, which, according to Attenoukon (2011), is a "methodology supporting the analysis, design, realization, and planning of the use of learning systems, integrating the concepts, processes, and principles of instructional design." Subsequently, several forms of knowledge transmission have

appeared with the addition of distancing between the teacher and his students. For Perraton et al. (2002), distance education is “an educational process and system in which all or a significant proportion of the teaching is carried out by someone, or something removed in space and/or time from the learner.”

With this teaching modality, a new problem appeared related to the effectiveness of the transmission of knowledge and the acquisition of skills by the learners, which measure academic success. Indeed, some students' social conditions do not allow them to acquire the equipment needed to access distance courses. Even when this equipment is available, faculty members are not guaranteed to master the e-learning pedagogy to propose content adapted to learners' needs and learning styles.

However, with the emergence of the COVID-19 pandemic, an even greater need for integrating technology in training was revealed. It has given substance to all that has already been done in distance learning or even blended teaching, allowing faculty members to continue transmitting knowledge while in a remote place. Alladatin et al. (2020) analyzed Beninese students' perceptions of distance education practices to promote pedagogical continuity during COVID-19. This study noted some limitations to the adoption of e-learning related to the lack of digital resources (having a computer or being able to purchase an Internet connection) to meet the learning needs of students or the inefficiency of distance learning methods, which do not give students enough time to acquire knowledge after their training. With the unpreparedness of Benin's public universities to offer pedagogical continuity after the emergence of COVID-19, it is interesting to explore what can foster the academic success of learners in the context of e-learning.

Several works have addressed issues related to academic success. For Dean (1998), faculty members view academic success as the student “maintaining academic success, securing a position in a chosen career field, graduation, and being able to apply the lessons learned in the college experience to other situations in life.” This definition is based on success in terms of grades and the student's ability to apply the knowledge gained in the professional world. While students can have a different view and consider success on a more personal level, the author concluded that:

“student success is defined as the accomplishment of one’s goals during a college or university tenure, assessed by the individual through a measure of satisfaction or self-esteem, and externally perceived usually through high academic marks and other collegiate accomplishments.”

In Benin, a definition of academic success by the National Education Council was reported by Attenoukon (2011) as follows: "Educational success is the application by the student of values, knowledge, skills and experiences that enable him or her to engage

socially, personally and professionally, according to his or her abilities and goals.” It involves maturing vocational choices and includes a notion of personal accomplishment.

This definition, therefore, includes an element of personal motivation for the learner, who is committed to acquiring knowledge and values that are useful in both his or her private and professional life. In addition to this student motivation, the learning system should be adapted to enable students to develop the expected skills and values during their training. This adaptation refers to the entire training system and the methods of transmitting knowledge, which must be optimized in a blended training context.

Docq et al. (2010) introduce the notions of added values to indicate the interest of teaching in a blended context for learners' acquisition of specific competencies. These skills can be based on five factors (information, motivation, activities, interactions, and productions). Thus, they can be listed as follows.

Table 1

Added values of a blended learning context from Docq et al. (2010)

Factors	Added values
Information, resources	C1: provides students with the resources necessary for in-depth learning. C2: takes advantage of the Internet to create an opening to the world.
Motivation	C3: contributes to familiarizing students with technological tools (those of their future socio-professional life). C4: Promotes personalized involvement of students in the course.
Activity	C5: stimulates learning through a variety of activities. C6: leads students to develop a process of analysis and critical judgment. C7: Promotes student autonomy in their learning.
Interaction	C8: leads students to build their knowledge with others. C9: maximizes teacher-student interactions to support student learning.
Production	C10: leads students to produce visible signs of their learning.

Based on this research, one can consider that introducing distance learning in a blended learning context can develop more for the learner than simply assimilating lessons and passing classes. Academic success can also be seen as the student's achievement through the acquisition of skills that can be reinvested in the professional world.

In addition to acquiring these competencies, it appears that the active role of the learner is more valued in the context of blended learning than in traditional forms of teaching. For Ben Henda (2021):

"The greatest advantage of distance learning is that it allows for adaptive or personalized learning by using the computer to provide content that is differentiated according to each learner's progress rather than a one-size-fits-all approach. It provides learners with the opportunity to showcase their talents and learn at their own pace and in a way that suits them".

Here appears the notion of active pedagogy for the Ben Henda (2021):

"The objective of active pedagogy is to make the learner the actor of his or her own learning, so that he or she builds skills in real or close to real situations. Thus, adopting an active pedagogy consists in making sure that learners acquire knowledge by doing something meaningful to them".

A second dimension for assessing academic success in a blended learning context would then be, in addition to the ability to acquire skills that can be reused in a professional context, that the learner can develop his or her skills through his or her efforts. The learning environment is also critical in fostering success in distance and blended learning contexts.

According to the Glossary of Education Reform (2013):

"learning environment refers to the diverse physical locations, contexts, and cultures in which students learn. [...] The term also encompasses the culture of a school or class – its presiding ethos and characteristics, including how individuals interact with and treat one another – as well as the ways in which teachers may organize an educational setting to facilitate learning – e.g., by conducting classes in relevant natural ecosystems, grouping desks in specific ways, decorating the walls with learning materials, or utilizing audio, visual, and digital technologies".

For Dillenbourg et al. (2002), a virtual learning environment is:

"a range of systems that comprise features like a designed information space, a social space being a place, participants that are active and present actors. [...] It must integrate with rich pedagogical scenarios and these scenarios must profit from its various facilitating features".

Cheawjindakarn et al. (2012) identified this virtual learning environment as a critical success factor in online education. They define it as the set of "locations where students access online resource, use systems for access to online course and communication, obtain tutor assistance, and receive assessment," emphasizing that "people learn best in a learning environment that is supportive, relaxing, and casual". The literature also refers to an adaptive online learning environment, which, according to El-Sabagh (2021), considers students' preferences and knowledge acquisition styles. In this context, students demonstrate

engagement in the way they access learning content, interact with each other and with the lecturer to mutually develop their knowledge.

A literature review by Ojokheta (2010) mentions many conditions for student success in a distance learning environment. These include the length of the course, learner motivation, the student's previous education level, their current age, social occupation, and gender. Other relevant factors include time to complete assignments, student-lecturer interaction, goal satisfaction, institutional commitment, and tutor contact with distance learners. Other factors also mentioned are the quality of course materials and media and student support during the distance course.

For blended learning contexts, Picciano (2017) proposed a framework that can support the achievement of the pedagogical goals of a curriculum. Thus, this learning environment should include content (Learning Management System (LMS), Content Management System (CMS), media), social/emotional (face-to-face instruction), dialectic/questioning (discussion board), assessment (assignments, learning analysis), collaboration/student-generated content/peer review (wiki), reflection (blog, journal).

The blended learning environment as also conceptualized by Ben Henda (2021) takes into consideration the scientific content of the course and the set of pedagogical activities that contribute to the development of skills by learners in an autonomous learning environment. Among these activities that are available on the Moodle LMS are:

- Workshop: allows for peer review,
- Database: allows participants to create, maintain, and search a database of records,
- Chat: allows participants to have a synchronous discussion in real-time (Chat in Canada),
- Consultation: allows you to collect data from students to help teachers know their class and reflect on their own teaching. Consultations are predefined (not editable),
- Assignment: allows teachers to grade and comment on files uploaded by students, or work done online or offline,
- Feedback: allows you to create and conduct surveys to collect feedback,
- Forum: allows participants to have asynchronous discussions,
- Glossary: allows participants to create and maintain a list of definitions, like a dictionary,
- Lesson: allows for flexible delivery of content, following different programmable paths,
- External tool: allows participants to interact with LTI-compliant learning resources and activities on other websites,
- SCORM package allows you to integrate SCORM packages in the course content,
- Survey: allows a teacher to ask a question and gives a choice of multiple answers,

- Test: allows the teacher to design and include tests (quizzes), which can include correct answers and/or automatic feedback,
- Wiki: a collection of web pages that anyone can create or modify.

With these activities and depending on the technological expertise of its local e-learning team, each academic institution could build a learning environment that allows students to make good use of the options presented by Moodle. Since UAC has developed its e-learning platform based on Moodle, we will base our study on the description of the learning environment as proposed by Ben Henda by correlating the perceptions of the learners with those of the faculty members and staff in charge of developing the platform. We will also refer to the experience of the Baobab platform by Mastercard Foundation Scholars.

Research Design: Methods and mode of analysis

Data Collection

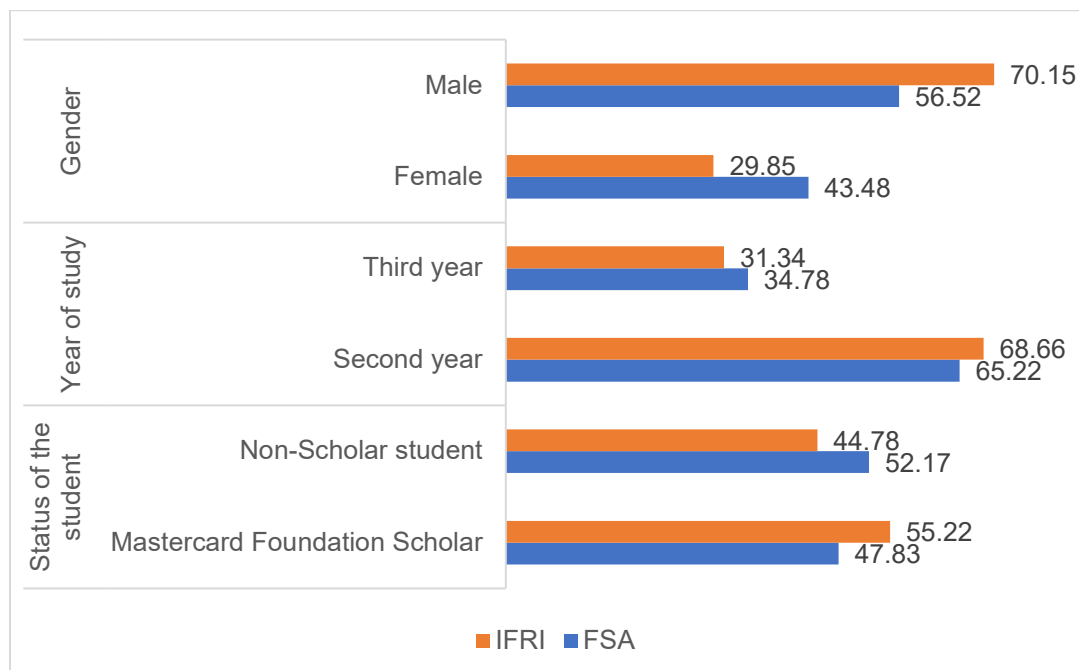
Sampling

The target population for this study was IFRI and FSA learners. The study specifically considered Mastercard Foundation Scholars and non-Scholar students in their second and third years of undergraduate study. Similarly, it considered faculty members who had once designed online course modules and faculty with no experience in this area. Finally, it considered technical staff who were trained in managing an online course platform and those who had not. The characteristics of the sample can be found in the table below:

Table 2:

Characteristics of the target population

Target population		
Students	Administrative Staff	Faculty members
Training Institution: IFRI and FSA	Whether or not you have been trained in the management of an online course platform	Be a faculty of IFRI or FSA
Status: Mastercard Foundation Scholars and non-Scholars		Have once designed or not a module of an online course or have been or not trained on the design of a module of an online course
Sex: Female and Male		
Level of study: Second year and third year of the bachelor's degree		

Figure 1*Characteristics of the student population in the study***Sampling Mode**

The sampling method used in this study is purposive sampling. Purposive sampling is not based on representation or randomness. It is used to select the units that provide a high degree of insight into the issues important to the evaluation. This type of sampling allows for "analytical generalization" (projections of the likely transferability of findings based on a theoretical analysis of the effect of context and the factors that produce the direct effects).

In other words, it consists of an information-rich case study of a given population to make analytical inferences about it. The units are selected according to one or more predetermined characteristics, and the sample may consist of a single unit. This choice is justified because the study considers three targets: students from two schools (IFRI and FSA for a comparative analysis), faculty members, and technical staff. This justifies the transparency in the selection and triangulation.

Data Collection

The method used for data collection is the face-to-face interview method. Structured, easy-to-follow questionnaires with clear instructions were designed and validated by the researchers. Then, the data collectors were recruited, trained, and deployed. The interviewers were divided according to the number of people to be surveyed and by target. The survey took place at the University and covered the period from July 1 to July 15, 2022.

To effectively achieve the study's objectives, a questionnaire was developed for each study target. These three data collection tools are based on three main themes: the material setting, the virtual setting, and the pedagogical and support setting of the e-learning platform at UAC.

Pre-tests

Table 3

Adequacy of research, data collection tools, and expected results.

Research question	Research	Data collection tools	Result expected
What physical learning environment can be created in an e-learning adoption strategy to support knowledge acquisition and student success at UAC?	Hypothesis 1: The material setting is a critical factor in knowledge acquisition and student success in an e-learning context.	Students' questionnaire Faculty members' questionnaire	The characteristics of the material learning environment in an e-learning context at the UAC are known.
	Hypothesis 2: The virtual setting of the e-learning platform contributes to knowledge acquisition and academic success.	Staff questionnaire	The device for supporting learners and teachers in an online course context is known.
	Hypothesis 3: Pedagogical support and tutoring to students in e-Learning are necessary conditions for enhanced knowledge acquisition and academic success.		The physical (software) setting of the e-learning platform is appreciated by users.

Data Processing

The processing of the collected data was carried out in three (3) stages:

- Counting and coding: We counted the questionnaires once the information collection phase was completed. Then, we counted the open and semi-closed questions to recode them.
- Creation of data entry masks: We designed the data entry masks for the questionnaires using CS Pro, tested them, and then validated them. These data entry masks were used to enter the collected data.
- Data entry, data cleansing, and database set-up: The data collected was entered using a data entry mask to facilitate information processing. To reduce as much as possible errors, such as omissions, duplicates, missing values, and inconsistencies, a

clean-up program was written, and we proceeded to impute values or correct data. Finally, the database was ready, and we exported it to statistical analysis software such as SPSS, Excel, and IRAMUTEQ.

Data Analysis

The data from the questionnaires were processed, and the qualitative data were studied anonymously. Once the database was cleaned, it was exported to SPSS. To achieve the objectives and to test the hypotheses, we used statistical analysis tools depending on the number of variables considered, the objectives pursued, and the nature of the variables included in the analysis. To do this, our analysis was both quantitative and qualitative.

The quantitative analysis tools used in our study are cross-tabulations and contingency table analysis. As for the qualitative analysis, to explore the extent and effectiveness of using an online course platform in the era of digitalization, we analyzed the opinions and comments of its users at the UAC. We reported their level of satisfaction and the different dimensions targeted and obtained.

In this study, the opinions were processed statistically with IRAMUTEQ and then manually cross-referenced to identify and refine the categories used to describe our results. The transcription of the opinions resulting from this work is in a file called "text corpus," which is considered the input file for the statistical textual analysis software. Also, we proceeded to a lemmatization of the content of both terms and expressions. This step aims to improve the consistency and coherence of the text corpus before analyzing the occurrences and items.

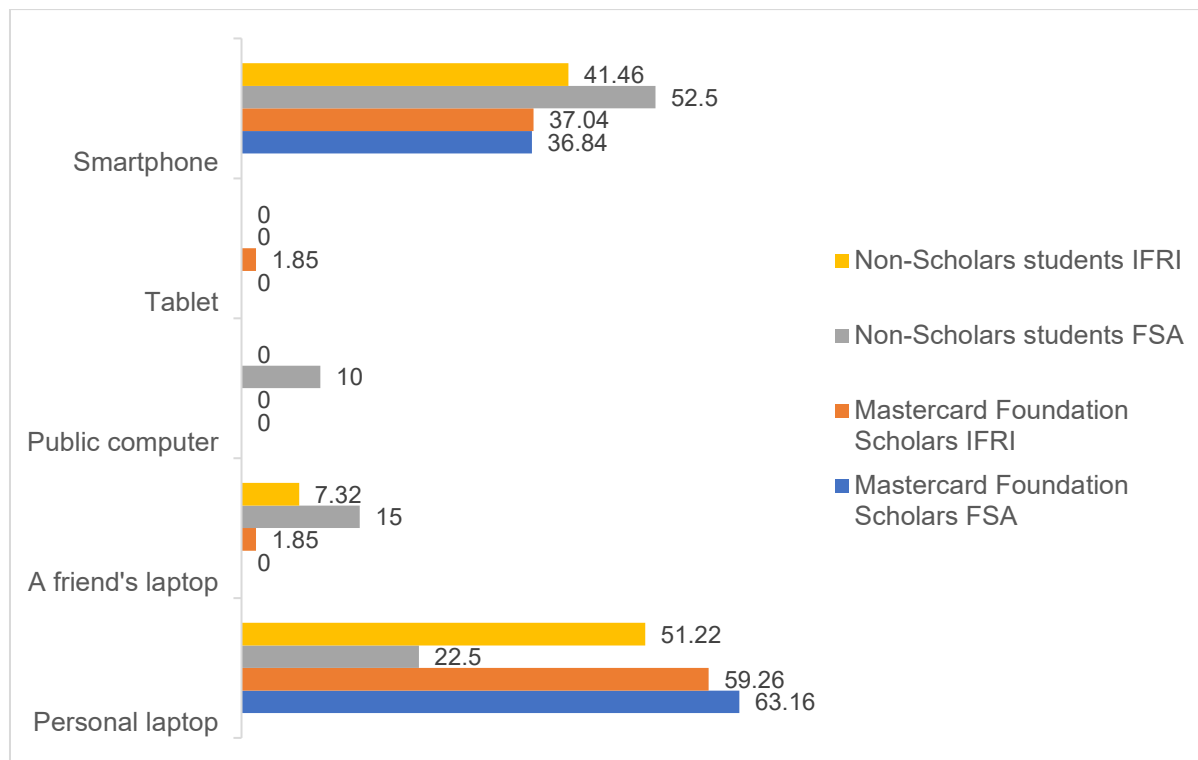
Research Findings/Results

Quantitative Analysis

Material setting of e-learning environment at UAC

Figure 2:

Type of equipment used to access the e-learning platform.

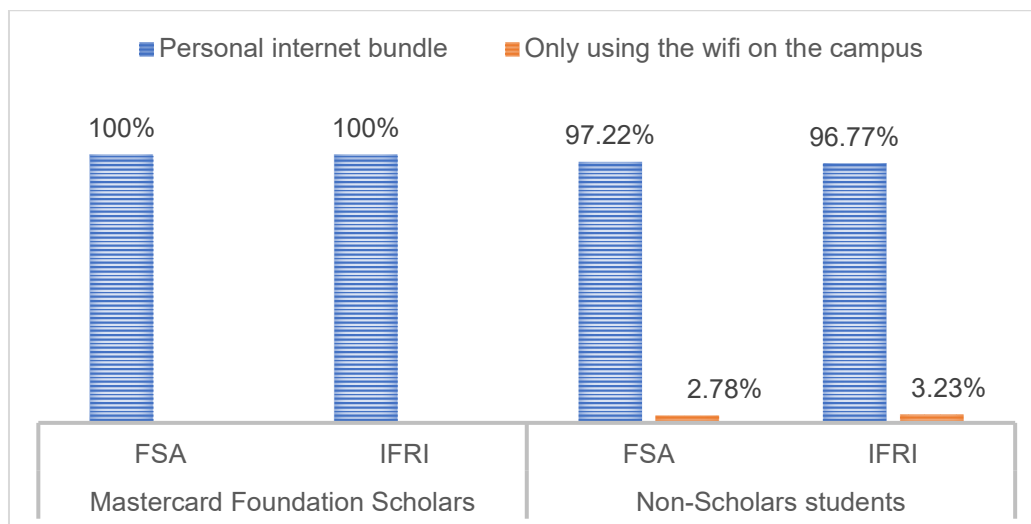


Students mostly use two devices to access the UAC's e-Learning platform. These are a personal laptop and a smartphone. Most Mastercard Foundation Scholars from both FSA (63.16%) and IFRI (59.26%) use their laptop to take online courses. This could be justified by the fact that they are all provided with a computer by the Mastercard Foundation Scholars Program.

On the other hand, among non-Scholar's students, smartphone (52.5% FSA and 41.46% IFRI) is the most used device by students to take online courses. At IFRI, more than half of the students (51.22%) take online courses with their personal laptop because, it is an indispensable learning tool for all students in the school. However, at FSA, having a computer becomes essential for students at the end of their Bachelor training for the writing of their thesis (research project). In addition to the laptop or the smartphone, students also indicated that they need a Wi-fi router, an USB key, and a headset.

Similarly, 100% of the faculty members claim to use their own laptops for online course content production and do not benefit from any computers provided by their schools.

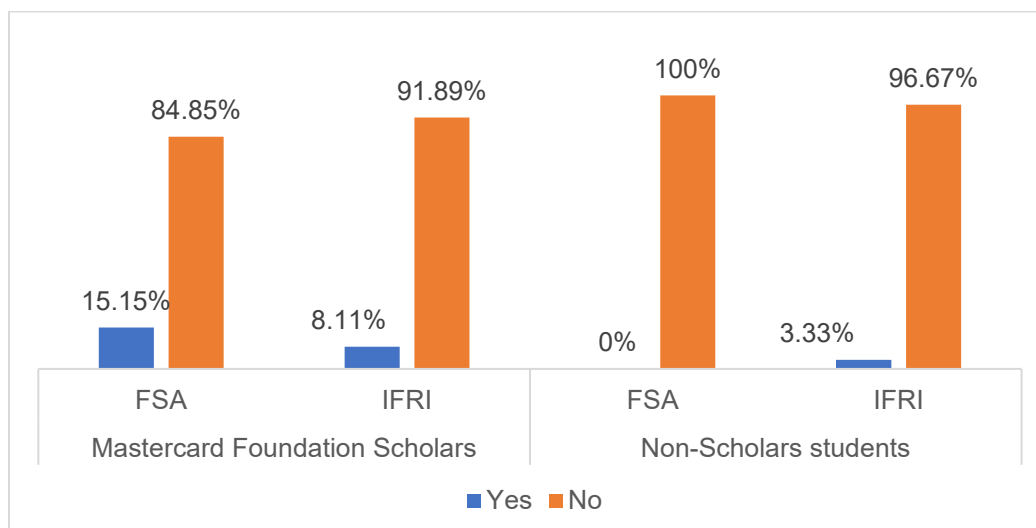
Figure 3:
Students' access to internet



To take online courses, access to a stable and quality internet connection is essential. But the Wi-Fi terminals of the University do not provide access to a quality internet connection. As a matter of fact, whether they are studying at FSA or IFRI and are Mastercard Foundation Scholars (100% FSA and 100% IFRI) or not (97.22% FSA and 96.77% IFRI), students purchase an Internet bundle to access the e-Learning platform. A very small proportion (2.78% FSA and 3.23% IFRI) of these learners only use the Wi-Fi on the campus.

However, according to them, the Internet connection at UAC does not provide a stable access to online education, nor does it promote good production of online course content. Like the students, all (100%) faculty members interviewed use their own Internet bundle to prepare and produce online courses.

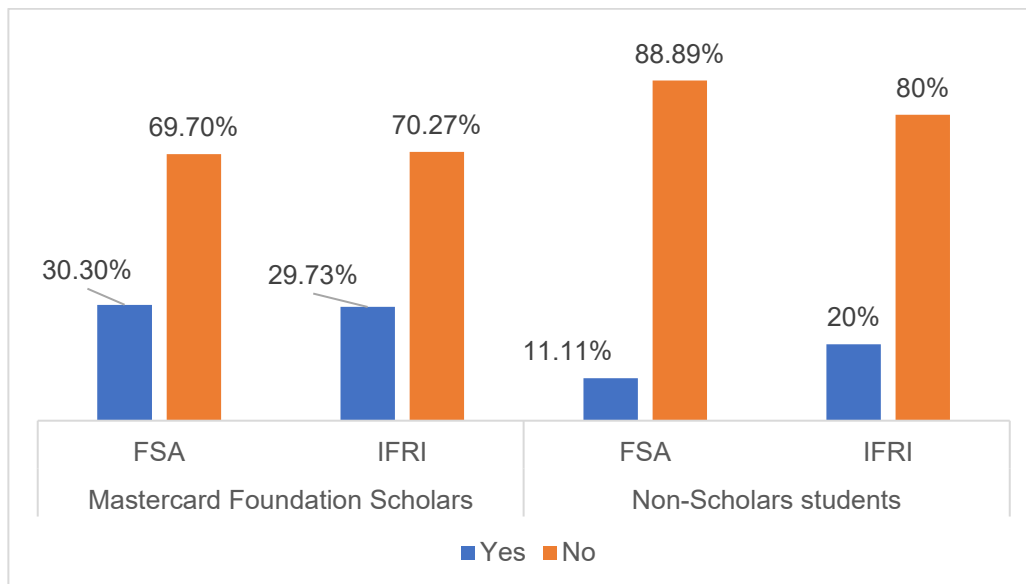
Figure 4
Students' opinion on the quality of the University Internet bandwidth



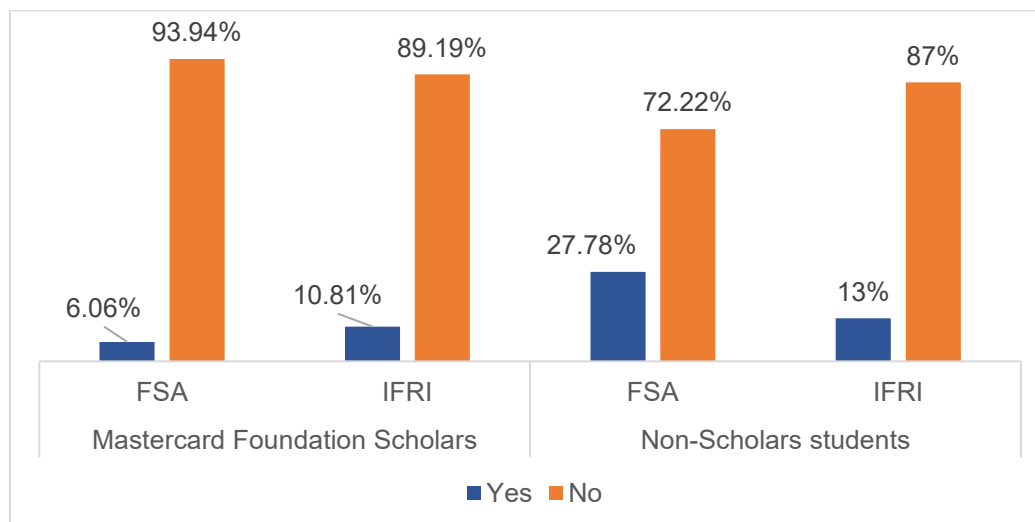
According to the students, the quality of the Internet bandwidth on the Wi-Fi terminals at UAC does not allow them, whether they are Mastercard Foundation Scholars (84.85% FSA and 91.89% IFRI) or not (100% FSA and 96.67% IFRI) and whatever their training institution, to take the online courses in proper conditions.

Figure 5

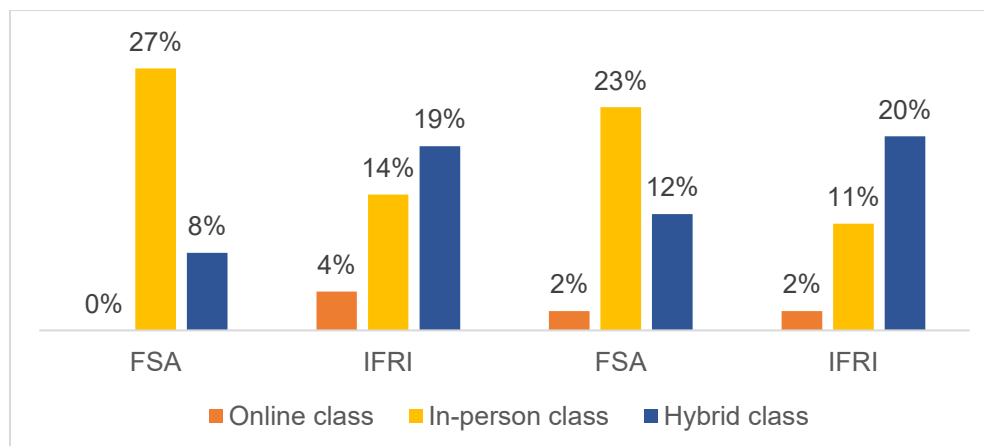
Internet bundle cost and access to online courses



With this difficulty, students resort to purchasing Internet bundles. However, the high cost of the bundles does not allow most of the Mastercard Foundation Scholars (69.70% FSA and 70.27% IFRI) and non-scholars students (88.89% FSA and 80% IFRI) to take an online course in proper conditions. Therefore, a significant proportion of learners cannot take online courses because of the prohibitive costs of the bundles.

Figure 6*Students' access to electricity on the campus*

Since online courses require electronic devices such as computers and smartphones, students need electrical power as much as they need an internet connection. Thus, almost all students have access to electricity to use their devices to access the e-learning platform.

Figure 7*Students' preferred learning environment*

Most FSA students, whether they are Mastercard Foundation Scholars or not (27% for Scholars and 23% for non-Scholars), opt for a classroom setting. However, those enrolled at IFRI prefer a blended learning environment (19% Scholar and 20% Non-Scholarship), i.e., part classroom and part online. A small proportion of IFRI students (4% Scholars and 2% Non-Scholars) opt to take online courses.

Partial Conclusion 1:

To assess the physical environment for online training at IFRI, data collected focused on devices used to access the e-Learning platform, the Internet coverage and costs, the availability of electrical power, and the preferred learning environment.

Even if electricity is available, the schools involved in the research do not provide faculty members and students with the equipment and quality Internet needed to run online classes. Students and faculty members are bound to acquire Internet bundles on their own. These costs are not affordable for most students who see this as an obstacle to accessing online courses. Most of them also do not prefer online training, even if some students enrolled at IFRI prefer blended learning.

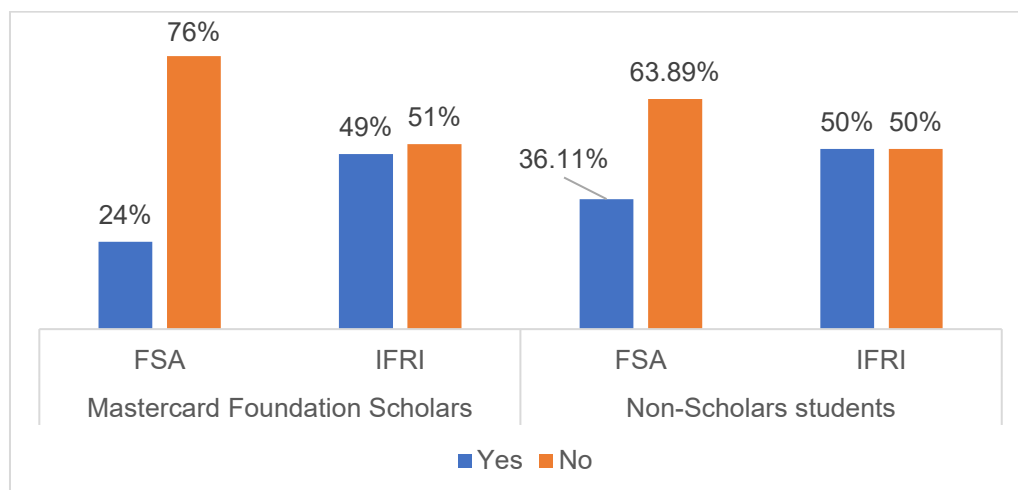
Verification of Hypothesis 1:

Access to a quality Internet connection is as essential to students in online learning as it is to faculty members in the production of online course content. Unfortunately, its access is minimal and of poor quality on campus. Electrical energy is available on campus, but there is a lack of electrical outlets in the classrooms. Finally, not all learners can access the e-learning platform because they do not always have a computer or a smartphone. Our first hypothesis stating that the material setting is a critical factor in knowledge acquisition and student success in an e-Learning context is confirmed from all the above.

The virtual setting of the e-Learning environment

Figure 8

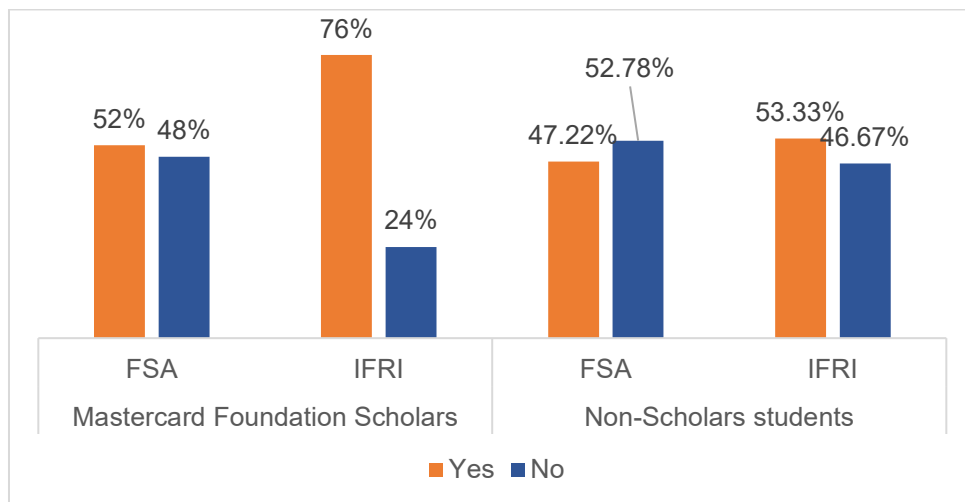
Students' ability to understand the online courses taken on the UAC e-Learning platform.



UAC developed its e-learning platform to provide access to online content and support to all students. Using this platform, FSA students, whether Mastercard Foundation Scholars (76%) or not (63.89%), were not able to understand the course taken easily. On the

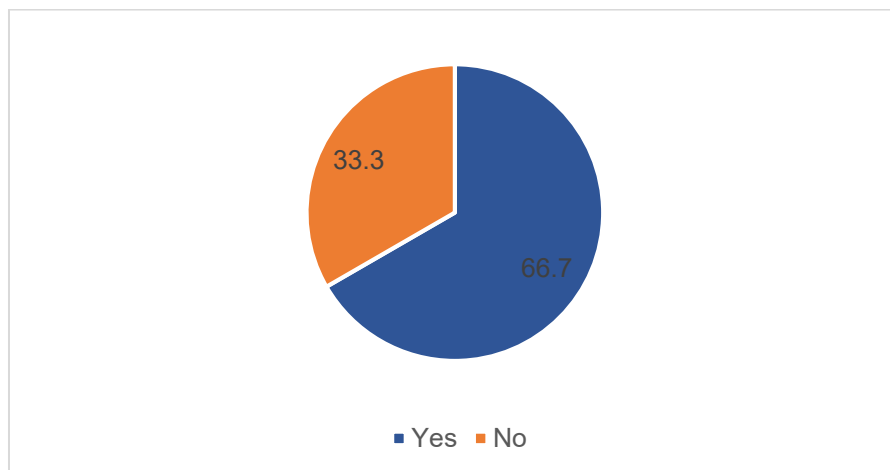
other hand, about half of the students at IFRI (49% Mastercard Foundation Scholars and 50% non-Scholars) were able to understand the courses taught through this platform easily. This result could be explained by the fact that students have acquired digital skills through training. Nonetheless, all the faculty members (100%) interviewed consider that introducing e-learning in university training is valuable.

Figure 9
Student's success rate in an e-Learning course exam



After taking the courses online, both FSA and IFRI students had a positive result at the end-of-course exam. Slightly more than three-quarters of IFRI Mastercard Foundation Scholars (76%) versus 52% of FSA Scholars passed their exam at the end of the online courses. This is the same among non-Scholar's students. The ability to understand and adapt to the online course is higher among IFRI students than FSA students.

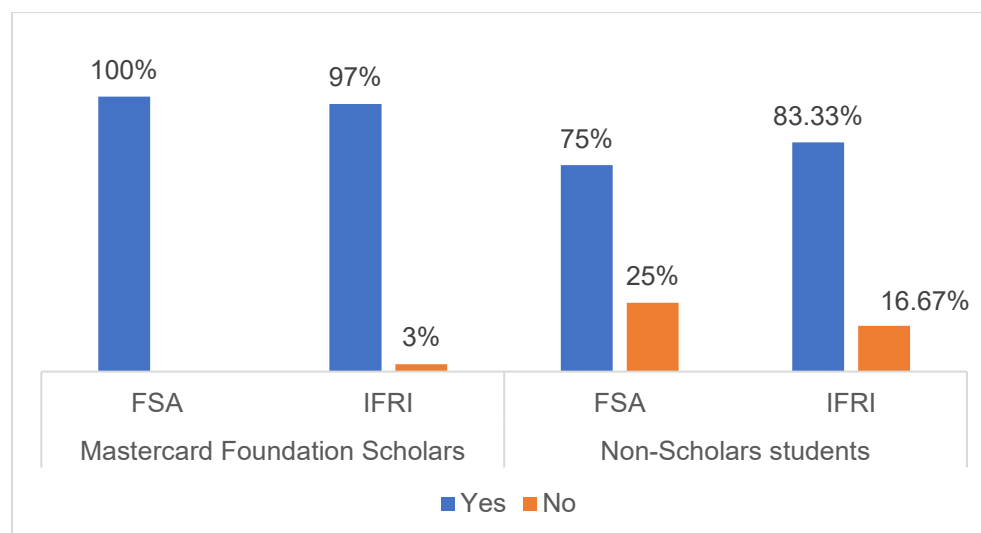
Figure 10
Faculty members' perception of e-Learning introduction in academic practices



When interviewed about the need to digitize the entire course until the passing of the exam, 66.67% of the faculty members considered that it is not a good idea as it may not be helpful to convey knowledge and skills to students.

Figure 11

Students' perception of blended courses utility for digital tools development



Almost all Mastercard Foundation Scholars at FSA (100%) and IFRI (97%) believe that running a blended course (part of the course online and part face-to-face) allows students as well as faculty members to develop digital skills. Non-Scholars students at both institutions (75% FSA and 83.33% IFRI) held the same opinion. According to them, using devices (laptops, tablets, smartphones, etc.) and navigating through the online platform allows students and faculty members to develop digital skills. Likewise, 100% of the faculty members consider blended learning is a good choice in the context of UAC.

Table 4

Digital skills used to complete an online course successfully.

Digital skills used by learners to complete an online course	Scholars		Non-Scholars	
	FSA	IFRI	FSA	IFRI
Ability to use a browser	20,24	20,16	25	10,87
Ability to create and manage a password	17,86	16,94	3,85	8,70
Ability to browse easily on a website	13,10	19,35	17,31	13,04
Ability to use collaborative work tools (chat, Q&A, Docs, Sheets)	19,05	23,39	17,31	50
Ability to search on a smartphone	29,76	20,16	36,54	17,39
Capacity to use ZOOM				2,17

To assimilate the online courses, students used various digital skills, such as collaborative work tools (chat, questions and answers, Docs, Sheets) and browsers, which are essential to access a platform. In addition, 2.17% of the students mastered using remote communication tools, which was a discovery for most of them. Students have also developed the ability to research on a smartphone.

Table 5

Faculty member's experience in online course production

Variables	Categories	Proportion (%)
Have already produced online course content	Yes	66,70
	No	33,30
Have already put a course online	Yes	66,70
	No	33,30
Previously used online course content in an educational setting	Yes	66,70
	No	33,30

The table above provides information on the production and use of online course content in teaching. It reveals that 66.70% of the faculty members have already produced online course content. Similarly, 66.70% have already put a course online and used online course content for teaching purposes.

Table 6

Ability to download files from the e-Learning platform.

Variables	Categories	Scholar		Non-Scholarship	
		FSA	IFRI	FSA	IFRI
The teacher gives you exercises through the platform	Yes	51,52	75,68	58,33	70
	No	48,48	24,32	41,67	30
I can read/download documents uploaded on the platform	Yes	54,55	64,86	44,44	56,67
	No	45,45	35,14	55,56	43,33
I can read/download videos uploaded on the platform	Yes	51,52	54,05	30,56	36,67
	No	48,48	45,95	69,44	63,33
I can upload my exercises on the platform for the lecturer	Yes	27,27	37,84	25	53,33
	No	72,73	62,16	75	46,67

During or at the end of the online courses, faculty members give exercises to be done through the platform. All the students, whether they are Mastercard Foundation Scholars (51.52% FSA and 75.68% IFRI) or not (58.33% FSA and 70% IFRI), complete the exercises sent by the faculty members through the e-learning platform.

Regarding the videos uploaded on the platform by the lecturer, the Scholars (51.52% FSA and 54.05% IFRI) find it easier to download them than the non-scholar students (30.56% FSA and 36.67% IFRI). On the other hand, IFRI students (64.86% Scholars and 56.67% non-Scholars) find it easier to download and read documents on the platform than

FSA students (54.55% Scholars and 44.44% non-Scholars). Unfortunately, both Scholars (72.73% FSA and 62.16% IFRI) and non-Scholar students (75% FSA and 46.67% IFRI) cannot upload resources and submit exercises on the platform. The overall finding is that IFRI students have an easier time using the e-learning platform than FSA students.

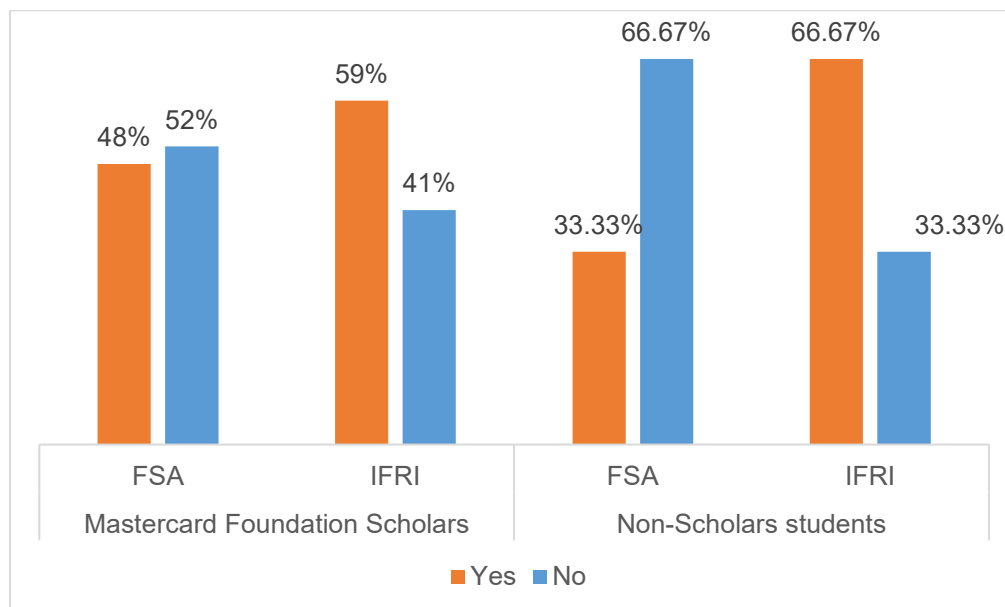
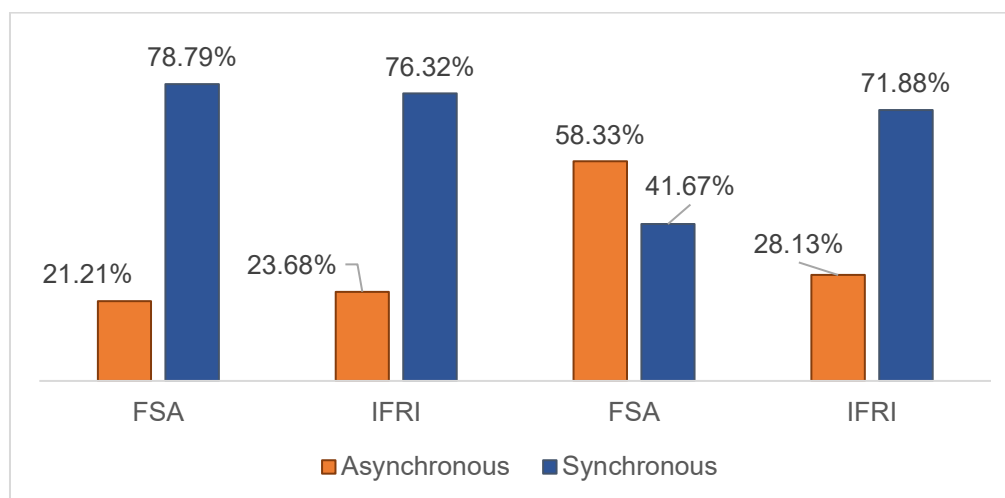
Table 7

Ability to share document and video content with students on the e-Learning platform.

Variables	Categories	Proportion (%)
I can share documents with students on the e-Learning platform	Yes	83,33
	No	16,67
I can share video content on the e-learning platform	Yes	66,67
	No	33,33
I can organize online discussions with students on the e-Learning platform.	Yes	50
	No	50
I can organize knowledge tests for students on the e-learning platform	Yes	50
	No	50
I can conduct classes using the e-learning platform	Yes	83,33
	No	16,67

Through the e-learning platform, faculty members share documents and videos and even organize knowledge tests for students. From the table above, 83.33% of the faculty members find it easy to share documents with students on the e-Learning platform, as opposed to only 16.67%. Similarly, 66.67% of the faculty members find it easy to broadcast video content on the e-Learning platform.

Regarding online discussions with students and the organization of knowledge tests for students, 50% of the faculty members can do it quickly. Finally, 83.33% of the faculty members have an easy time running courses using the e-Learning platform, compared to only 16.67%.

Figure 12*Capacity to conduct a discussion online with the lecturer.***Figure 13***Nature of the discussion with the lecturer*

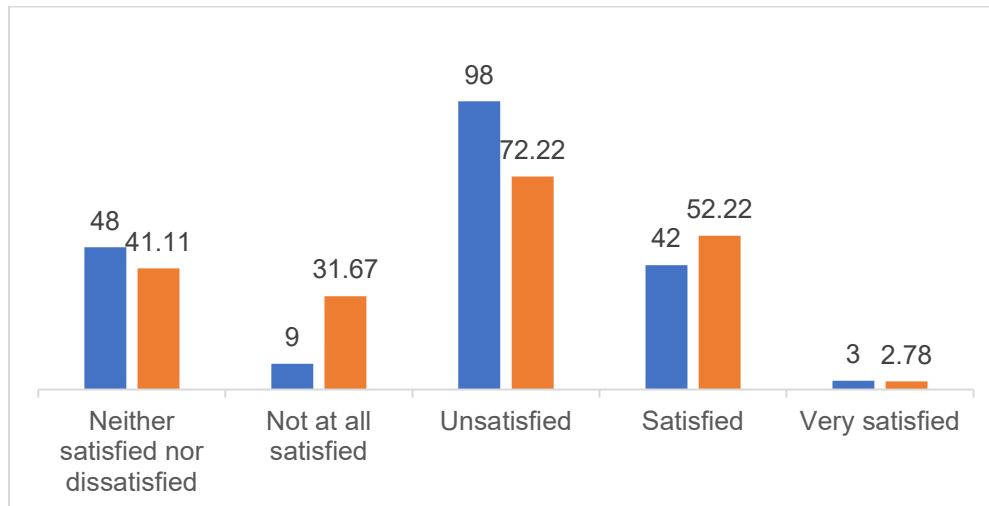
E-learning offers the possibility for students to discuss with their lecturer, ask questions, and have more explanations. IFRI students (59% Scholars and 66.67% non-Scholars) find chatting online with the lecturer on the platform more accessible. The Scholars enrolled at IFRI (59%) find chatting online with the lecturer easier than those at FSA (48%).

Regarding the nature of the discussions, they are mostly synchronous, as stated by many scholars (78.79% FSA and 76.32% IFRI) who take specific courses and participate in some events organized on the Baobab platform. However, among non-Scholar students, the discussion is asynchronous (questions asked by the student and answers from the teacher posted later) for 58.33% of FSA students and synchronous for non-Scholar students at IFRI

(71.88%). Non-Scholars students use the e-Learning platform at UAC, while Scholars share their experience of the Baobab platform.

Figure 14

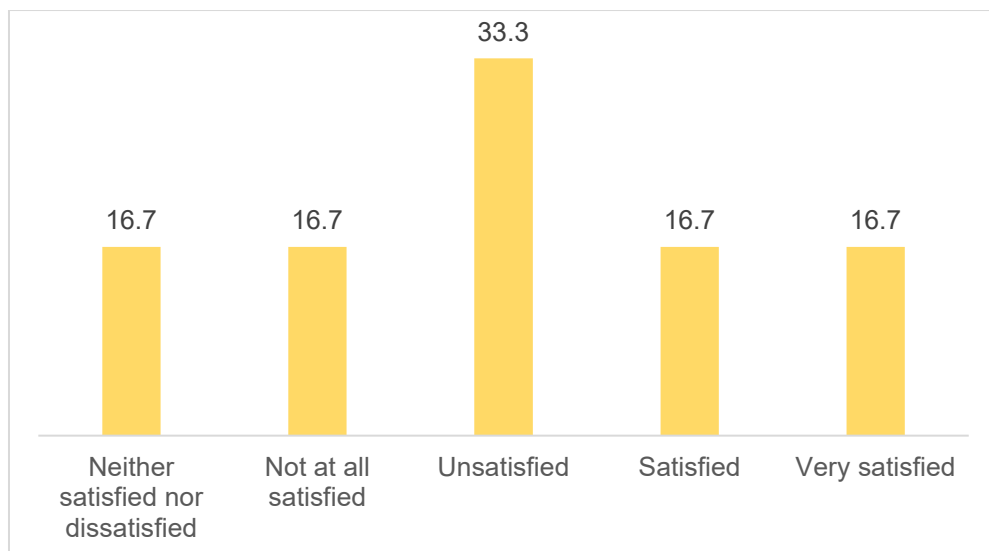
Appreciation of the presentation of the university e-Learning platform by the students



From the analysis of this table, it appears that the students, whether from the FSA or the IFRI, are globally not very satisfied with the presentation of the online course platform. It is, therefore, necessary to improve the platform for optimal and efficient use.

Chart 15

Appreciation of the presentation of the university e-Learning platform by the faculty members

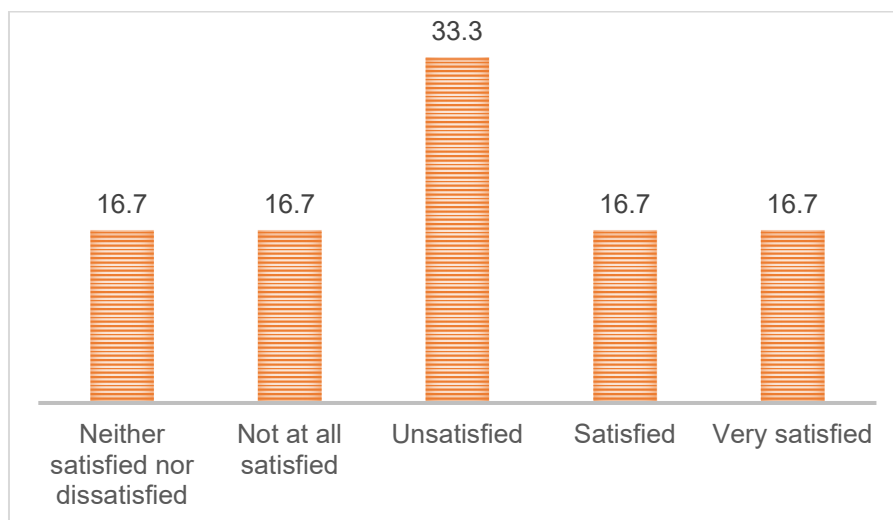


Like the students, most of the teachers (33%) are not very satisfied with UAC's e-Learning platform presentation.

Practice of alternative e-learning platforms

Chart 16

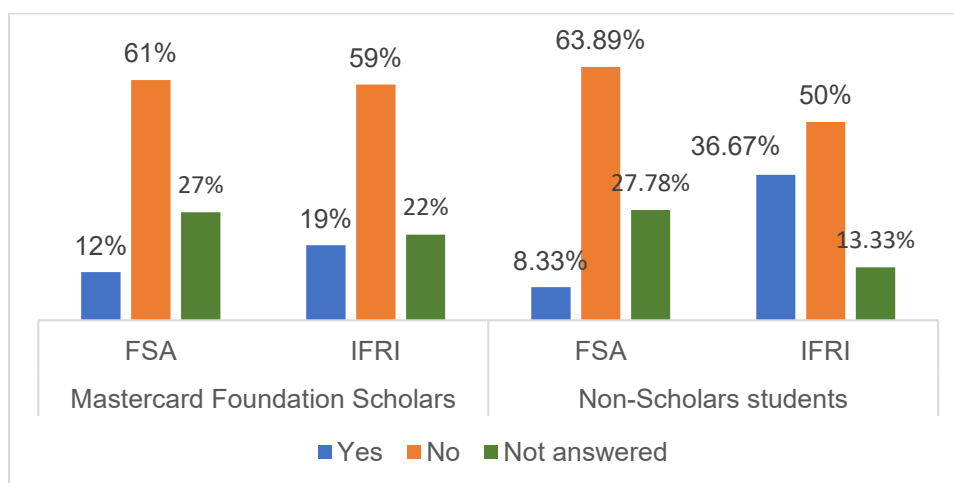
Students' satisfaction with the use of alternative e-learning platform



Three-quarters of Mastercard Foundation Scholars, whether from FSA (61%) or IFRI (73%), have already taken online courses on alternative platforms. However, among non-Scholars, 70% of those from IFRI have already taken courses on alternative platforms, unlike those from FSA, where 80.56% have not taken courses on any course on platforms other than UAC's.

Chart 17

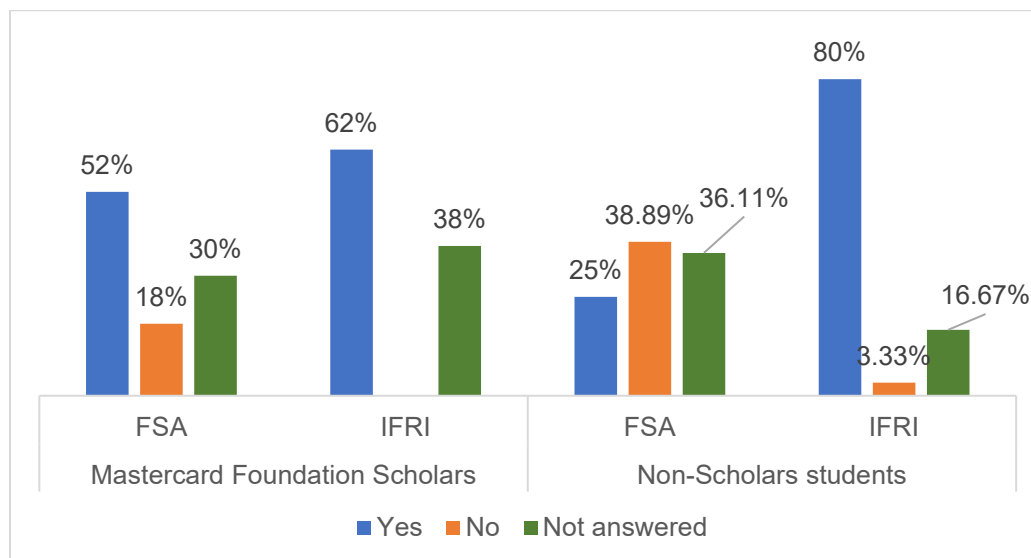
Practice of blended course on alternative platform



According to most student respondents, these courses taken on alternative platforms were not in the context of a blended course, whether they are Scholars (61% FSA and 59% IFRI) or not (63.89% FSA and 50% IFRI).

Figure 18

Capacity to understand the course taken on alternative platforms.



By using an alternative platform, Mastercard Foundation Scholars and non-Scholars could understand the course. This ability to understand easily allowed most Scholars (52% FSA and 62% IFRI) to pass the exams at the end of the course. Among non-Scholar students, those studying at IFRI consider that they can understand the e-Learning course at a high proportion (80%). However, those studying at FSA are very low to consider that they understand the course taken (25%).

Partial conclusion:

There is unanimity among the surveyed that online or blended courses help increase participants' digital skills. However, few students and faculty members were satisfied with the presentation of UAC's e-Learning platform. They also had difficulties carrying out the different operations, such as viewing, downloading, and uploading different documents and media. Both students and faculty members also experienced difficulties in exchanging synchronously and asynchronously via the platform. Students who used an alternative platform claimed to have had a better training experience and better academic results.

Testing of Hypothesis 2:

E-learning at UAC has allowed students to increase their digital skills. However, faculty members and students have encountered difficulties using the e-learning platform designed at the UAC. Thus, hypothesis 2, indicating that the virtual setting of the e-Learning platform contributes to knowledge acquisition and academic success, is confirmed.

Educational and support setting of the e-learning environment

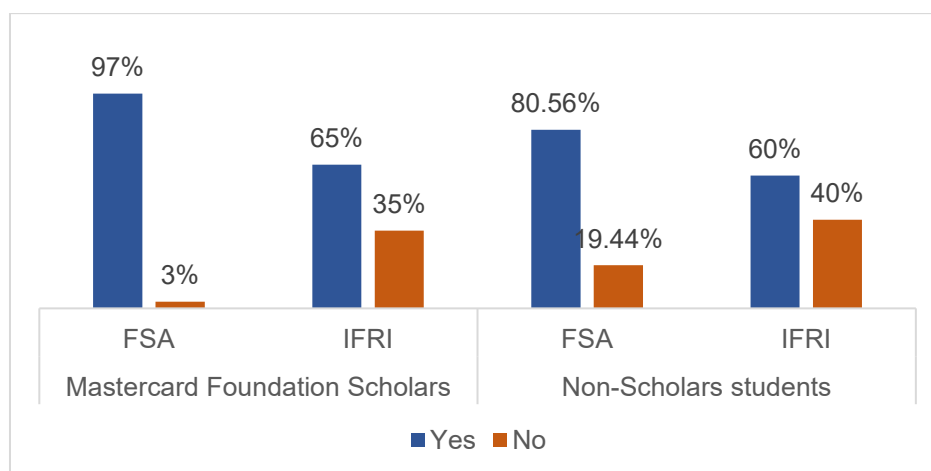
For the success of blended training at the UAC and the smooth running of the online courses, three instructional designers (two website developers and one graphic design and video editor) were recruited from UAC's IT department.

Two out of three have received training to offer techno-pedagogical support to students in using the online course platform, as well as instructional design support to faculty members in producing online course content. All of them are therefore able to offer support to students to better understand the courses in a blended learning context, train faculty members, and provide them adequate support on the production of online courses and techno-pedagogy.

As for the faculty members, the majority (66.7%) of the respondents felt that they needed training on the production of online course content, although all (100%) indicated that they had already received training on this topic. When asked about their level of satisfaction with this training, half (50%) of the respondents said they were delighted, 16.67% said they were satisfied, and 33.33% were indifferent to this training.

Figure 19

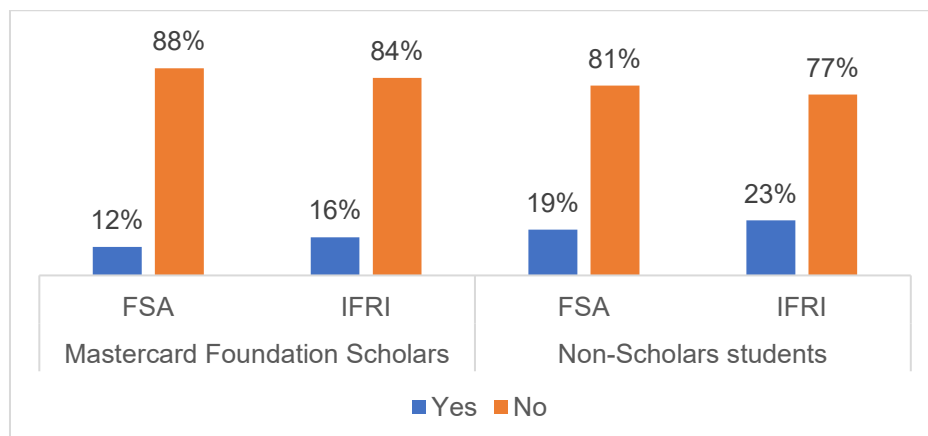
Students' training needs to use the e-learning platform.



As for students, both Mastercard Foundation Scholars (97% FSA and 65% IFRI) and non-Scholars (80.56% FSA and 60% IFRI) considered that providing training for them on how to learn online is essential.

Figure 20

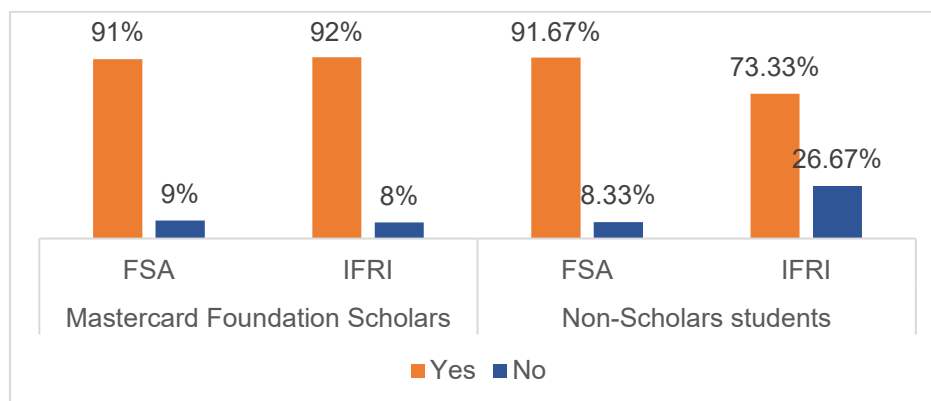
Initial training for students before using the e-Learning platform.



However, most of the students (more than 80%), whether Mastercard Foundation Scholars or not and studying at FSA or IFRI, acknowledged that they had not been trained to use the UAC e-learning platform.

Figure 21

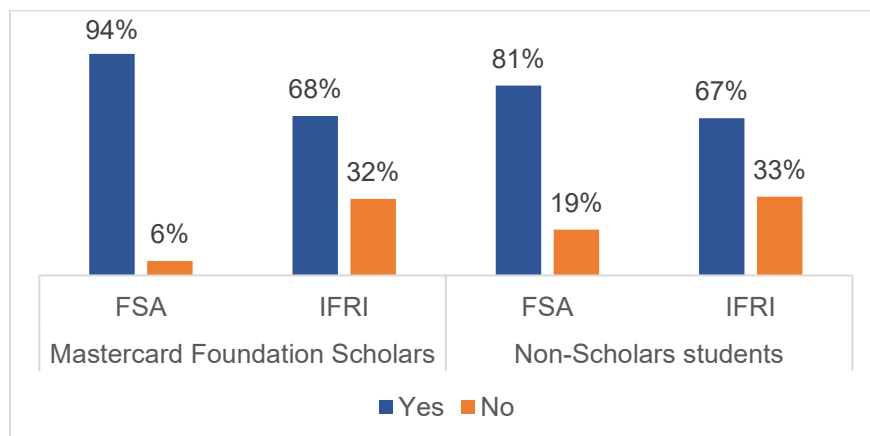
Students' opinion on the need to train faculty members on e-learning content production.



Similarly, most Mastercard Foundation Scholars (97% FSA and 65% IFRI) and non-scholars (97% FSA and 65% IFRI) believe that it is also essential to train faculty members on how to produce online training content.

Figure 22

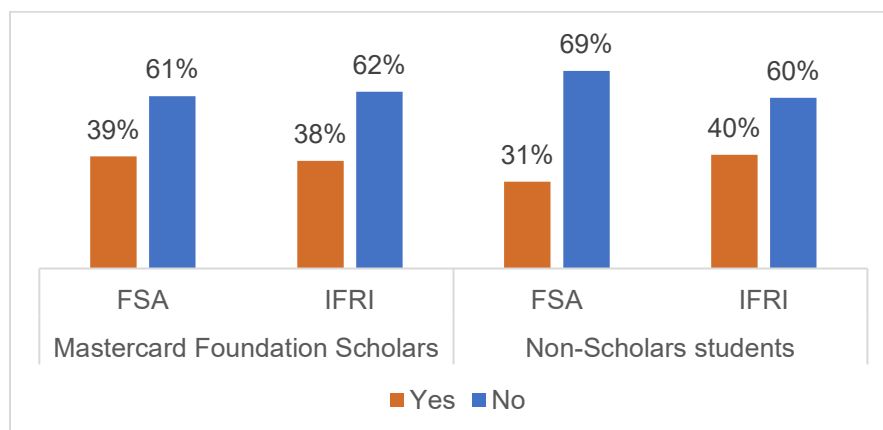
Students' need for tutoring to learn in a blended e-learning environment.



Most students at both institutions, whether on Scholars (94% FSA and 68% IFRI) or not (81% FSA and 67% IFRI), also felt that they needed tutoring to learn well in a blended learning environment.

Figure 23

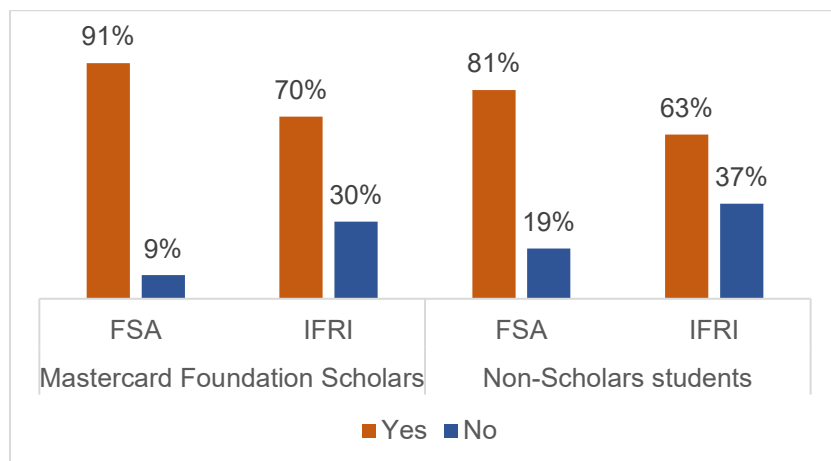
Existing staff support students.



Although they felt they needed training and tutoring to use an e-learning platform, most students at FSA (61% Scholars and 69% Non-Scholars) and IFRI (62% Scholars and 60% Non-Scholars) did not receive any tutoring from staff at their school.

Figure 24

Students' pedagogical needs to learn in a blended learning context.



Most students at both training institutions, whether on scholarship (91% FSA and 70% IFRI) or not (81% FSA and 63% IFRI), expressed the need for a lecturer's pedagogical support to learn well in a blended learning context.

Figure 25

Faculty members need coaching to produce online training content.

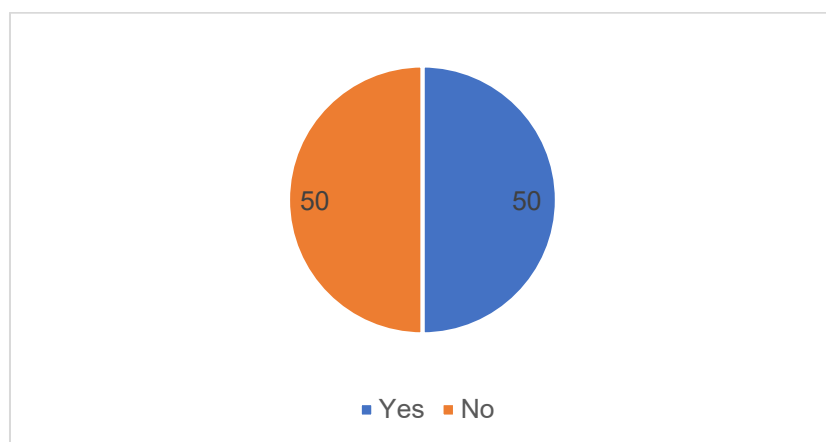
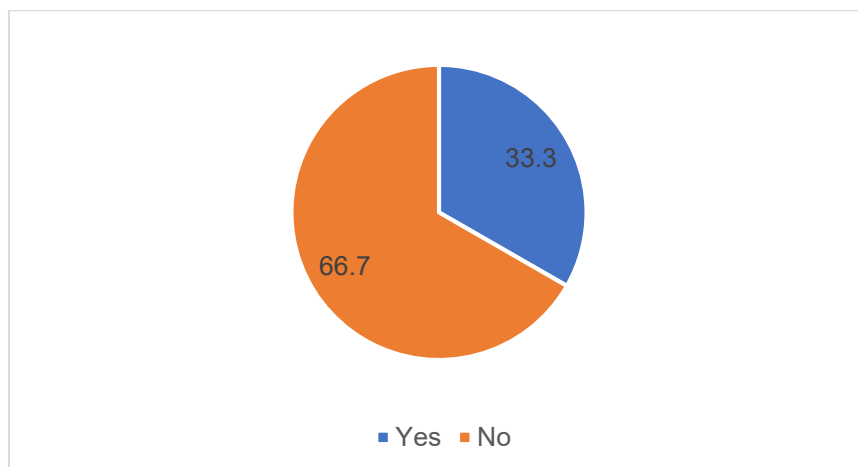


Chart 26

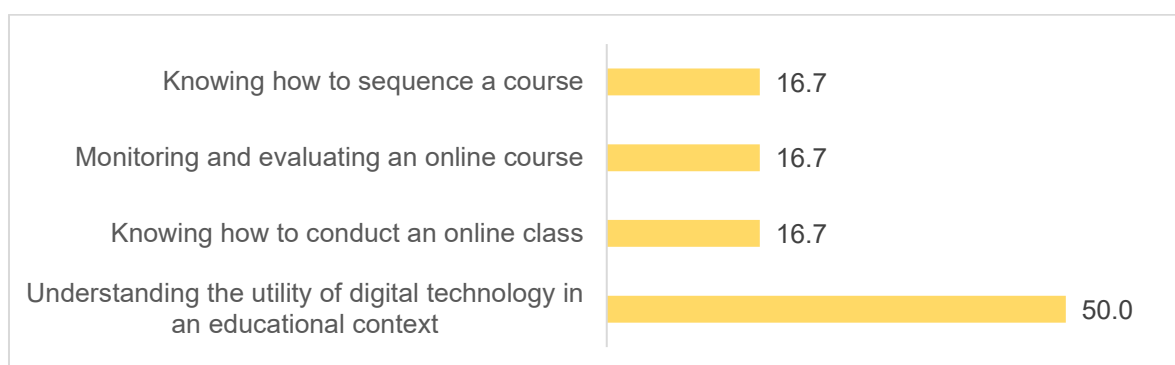
Faculty members need coaching to integrate course content on the e-learning platform.



To produce online course content, 50% of the faculty members said they needed coaching, and 66.70% felt they needed it to integrate an online course into UAC's e-Learning platform successfully.

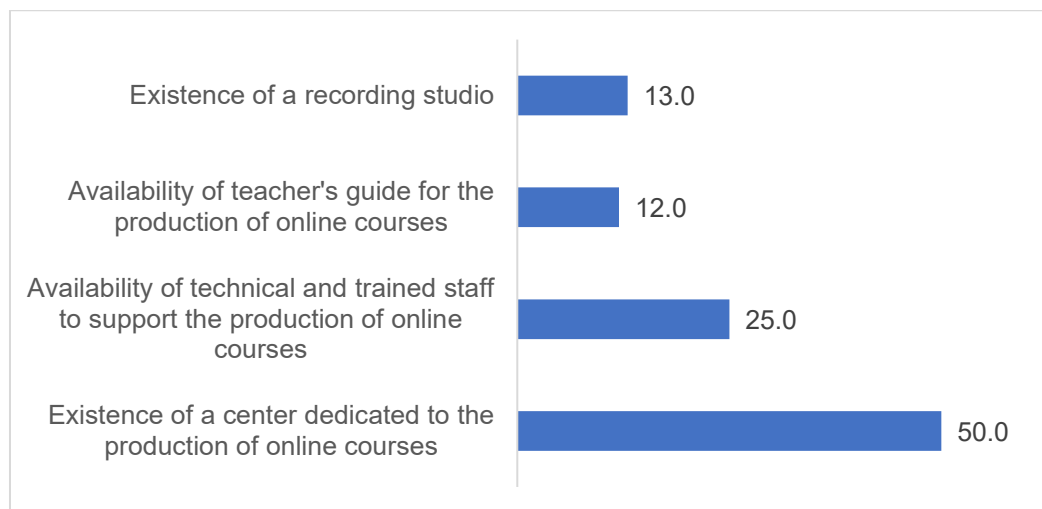
Figure 27

Competencies developed by faculty members after the training in techno-pedagogy

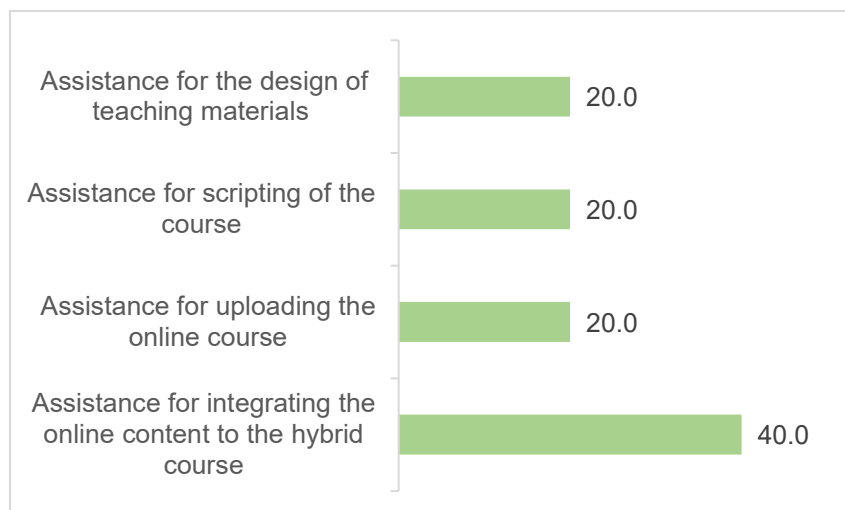


After their training by Arizona State University through the e-Learning Initiative, 50% of the faculty members now feel they have mastered using digital technology in an educational context. Similarly, less than a quarter of the faculty members can monitor and evaluate an online course, and the same percentage know how to conduct an online class. Finally, 14.29% claim to know how to sequence a course.

Furthermore, all the faculty members acknowledged that introducing blended learning allows students to better understand their course. It also allows them to acquire knowledge independently and be sufficiently equipped to pass their exam.

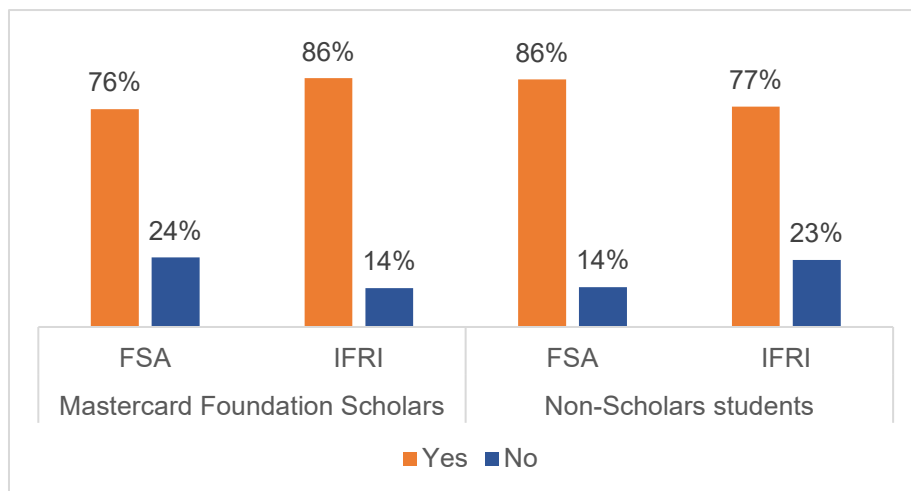
Figure 29*Institutional support to produce online courses*

Half (50%) of the faculty members said that they were aware of a center dedicated to the production of online courses, and 13% considered that this center had a studio for recording courses. Twenty-five percent (25%) indicated that trained technical staff were available to support the production of online courses, and 12% noted that a lecturer's guide on online course production was available.

Figure 30*Support is needed by faculty members to produce online courses.*

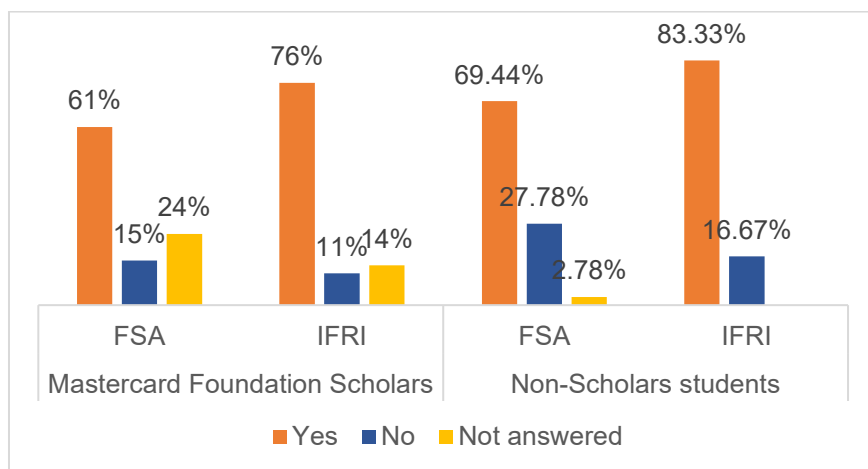
40% of faculty members needed assistance in scripting their courses. Similarly, they need assistance uploading their courses online and integrating their online course into a blended learning environment. Finally, faculty members need assistance in designing teaching materials for online courses.

Figure 31
Online courses pacing perception by the students.



When asked about the sequencing of the online courses on UAC’s e-learning platform, most students at both training institutions, whether Scholars (76% FSA and 86% IFRI) or not (86% FSA and 77% IFRI), confirmed that it was realized.

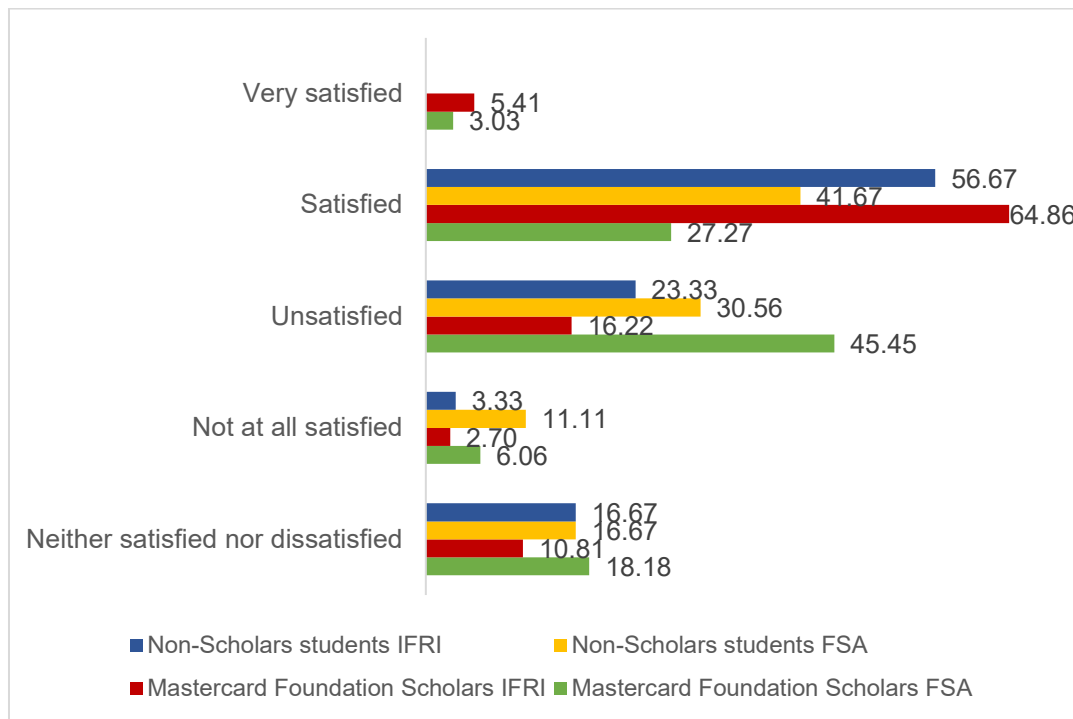
Figure 32
Utility of the course pacing for the students



According to students, 61% FSA and 76% IFRI Mastercard Foundation Scholars and 69.44% FSA and 83.33% IFRI non-Scholars, the pacing of the courses on the e-learning platform allowed them to gain new knowledge at their rhythm.

Figure 33

Appreciation of the online training content of the university e-learning platform by the students



Overall, students are satisfied with the content of the courses on the e-Learning course platform. IFRI students (64.86% Scholars and 56.67% Non-Scholars) are more satisfied than FSA students (27.27% Scholars and 41.67% Non-Scholars).

Partial conclusion:

The need for pedagogical support is notable among both learners and faculty members. It is more evident for non-Scholar's students at the FSA. It is essential to improve the content and sequencing of courses and to provide more training to staff and faculty members on the production, integration, and delivery of online courses. Learners noted that they must be trained to use and master their learning environment.

Testing of Hypothesis 3:

Training of all users of the e-learning platform on how to run it is called for. Similarly, students request tutoring and pedagogical support from their faculty members to use online content in a blended learning context. Hypothesis 3, according to which pedagogical support and tutoring to students in e-Learning is a necessary condition for enhanced knowledge acquisition, and academic success, is confirmed.

Qualitative analysis: targets' perception of the e-learning environment at UAC

Here, we analyze the perception of students, faculty members, and staff on adopting blended training at the UAC and the characteristics of the learning environment for its implementation.

Students' Perception

Material setting of the e-learning environment

Almost all Mastercard Foundation Scholars and non-Scholar students considered that the UAC's learning environment is inadequate for online training. First, they noted the low speed of the Internet connection. They indicated that they needed to purchase Internet bundles to access the e-Learning platform, which is expensive. Their perception of the quality of the internet connection is given through the following comments:

“The online courses are not very accessible because of the Internet connection quality, and we cannot listen to the lecturer properly.”

“I find that with online courses, the connection is not very good, and we cannot participate 100%; the network is not always stable.”

“The instability of the connection and lack of money to purchase Internet bundles.”

“We prefer face-to-face courses because of the cost of Internet bundles on the one hand and the low quality of connection on the other.”

“The cost of Internet bundles from GSM networks is a barrier for us. In addition, one thing is to purchase the bundles; another is to be in a good location to have a good broadband connection.”

In addition to the difficulty related to access to the Internet connection noted by the learners, we also note the inadequacy of power outlets and the permanent availability of electricity on campus. Unfortunately, not all students have a laptop to access the courses online. For those who do, their computers are sometimes without autonomy. Most students use their smartphones, which does not always facilitate access to the online course platform. We can read in their comments:

“Power outage causing our phones to be discharged.”

“Our computers discharge sometimes, and there are not enough plugs to charge.”

"We have computers with no autonomy, and there is a lack of power outlets to plug them in."

"Difficulty for some who do not have a smartphone or computer to access the platform."

"Difficulty of having a smartphone or computer."

"Insufficient and no access to computer rooms to better follow online courses."

The virtual setting of the e-Learning environment

For the learners, the online course platform must meet specific criteria to facilitate understanding the courses to attain academic success. They express themselves in these terms:

"Flexible, intuitive, attractive".

"Very ergonomic (pretty, intuitive, fun, not too much information at once ...) and accessible to everyone even offline."

"An online course platform should be designed so that we see the lecturer deliver its course. Moreover, the platform will record the lectures given and the students will be able to reaccess it to it when they still need the teacher's explanations."

"Easy to access, comfortable virtual space."

"Simple and accessible to all."

"For an online platform that will be dedicated to students must have the following features: easy access to the platform, the ability to upload PDF documents and videos, the ability to download the course materials."

"Easy to access and secure."

"Easy to download documents and videos and suitable for all types of connection."

"It has to come with a user guide."

Pedagogical support and tutoring

Students expressed the need for various supports from their educational institution to meet academic success in a blended learning context. Most of these needs were material.

These included the provision of a good internet connection, the installation of power outlets in the classrooms, and comments such as

“Providing the students with adequate materials and Wi-Fi coverage.”

“FSA should provide students with good connectivity in the classrooms and library.”

“A stable work environment with laptops and desktops accompanied by a good Internet connection.”

“Have a computer room to facilitate access to the course for those who do not have computer tools.”

In addition, students also express the need to be trained on using the e-Learning platform and receive a pedagogical guide and tutoring by technical staff. Finally, they wish to discuss with their faculty members to receive additional explanations in case they do not understand a course.

They expressed this need for support using several expressions, such as:

“Technological support.”

“Face-to-face exercise session.”

“Online discussion session with faculty members.”

“That faculty members are connected during synchronous sessions when they will have enough time to answer students’ questions.”

“To help us understand, our faculty members should repeat the concept a few times in class and do the review at every other session. School administrations must ensure the presence of the lecturer and the students online.”

“Encouraging faculty members to take the time to explain the course.”

“Question and concern sessions, a pdf version of the course.”

“After the online courses, I would like them to hold tutorial sessions with the students to explain further some concepts not understood.”

“The availability of faculty members to explain the online courses and not just send the course materials.”

“Thorough and detailed explanation from the faculty members and a satisfaction survey of the use of the courses and platform from the administration.”

“The fluidity in their explanations and availability to receive our concerns.”

Overall, the students opt for blended learning at UAC but suggest that only the theoretical courses occur online. Practical courses, tutorials, and experiments should be conducted in person to facilitate application and understanding by the learners.

Faculty members' Perception

The material setting of the online learning environment

Like the students, faculty members also expressed the need for materials to produce the course contents. They express the need for a good Internet connection, a laptop, a digital classroom, and up-to-date and accessible virtual libraries.

Indeed, faculty members at the UAC are confronted with the low speed of the Internet connection on the campus, the lack of recording rooms, and the unavailability of computers provided by their schools. To improve the acquisition of knowledge by students at UAC in the context of online courses, faculty members propose the establishment of an adequate material setting. To this effect, they express themselves in these terms:

“Subsidized cost computers and laptops for each student, free internet, free digital library.”

“To provide large rooms equipped with computers and perfect quality Internet to students.”

“Dedicated digital classroom - free Wi-Fi for students and faculty.”

Pedagogical support and tutoring

All faculty members interviewed agreed on the need to be trained on the production of online course content, the sequencing and pacing of their course, and the use of the e-learning platform.

Technical Staff's Perception

The virtual setting of the online learning environment

Technical staff trained in techno-pedagogy describes the characteristics of an adequate virtual setting contributing to learners' better acquisition of knowledge. This setting would require an available platform and a fluid connection to the Internet. The platform must remain active and accessible so students can access it anywhere. In addition, the existence of forums, forum moderators, and tutoring could help students advance in acquiring knowledge. In the same way, knowledge evaluation based on random and not fixed MCQs, for example, could reinforce and certify the acquisition of new knowledge by the students. A tutorial on using the platform should be available to its users.

Educational and support setting

For the technical staff, the support they offer to students and faculty members in an online course context is critical, especially since it allows the learner to feel considered and assisted as if they were in a face-to-face learning context. Similarly, this technical support facilitates the use of the platform for different users. Finally, the interactivity of the online course platform reassures students when they encounter difficulties.

For faculty members, the support of technical staff can help to organize their course content better, to better define evaluation activities, and to learn how to transmit knowledge, skills, and attitudes in the digital age.

Discussion

In this research, we analyzed the learning environment from three main perspectives: the material setting, the virtual setting, and the pedagogical and tutoring environment. For this research, students' success was defined by their ability to reinvest in life the knowledge and skills they have acquired during their training.

Three hypotheses were made about the research question and the need for characterization of the learning environment:

Hypothesis 1: The material setting is a critical factor for knowledge acquisition and student success in an e-learning context.

Hypothesis 2: The virtual setting of the e-learning platform contributes to knowledge acquisition and academic success.

Hypothesis 3: Pedagogical support and tutoring to students in e-Learning are necessary conditions for enhanced knowledge acquisition and academic success.

Material characteristics of the e-learning environment for academic success at UAC

The training environment is characterized by limited access to a stable and quality internet connection for students and faculty members. UAC's campus does not provide Wi-Fi Internet coverage to students, who must purchase Internet bundles to access the platform. Students do not have access to digital classrooms, and those who have been able to acquire a computer have difficulty accessing battery recharging stations in the classrooms.

This situation somewhat differs between IFRI and FSA and Mastercard Foundation Scholars and non-Scholar students. This difference exists because, on the one hand, a computer is a mandatory learning tool for IFRI students. On the other hand, all Mastercard Foundation Scholars are provided with computers and educational materials. This undoubtedly facilitates learning and access to online resources for them.

Facilitating academic success in an e-learning context implicates guaranteeing students' access to the material resources necessary to access knowledge. A range of proposals were collected during the interviews. They concern the provision of computers to students at a subsidized cost, the enhancement of Internet coverage throughout the campus, the establishment of a digital library, digital classrooms, etc.

Innovative mechanisms for creating such an enabling learning environment must be sought. UAC could think about public-private partnerships in this sense and find mechanisms for financing these solutions. Discussions could be held with Internet service providers to make the e-learning platforms available free of charge to UAC students. Same discussions could also be held with student representatives so that they can contribute to acquiring their learning materials through a lump sum contribution from their peers.

Virtual characteristics of the e-Learning environment for academic success at UAC

Students involved in this research used the e-Learning platform developed by UAC, the one developed by the government, and alternative learning platforms. Also, Mastercard Foundation Scholars had a significant experience using the Baobab platform.

The ergonomics and content of the platform are essential to captivate the students' interest and ensure. They must also facilitate knowledge transfer according to the learning objectives previously set, as well as empower students to be able to learn by themselves. According to them, the platform must be simple and attractive and allow simple operations and access to the functionalities conceptualized by Ben Henda (2021).

Indeed, the blended learning environment, as conceptualized by Ben Henda (2021), takes into consideration not only the scientific content of the course but also all the

pedagogical activities that contribute to the development of skills by learners in an autonomous learning environment. The Moodle LMS integrates synchronous and asynchronous discussion spaces, resources, forums, courses, wikis for collaborative work, summative and peer evaluations, feedback spaces, etc.

To develop its platform, UAC chose Moodle. Interactions with students showed they had great difficulty understanding the courses and passing the exams. The closing of the online platform developed by the government also had the consequence that most of the students and faculty members surveyed would like to use blended learning rather than exclusive online learning. Students still insist on maintaining physical interaction with their lecturer, which could not be achieved with the tools offered by the platform developed by the government.

Students who had used alternative platforms or the Baobab platform reported that they had an easier time learning and validating their courses. This ability was differentiated between IFRI and FSA learners because IFRI trains in computer science and has more experience with online learning. Nevertheless, IFRI students were not unanimous in their preference for online courses.

The learning environment (Moodle adopted at UAC) needs to be revamped to pique the interest of students and allow them to navigate through the content offered easily and take advantage of the experience. UAC will also need to conduct feedback studies to improve the offering and maintain efforts despite the regression of the COVID-19 pandemic.

Pedagogical and tutoring characteristics of the e-learning environment for academic success at UAC

For Kim et al. (2019), the expression of a strong commitment by universities to facilitate student success in a digital learning environment is manifested in: "the need to provide students with opportunities to learn and adapt online learning resources and infrastructure as a means to deepen their experiences. Universities need to provide training, guidance, and support based on student profiles that stem from regular review of their experiences and level of adoption of online learning for academic engagement and success."

The interviews show a shared need for faculty members and even technical staff to be trained in the production and integration of courses and provide the necessary support to the students.

Even though faculty members and technical staff interviewed declared that they were trained through the e-Learning Initiative and other projects at UAC, they still expressed a need to be trained again. Thus, the following questions emerge: Why are they still in such demand for training? What needs are not covered by the training received? How effective

was the training received? What are the shortcomings of the training organized by Arizona State University as part of the e-learning initiative?

Some elements of analysis are worth exploring. During the COVID-19 crisis period, the technical staff in charge of course production and integration, consisting of only three staff for the entire university, was overwhelmed by the demand. This situation highlights the problem of the number of staff dedicated to creating the platform and content.

The training provided by ASU was conducted in English with a well-constructed methodology. However, it was demanding in terms of availability for the faculty members and staff who participated. Now that the restrictions related to COVID-19 have been lifted, an evaluation mission to UAC could be considered to develop a roadmap for implementing a pilot phase within the university with a follow-up of the experience for context-related learning.

Recommendations

Recommendations at the end of this research can be made on the three main components of the e-learning environment.

Recommendation on the material setting

- Facilitate access to devices (computers, smartphones, or tablets) by all students. Either by building digital classrooms or contributing to the purchase of the devices by the students through financial aid.
- Provide quality Internet connection on the campus.
- Enhance the electricity coverage on the campus.

Recommendation on the virtual setting

- Conduct a benchmarking to identify the adequate LMS according to students' learning needs.
- Develop tools and modules to help students access the various pedagogical activities, as described by Ben Henda (2021),
- Create good hosting and maintenance conditions for the e-learning platform to make sure it is accessible every time to students,
- Provide access to materials offline to ensure that even without the Internet, students can continue learning.

Recommendation on the pedagogical support

- Develop an e-learning promotion strategic document.

- Organize training for all students on how to learn online.
- Provide additional training to faculty and staff on Instructional Design and Online Pedagogy.
- Train a selected number of students to supplement technical staff in providing tutoring to their peers.
- Recruit additional staff to implement the e-Learning.

Research Contributions and Limitations

This research contributed to collecting data on the knowledge and perception of actors in two schools at UAC. It does not reflect the reality for the university and its other 28 schools. However, at least for the schools interested in integrating e-learning into academic practices, the research provides insights into the primary conditions for students to foster academic success.

However, several challenges were encountered in collecting and analyzing the data used in this report. These are presented as follows:

- The data collection coincided with the last academic year exams at IFRI and FSA.
- Students in the third year of the bachelor program were difficult to interview because most were doing their internships outside campus.
- Some non-Scholar's students were reluctant to answer questions from surveyors because they believed the research was only for Mastercard Foundation Scholars, even when they were told otherwise.
- Some faculty members were unavailable, which caused a delay in data collection.

Nonetheless, we believe this research can be considered a first step to understanding the reality at UAC, evaluating the needs of the actors, and proposing better e-Learning conditions.

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