Social Education Research
https://ojs.wiserpub.com/index.php/SER/

UNIVERSAL WISER PUBLISHER

Research Article

Online Education, International Cooperation and Sustainable Development in Sudan

Jorge Carlos Naranjo Alcaide[1*], Sabrina Greco[2]

[1]Comboni College of Science and Technology, Khartoum, Sudan
[2]National Research Council of Italy, Institute of Heritage Science, Lecce, Italy
E-mail: naranjoalcaide@hotmail.com

Received: 25 February 2023; **Revised:** 2 June 2023; **Accepted:** 5 June 2023

Abstract: This article describes three online learning experiences carried out between 2017 and 2021 by Comboni College of Science and Technology, a Sudanese higher education institution in a context characterized by frequent power cuts, irregular and limited internet access, lack of preparedness of the teaching staff, and very limited digital skills among students. These educational interventions consisted of two international cooperation projects and a learning experience through Moodle during the COVID-19 lockdown, from which it was possible to collect data on students' performance and compare it with data obtained under ordinary conditions using a paired sample t-test. The research analyzes these three online educational interventions, the context in which they took place, and their subsequent outcomes within the framework of the relationship between higher education, human capital development, and job insertion. The study reveals that, in addition to connectivity problems inherent to the context, some soft skills, such as time management and familiarity with using an e-mail account, should be considered in the selection or training of learners. The research also indicates that any international e-learning project in a Least Developed Country (LDC) should account for the fact that most students do not own a personal laptop and access the internet primarily through their smartphones. Moreover, students in Information and Communication Technologies (ICT)–based university programs show a better predisposition for online programs than others. The study highlights the importance of computer literacy courses in the first semester of undergraduate programs for non-ICT programs and of the presence of a physical tutor to ensure the success of any international educational project, even for students in ICT-based university degrees, which may be particularly relevant once the ongoing war ends and the field becomes open for international cooperation in education.

***Keywords*:** e-learning, sustainable development, Sudan, Higher Education, migrations, employment

1. Introduction

The Ministry of Higher Education and Scientific Research of Sudan did not allow the development of online courses except to the Open University of Sudan and the Open Arab University before the COVID-19 pandemic. Moreover training activities outside academic degrees were not so common because of low digital skills of most students and teaching staff, limited access to the internet (Sabir & Kunna, 2022) and even to the electricity. To these factors we have to add limited competence in English language when this was the instruction language as the learners

DOI: https://doi.org/10.37256/ser.4220232564

are mainly Arabic speakers. Other studies show that the optimal language for learning is the learner's native language (UNESCO, 2008).

Universities in Sudan responded in very different ways to the COVID-19 pandemic going from those that just closed their doors to those that adapted their curricula to fully online courses (Nuha & Nizar, 2020).

Comboni College of Science and Technology, a university college located in Khartoum, is a particular case as it benefitted from two online international educational programs performed by two institutes of the National Research Council of Italy in English language between 2017 and 2021 and used its own Learning Management System (LMS) during the pandemic lockdown to start the second semester of the 2019-2020 academic year.

In 2021, two years after the end of the first online program, the College carried out an assessment to analyse its outcomes. This article revises the three learning experiences sometime after their completion in the framework of the relation between higher education, human capital development, labour market insertion and demography in order to draw conclusions and recommendations that may orientate international cooperation programs based on online learning activities in a context similar to the Sudanese one. The conclusions of the assessment of these projects of international cooperation become particularly relevant now that Sudan is passing through a civil war since April 15, 2023, and the time will arrive to support this Least Developed Country (LDC) to recover from its terrible consequences. The study analyses the kind of problems and challenges specific to the context that condition the learning experience of the students, the selection criteria that may facilitate the success of international cooperation projects and the kind of skills learners should have or develop.

2. The context of the educational interventions

2.1 *The socio-economic context*

In the current phase of economic globalization, it is crucial for Least Developed Countries to innovate in society through skills development and continuous and high-level training. In this context, university education appears to be the key factor in the demographic and socio-economic change of such countries and in particular in the case of Sudan.

Sudan, in addition to having been the largest country of the African continent until 2011, is characterized by its peculiar geographical position being in contact with the Horn of Africa and at the crossroads between the Sahel, the Arabian Peninsula and the Nile Valley. It has represented an area of strong territorial mobility of populations where Arab and African cultures have intertwined in a completely original way.

Around the time of the independence of South Sudan in 2011, there was a huge territorial mobility towards the south by the South Sudanese population living in northern Sudan as Internally Displaced Persons (IDPs), and since December 2012, with the start of the civil war in the new-born Republic of South Sudan, in the opposite direction, i.e. towards Sudan, since then economically debilitated by the loss of the oil fields left in the new country (Greco, 2012).

Furthermore, substantial flows of young Eritrean refugees flee the dictatorship of Isaias Afwerki and continue to feed the eastern Sudan area (De Waal, 2022).

At present instead, the current fighting has already displaced over 800,000 people inside Sudan. In addition, over 220,000 refugees and refugee returnees have left Sudan (UNHCR, 2023). While Sudan holds a particular strategic position as the origin, transit and reception of migratory flows, it has a typical African demography with a 2.4% population growth in 2022 (World Economics, 2023) whose evolution will partially depend on the future development of Higher Education.

There is a consensus in the international scientific community regarding the decisive role of education and training in the development process of demographic dynamics. Within any territorial area, the role of human capital is fundamental and the emphasis is placed in particular on skills and knowledge (Roza Linda et al., 2020). Furthermore, demographic dynamics strongly interact with others of an economic, social, political and cultural nature. The conception of the population-development dualism deprives the meaning of any other conception that considers the population as a completely exogenous variable to development.

In Sudan, some factors such as corruption, political instability and the commercial and financial sanctions imposed by the United States since 1997 have slowed down the socio-economic development (United States Government, 2023).

After the fall of the regime of Omar Al-Bashir in 2019, the country's transition looked to recover impetus but was

abruptly stopped by the armed conflict between the Sudanese Armed Forces and the Rapid Support Forces that started on April 15, 2023 (Tounsel, 2023).

The outlook for near-term economic growth was already blurred before this war, mainly due to hyperinflation, chronic unemployment and unsustainable external debt (UNFPA, 2022). This vulnerability is the consequence of insufficient structural transformations aimed at boosting growth and employment.

Youth unemployment appears to be one of the main causes of poverty and the strategy proposed by the International Monetary Fund for achieving inclusive and sustainable economic growth included the creation of work that is accessible to all levels of Sudanese society (IMF, 2021). Even if "from April 2021 to August 2021, the unemployment (as a share of those in labour force) decreased from 47% to 39% for all, from 35% to 28% for male, and from 64% to 53% for female" (Samia, 2022, p. 18), the rate was still very high.

Unemployment mainly affects young population, women, persons with no work experience, fresh graduates and IDPs. The population under the age of 30 is about 70% of the total population (JICA, 2021, p. 1-1).

2.2 *The Sudanese context for online education and human capital development*

Any education intervention that aims to facilitate the professional insertion of young people in Sudan should analyse its labour market structure. Five interconnected elements need to be considered in addition to the recent political events: the dominance of the public sector in total employment; the demographic structure; low skill and brain drain issues; the phenomenon of youth unemployment; and the discrepancy between the educational output and the labour market.

The dominance of the public sector (government) in total employment over the weakness of the private sector is a major feature of the labour market in Sudan as in many other Arab and developing countries. From 2007 to 2016, the share of the public sector in the Gross Domestic Product (GDP) increased from 6% to almost 40% and the sector became the main driver of growth (UN, 2016). There was some improvement after the reforms implemented by the government in 2017 to promote the private sector. From position 170 out of 190 countries in 2017, it ranked position 162 out of 190 countries in 2018 but it came back to position 171 in 2020 (World Bank, 2020).

In the transitional period after the fall of Omar el-Bashir, the army has been strongly empowered. While Sudan is the 172nd nation in terms of human development (UNDP, 2022), it is ranked 75 of 145 out of the countries considered for the annual Global Firepower ranking (Global Fire Power, 2023).

The demographic factor is the second axis to analyse the local market structure. Sudan has grown from 10 million inhabitants in 1956, including the population of South Sudan, to 45,657,202 inhabitants for Sudan alone (World Bank, 2023). To this population it is necessary to add the share of refugees from neighbouring countries who also compete with the local population in finding work. According to United Nations High Commissioner for Refugees (UNHCR), there are 1.1 million refugees, one of the largest refugee populations in Africa (70% from South Sudan, 11% from Eritrea and 5% from Ethiopia), and 3 million IDPs mainly from Darfur (UNHCR, 2022).

It is worth mentioning that South Sudan is the last country in the world in terms of Human Development Index (HDI, position number 191) while Eritrea (position number 176) and Ethiopia (position number 175) are also among the last ones (UNDP, 2022). Their development level confirms, as the Agenda for Sustainable Development Goals states, that the internal conflicts of these countries, their "related humanitarian crises and forced displacement of people threaten to reverse much of the development progress made in recent decades" (UN, 2015, p. 5).

Furthermore, it should be considered that the majority of the total population of Sudan is between the ages of 5 and 24, representing approximately 50% of the total population of Sudan (UNFPA, 2022). From this fact we can understand the great demand for education, the difficulty for the labour market to absorb such a large number of young people once their university studies have finished and the importance of human capital training and development.

In fact, a third element that defines the structure of the labour market concerns the problems related to low skill level and brain drain. The most important factor is the low GDP, which implies that high skills are not financially rewarded. In the university sphere, a report published on October 25, 2016 by the Ministry of Higher Education and Scientific Research of Sudan "reveals that 2,158 university employees have left the country" from January to September, including "108 professors, 315 associate professors, 873 assistant professors, 548 lecturers and 314 teaching assistants" (Sawahel, 2016). In 2022 the index of human flight and brain drain in Sudan was 7.8 points over a maximum of 10 (The Global Economy, 2023). The current armed conflict has increased this index.

Since the coming to power of Omar Al-Bashir, the university system in Sudan has undergone a rapid quantitative development which has brought the number of university students from 6,080 in 1989 to 575,719 students in 2023. Higher education institutions have also multiplied, going from five public universities in 1989 to 135 private and public higher education institutions in 2016. Their number in 2023 reaches 155. Thirty nine are public universities from which eight are located in the capital. One hundred and sixteen are private higher education institutions, universities and colleges. Most of them are located in Khartoum: 17 private universities and 65 private colleges (Mohamed Ali, 2023).

In this way, higher education faced the quantitative challenge even though the enrolment rate in universities is only 16.9% (UIS, 2023). While the agricultural sector represents 42% of employment in Sudan and is essential for its development, the majority of university students are enrolled in programs related to humanities (62%). The discrepancy between the educational output (supply) and the labour market (demand) reveals the need to "update skill levels and encourage the development of local technologies to reduce the technological gap and achieve economic development in Sudan" (Samia, 2011).

Therefore, the fundamental challenge facing university education in Sudan at the moment has not so much to do with quantity but with quality. In this regard, Professor Imad Al-Din published in 2014 an evaluation carried out in the main university of Sudan, i.e. the University of Khartoum. The SWOT analysis of the University highlighted the following weaknesses: "the insufficient configuration of academic programs to respond to the real needs of the labour market and the lack of providing graduates with the skills and knowledge necessary to make them competitive" (Imad Al-Din, 2014).

From December 2019 to 2022, the instability derived from the popular uprising against the regime of Omar Al-Bashir led to the closing of the main public Sudanese universities and froze the picture above described.

Considering all this fragile structure, it is easy to understand why the COVID-19 pandemic (June-July 2020) contributed to "the loss of jobs for the majority and nearly two thirds of households [and to] the increase in temporary or permanent layoff/suspension of workers, reduced hours, reduced wages, delays in wage payment and limited provision of social protection/insurance between April and August 2021" (Samia, 2022).

On March 15, 2020, all Sudanese universities, public and private, were forced to close due to the COVID-19 epidemic. On June 21, 2020, the Ministry of Higher Education and Scientific Research (MOHE) of the Republic of Sudan encouraged universities to explore the possibility of resuming academic activities through online platforms, despite the multiple challenges that such an initiative would have entailed, due to power outages, limited or irregular access to the Internet, poor preparation of teaching staff and very limited digital skills among students. Most universities did not feel ready to assume the challenge due to above mentioned factors.

From the beginning of the ongoing conflict on April 15, 2023, some universities located in Khartoum State have been looted or damaged and a non-quantified yet amount of teaching staff has left the country (Abd El-Galil & Alashwal, 2023). The war in progress will open a new scenario at its end when the role of projects of international cooperation in the educational field will multiply to support the return to normality of the Sudanese higher education landscape.

2.3 *The Comboni College of Science and Technology and its students*

Comboni College of Science and Technology (CCST) was one of the few universities in Sudan that assumed the challenge of resuming academic activities online during the COVID-19 lockdown. CCST is a private university college located in Khartoum that offered at the time three degrees in ICT oriented programs (BSc in Computer Science, Intermediate Diplomas in Information Technology (IT) applied to Administration and to Accounting), a BA in English Language and Literature and a BA in Christian Education and Religion for the benefit of around 700 students.

The second semester of the 2019-2020 academic year began in August 2020 by offering hybrid courses, consisting of distance theory lessons through the Moodle LMS and face-to-face seminars, in small groups, in the computer labs.

This College had already benefitted from one online international training programme in 2017-2019 (INSO Project) and would later enjoy a second one in January 2021 (SudanINNOVATION Project).

It is located in the city center of Khartoum, 700 metres south of the Presidential Palace, and therefore at one of the main military battlefields of the war in progress.

3. The three educational interventions

3.1 *The INSO project*

3.1.1 *Project description and objectives*

The "Innovation in Society (INSO): training paths and human capital enhancement in Sudan" project was designed in the framework of the "Regional Development and Protection Programme for North Africa" (RDPP NA) promoted by the European Union with the aim to support a group of African countries which are among the most fragile and affected by the migratory phenomenon. The head of the project was the National Research Council of Italy-Institute for Research on Innovation and Services for Development (CNR-IRISS) and the partners were the University of Bari (Italy), CCST and the Ministry of Higher Education and Scientific Research (MOHE) of the Republic of Sudan while the funder was the Department on Civil Liberties and Immigration of the Ministry of Interior of Italy. The project was sponsored by the Embassy of Italy to Sudan and by the Embassy of Sudan to Italy.

The project goal was to strengthen the protection of migrants and refugees, improving their living conditions and offering them alternatives to irregular migration along the central Mediterranean route, and to support the development of local job opportunities. Thus, the project objectives were to:

a) develop the skills necessary for the integration of university students into the local labour market;

b) strengthen the ability to transform their graduation projects into initiatives that generate job opportunities;

c) contribute to the digitization process of the country.

The group of beneficiaries included 138 students from 16 Sudanese public and private universities of Sudan, university lecturers and officials of the MOHE.

In a country that in terms of knowledge of Information and Communication Technologies (ICT) is trying to bridge the gap between skills and the transition towards digitization of the public administration and the private sector, the selected beneficiaries of the training course were university students enrolled in ICT based programs like the Bachelor's Science (BSc) in Computer Science, the Intermediate Diploma in Information Technology, the BSc in Software Engineering and the BSc Information Systems who had adequate knowledge of English language.

Two hundred and thirty-five students registered for the English language proficiency test. One hundred thirty-eight suitable students were selected through a placement test executed by CCST, of which 62.3% were Sudanese, 31.1% South Sudanese and 6.6% Ethiopians and Eritreans. Most refugee students were coming from CCST.

The training contents focused on the concepts of sustainability, the creation of micro-enterprises, job search techniques and the development of project proposals. Furthermore, the joint training path for university lecturers and officials of the MOHE, aimed to the creation of a Career Orientation Department in Sudanese universities, leveraging on the analysis of responsible territorial governance, pedagogical innovation and international scientific cooperation.

The analysis of the territorial reality highlighted the fact that it was essential to conduct training activities for students through a blended approach, combining online lessons with others in presence and practical internships in loco. These ones were carried out through a methodological approach based on the mapping of local companies and authorities and Non-Government Organizations (NGO).

The LMS was Moodle and was managed by the Centre of Long Life Learning of the University of Bari (CAP) that produced a non-published report from where it is possible to draw the data of the following sections.

3.1.2 *Students engagement in the INSO project*

The project envisaged the engagement of 138 students. One of them did not attend the face-to-face workshops that took place at the headquarters of CCST. The average participation was 78% in relation to a total of 72 training hours. In the frequency distribution, most of the students grouped around the maximum time of participation. In fact, 98 students took part in more than 75% of the total time of the workshops while 29 completed them totally. Just 13 students took part in less than 50% of the learning hours.

The problem came when it was found that 35 of the project students did not own a personal e-mail address and were discarded for that reason. Consequently, only 103 students were able to continue the online training stage (73.57% of the foreseen number of students).

Among them, 16 students never accessed the platform and did not benefit from the training provided. Therefore,

the online training activities were carried out by just 87 students.

As mentioned before, the project students had been selected among those enrolled in ICT based academic programs with a good level of English language. In spite of this, many of them were not acquainted with the use of an e-mail address or were writing their names in Latin characters each time in a different way. It is important to consider that the original names of the Sudanese students are in Arabic language, which only has three vowels (a, i, u), and that the written language just includes the consonants. This fact should be considered in any future e-learning international program with Arabic speaker students.

Seventy-three video lectures were uploaded on the platform. They registered an average of 217.19 views per video lesson. The individual study was also supported by in-depth material in PDF and conceptual maps. A total of 102 resources were uploaded. Each one was displayed 197.72 times on average. There were 257 speeches and 4,215 views, including the chats, inside the forums and chats that the LMS proposed.

3.1.3 *Learning process assessment*

The learning progress for the six online training modules was assessed through a questionnaire formed by three multiple-choice questions per module that was available through the LMS. 50 students out of the 87 active students (57.47%) completed the questionnaire. The performance of 28 students was excellent (13-18 correct answers) and 22 students performed well (7-12 correct answers).

The two lecturers of CCST trained by the project in Naples (headquarters of CNR-IRISS) and Bari were in charge of organizing the internships for the 67 students of the project who studied at the College. Five of them did not have an e-mail address and therefore were not active in the digital platform. These students were distributed in 13 private and government institutions including the MOHE. Unfortunately, it was not possible to coordinate the internships of the students coming from the other universities.

The CAP assessed the student's soft skills, in particular their career development skills. The CAP team also produced an individual profile for every student that contained a description of their career development skills and some recommendations for their professional development.

The CAP distributed another questionnaire through "Google Forms" to evaluate the effectiveness of the online training, comparing the expected objectives with the results obtained. The three evaluation criteria were:

1. Students' satisfaction with the usefulness of the course;
2. Evaluation of the learning process in terms of self-perception;
3. Transferability-impact on working career.

From the analysis of the results, it was possible to conclude that the module on "job search techniques" got the best score as it was considered the one where the objectives were best achieved and the most useful in relation to their studies and job search (Colosimo, 2019).

The module on "marketing management" was the second better considered in terms of achieved objectives and the one on "social networks and relational dynamics" in terms of usefulness in relation to studies and job search.

The students expressed their satisfaction with the contribution of the online training to their previous knowledge and affirmed to have improved "a lot" their working efficiency after the course (71%) and to have already had the opportunity to use the knowledge learned in their university tests or in their professional experience (19/34).

3.1.4 *Some qualitative outcomes*

Among the positive project outcomes for the Sudanese partner, CCST, it is worth mentioning the improvement in the quality of the students' internships, the creation of job opportunities, the design of a new Bachelor Science program inspired in the experience carried out during the project and, above all, the creation of a Start-ups Incubator to support the establishment of digital based small companies.

Before the project, the student at CCST was supposed to identify the institution where he/she would carry out that internship and get the approval from the College lecturer in charge. After the project training, the two College lecturers that benefitted from it prepared conventions with 13 companies for those internships defining objectives, time limits and minimum duration.

CCST designed a new BSc in Information Technology inspired in the fruits of the project that includes subjects

like Entrepreneurship and Information Technology, Sustainability and Social Responsibility and incorporates contents like Circular Economy and the Triple Bottom Line in subjects of Accounting, Economy and Finances. It was approved by the MOHE and started in December 2020.

After the completion of the INSO project in 2019, CCST sent a questionnaire to the project students in December 2020 where 77% of the respondents expressed their desire to start their own business but they felt blocked by obstacles like the lack of capital (94.6%), the lack of know how (13.5%), the fear of the unknown (8.1%) and the lack of self-confidence (5.4%). These results were based on the self-perception of the students. Nonetheless, experience shows that they are not so aware about their lack of know how.

All those elements justified the need of creating a Start-ups Incubator that could support university graduates or students to transform their business ideas into reality and give continuity to the project. In fact, "the African Union (AU) states that the growth of SMEs is essential to achieving the Africa's development goals" (JICA, 2021, p. 1-2). This Start-up Incubator was created in 2019 under the name of Comboni Innovation and Entrepreneurship Centre and registered in 2021 as C-Hub Limited Company by Guarantee.

A questionnaire survey was distributed among the project participants to collect data on their employment achievements after almost two years of their graduation and a series of interviews about their professional integration was also carried out with them. The conclusion underlined the high rate of employment in the context (29/42) and the positive impact of specific training related to job search techniques (Naranjo Alcaide et al., 2023).

3.2 *The SudanINNOVATION project*

The already mentioned position of Sudan since ancient times as origin, transit and destination of migratory flows and a country of intense cultural exchanges has left the marks of a cultural and historical-architectural heritage incomparable to the rest of sub-Saharan Africa. This cultural heritage remains undervalued both at national and at international level. There is a lack of tourist infrastructures and a strong probability of seeing these treasures gradually fade away due to farming, mining and lack of awareness. The current armed conflict is already threatening the main museums of the capital and destroyed part its cultural heritage (Cooper, 2023; Metwaly, 2023).

The acquisition of interdisciplinary skills for the knowledge, protection and enhancement of cultural heritage as a driver for sustainable development, is strategic in the transition phase underway in Sudan. The training project, "A new Sudan through culture, technology and innovation" (SudanINNOVATION), hinged on the continuity of the INSO project and on the resulting start-up incubator.

The project was headed by the National Research Council of Italy-Institute of Heritage Science (CNR-ISPC) and funded by the Embassy of Italy to Sudan in the framework of the scientific diplomacy activities of the "Integrated promotion and re-launch of the country system" programme of the Ministry of Foreign Affairs and International Cooperation of Italy.

The general objective of the project was to promote the transformation of the Sudanese cultural heritage into a resource for the sustainable development of the territory by applying digital technologies for its knowledge and conservation and for the creation of business opportunities. The beneficiaries of the online workshop program on new digital technologies applied to the cultural heritage sector were:

a) 20 finalist students of the BSc in Computer Science at the CCST who had to develop their graduation project and with a good level of knowledge of the English language;

b) 9 university lecturers from the CCST Department of Computer Science. Some of them were supposed to supervise the graduation projects of the students where the training contents were supposed to be applied.

The training course consisted of a series of webinars that were conducted from January 25 to February 4, 2021. A difference in relation to the online training carried out during the INSO project was that all the students were brought physically together to a conference room of the College from where they could follow the video-conferences and interact with the facilitators located in Italy.

At the end of the academic year the aforementioned students, divided in groups of 3 or 4, developed high quality projects such as "Polychromy in Ancient Sculpture and Architecture. Study, Visualization and Virtual Reconstruction of the Wall of a Meroitic Temple"; "Virtual Visit to the City of Sawakin"; "Virtual visit to the Kerma museum" (Khamis et al., 2021).

3.3 *Comboni College of Science and Technology and Moodle*

3.3.1 *Research background*

In the context of the COVID-19 pandemic, the Ministry of Higher Education and Scientific Research of Sudan encouraged universities, that had been closed on March 14, to resume their activities in an online modality, which was something new for most of them (Sawahel, 2020). During the month of July 2020, CCST organized workshops for groups of about ten lecturers on the following topics: the change of mentality necessary for the transformation from being a knowledge provider to becoming a learning facilitator through a LMS like Moodle; the use of the Internet by Sudanese youth; the motivations for the introduction of Moodle and technical and pedagogical training for effective teaching and online learning management.

Considering the frequent power outages that afflicted the country, the poor download speed and the limited access to the Internet by students, it was decided not to resort to video lessons or video conferences (synchronous or asynchronous) but to upload learning contents to downloadable PDF files and to promote interaction through Moodle tools such as synchronous chat rooms and asynchronous forums.

During the first week of a certainly particular second semester, from August 17 to 22, the students participated in training workshops in the computer laboratories of the College on the use of Moodle, on which most of the lecturers had already uploaded the learning contents.

On September 14, face-to-face lessons for more complex subjects resumed and on September 21 all students returned to class.

3.3.2 *Research objective and strategy*

The research objective is to evaluate the learning experience of CCST students who have used Moodle. This objective can be expressed into the form of two main questions:

• How was the learning experience of the students through the LMS?

• How can the use of the platform be made more effective, given the specific characteristics of the context?

The first question has a descriptive character while the second one is exploratory; therefore, the research can be given both a descriptive and an exploratory character.

The research also dealt with these specific objectives or sub-questions:

a) Have students' previous digital skills influenced their use of Moodle?

b) Has the students' level of English had an impact on their access to the platform?

c) Did a group of students who used the LMS throughout all the second semester achieve lower results than those of the first semester who had face-to-face lessons?

Given the research objective, the fact that there is no control over behavioural events and that the questions focus on contemporary events, the most convenient research tool is the questionnaire (Yin, 2018). As for the quantitative evaluation of the results (question c), the study proposes a comparison between the marks of the first semester of the 2019-2020 academic year, carried out entirely in presence, and the second semester just for the course of Italian language which was entirely made through the LMS. The students worked with the same syllabus and textbook, but with two different lecturers and, of course, with the online component during the second semester.

3.3.3 *Research tools*

An anonymous questionnaire with questions divided into three parts was chosen as the main survey tool. The first part aimed to collect demographic data and information about the students' linguistic background, their possibilities to connect to the internet and their habits in this regard before this learning experience. In this way, the necessary information to answer the first two sub-questions is collected.

The second part of the questionnaire focused on the evaluation of the orientation and training workshops on the use of Moodle.

For both two parts the questionnaire was made of multiple-choice questions. Finally, the third part of the questionnaire aimed to answer the two main questions, which explain the primary objective of the research; responses were classified according to the six dimensions defined by Sun et al. (2008, p. 1184): "student, teacher-lecturer, course,

technology, system and environment".

As regards the third sub-question, the study describes the learning experience of the students of Italian language who used Moodle for the entire duration of the course and compares the marks of the first and second semester through the application of the Paired Sample t-test. Since the samples of Italian learners consist of less than thirty individuals, the Shapiro-Wilk test was chosen to verify the normality of the sample (Naranjo & Molineri, 2021).

3.3.4 *Student population, sample and data collection*

The total number of students enrolled in August 2020, at the beginning of the second semester of the 2019-2020 academic year, was 677. The 77 students of the BA in Educational Sciences and the Christian Religion were not included in the study, as they had not used the platform.

The questionnaire therefore involved students of the BSc in Computer Science (CS), BA in English Language and Literature (EN) and the intermediate diplomas in Information-Technology for Management (ITM) and Accounting (ITA) (Table 1).

Table 1. Number of respondents

	CS	EN	ITM	ITA	Total
No. of respondents	64	186	79	77	406
Total No. of students	101	275	106	118	600
%	63.37	67.64	74.53	65.25	67.67

3.3.5 *Results*

Before evaluating the training experience, the questionnaire focused on the collection of data related to student characteristics, linguistic background and digital habits (Table 2).

Table 2. Linguistic background and nationality

		CS		EN		ITA		ITM		
		No.	%	No.	%	No.	%	No.	%	Total
Basic school in	Arabic	48	76.2	155	83.3	34	43.6	38	50	275
	English	15	23.8	31	16.7	42	56.3	38	50	126
Secondary in	Arabic	47	75.8	154	85.6	29	48.2	36	48	266
	English	15	24.2	26	14.4	47	61.8	39	52	127
Nationality	Sudanese	44.6%		76%		39%		17.9%		
	Sud Sudanese	36.6%		20.4%		44%		50%		
	Other	17.8 %		3.6%		17%		32.1%		

It should be remembered that the Civil War in South Sudan, started in December 2013, caused an exodus of South Sudanese people towards Sudan over the following years. Many enrolled in CCST, mainly for IT diplomas (ITA and

ITM), as they find better economic conditions than in other universities in Sudan, whose fees for foreigners are much higher and are to be paid in USD. Foreign students also find an environment that respects their cultural diversity. These students have completed their basic and secondary school cycle in English and are between 20 and 30 years old. They are therefore slightly more mature than the others who are between 18 and 21 years old due to the turbulent journey of studies in their home country.

The BSc in Computer Science also has a high percentage of South Sudanese students (36.62%), but those who studied in English before entering university are much fewer (about 24%). This is explained by the fact that most of them are students born and raised in Sudan by South Sudanese families who took refuge in Sudan during the war that led South Sudan to declare independence in 2011. Most of those who have been placed under the category "others" are Eritreans, born in Sudan, or Ethiopians.

The questionnaire continued by asking the students with which device they usually access the internet. Most of them (67%) own a Smartphone, which is the most common means of connection (55.17%). Only 41.63% own a laptop and this percentage is higher among Computer Science students (59.38%), for whom the PC is a study and work tool. The College has opened computer labs, which have become the primary place to connect for 22.17 percent of students (Table 3).

Table 3. Ownership of digital devices and access to the Internet

		CS		EN		ITA		ITM		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%
Owner of a smartphone	No	19	29.69	61	32.8	26	33.77	23	29.11	129	31.77
	Yes	45	70.31	125	67.2	51	66.23	51	64.56	272	67
	NA							5		5	1.23
	Total	64		186		77		79		406	
Owner of a laptop	No	26	40.63	116	62.37	40	51.95	49	62.03	231	56.90
	Yes	38	59.38	69	37.10	37	48.05	25	31.65	169	41.63
	NA			1				5		6	1.48
	Total	64		186		77		79		406	
Internet café		5	7.81	9	4.84	11	14.29	5	6.33	30	7.39
College labs		11	17.19	53	28.49	14	18.18	12	15.19	90	22.17
Laptop		9	14.06	16	8.60	7	9.09	6	7.59	38	9.36
Smartphone		37	57.81	96	51.61	40	51.95	48	60.76	221	55.17
NA		2	3.12	12	6.45	5	6.49	8	1.01	27	6.65
Grand total		64		186		77		79		406	

To assess the way students accessed the internet in the period prior to August 2020, the survey asked about the use of email, WhatsApp, the CCST Facebook page and a more complex operation such as sending attachments (Table 4).

Table 4. Internet use

		CS	EN	ITA	ITM	Subt Total	Total %
E-mail user	No	20	68	33	26	147	36.2
	Yes	43	111	41	45	240	59.11
	NA	1	7	3	8	19	4.67
	Total	64	186	77	79	406	
WhatsApp user	No	12	41	18	14	85	20.94
	Yes	51	140	56	57	304	74.88
	NR	1	5	3	8	17	4.19
	Total	64	186	77	79	406	
CCST Facebook visitor	Every day	15	35	21	11	82	20.20
	Never	8	52	12	19	91	22.41
	Once a week	40	94	37	43	214	52.71
	NA	1	5	7	6	19	4.68
	Total	64	186	77	79	406	
Did you ever send an e-mail with attachment?	No	27	112	40	41	220	54.19
	Yes	33	61	32	30	156	38.42
	NA	4	13	5	8	30	7.39
	Total	64	186	77	79	406	

82.51% of the students declared that they had received the credentials for accessing Moodle upon enrolment, before the start of the semester.

During the first week of the second semester (August 17-23), the College held training workshops for small groups, but only 43.60% of the students attended. The highest percentage is recorded among those enrolled in ITM (48.10%) and ITA (48.05%), while the lowest one among those enrolled in English Language and Literature (40.86%) who would have needed it more than others, but they initially appeared more hostile to this new form of learning. The participation rate among Computer Science students is quite low (40.62%), probably due to their more advanced digital skills and to their greater level of autonomy with digital tools. As already mentioned, many students resided outside Khartoum and in those days there were major fuel supply problems across the country and transportation was not guaranteed.

Table 5 shows that Computer Science students are the most satisfied with the workshops. The same teachers facilitated the workshops for the students of CS, ITA and ITM while they were different for those of EN. It can therefore be inferred that the better predisposition to online study of CS students was a determining factor, more than the quality of the workshops itself.

The College opened computer labs for the students to access Moodle from a computer and with the support of a technical assistant. 46.8% of the interviewees stated that they were aware of this opportunity, while 32.26% declared that they did not know about it. More than for the other courses, those enrolled in English Language and Literature were well informed (50%). It is important to underline how the laboratories were opened near the classrooms where face-to-face lessons were normally held.

Table 5. Assessment of the workshop of introduction to moodle

Assessment	CS		EN		ITA		ITM		Total
	No.	%	No.	%	No.	%	No.	%	
Clear and satisfying	14	53.85	20	26.32	13	35.13	9	23.68	56
Too difficult	2	7.69	13	17.10	8	21.62	15	39.47	38
It helped me in a certain way	9	34.62	38	50	14	37.84	10	26.32	71
NA	1	3.85	5	6.58	2	5.41	4	10.53	12
Total/% of interviews	26	40.62	76	40.86	37	48.05	38	48.10	177

NB. The answers of the students who had not participated in the workshops but expressed an opinion were eliminated

The reason why many did not use the laboratories was the cost of public transport (31.53%) as well as the fact that some students (15.76%) resided outside Khartoum.

Table 6. Main challenges when using moodle

Difficulties	CS		EN		ITA		ITM		Total	
	No	%	No	%	No	%	No	%	No	%
Dimension: Student										
I have never worked with a PC for long	19	29.7	91	48.9	30	39.0	31	39.2	171	42.1
I found it difficult to organize my study time	36	56.3	98	52.7	39	50.6	39	49.4	212	52.2
Dimension: Lecturer										
I found it difficult to communicate with the lecturer	36	56.3	81	43.5	33	42.9	36	45.6	186	45.8
Dimension: Course										
Some courses were not well prepared	32	50,0	93	50.0	36	46.8	40	50.6	201	49.5
Dimension: Tecnology										
My access credentials to Moodle were not working properly	16	25.0	45	24.2	15	19.5	19	24.1	95	23.4
I did not know to whom address to solve my access problems to Moodle	12	18.8	52	28.0	23	29.9	26	32.9	113	27.8
The Internet connection was slow and discontinuous	43	67.2	93	50.0	51	66.2	47	59.5	234	57.6
Dimension: System										
I did not know where to insert the credentials	9	14.1	36	19.4	15	19.5	17	21.5	77	19.0
I accessed the LMS but I found it too complex	22	34.4	86	46.2	28	36.4	32	40.5	168	41.4
I accessed the LMS but I got lost among too much information	14	21.9	72	38.7	29	37.7	27	34.2	142	35.0
I found some difficulties at the beginning but then I got used to the LMS	26	40.6	85	45.7	23	29.9	35	44.3	169	41.6

The quality of the courses available on the platform has been evaluated with scores ranging from 4.73/10 (ITM) to 5.37/10 (EN). Interestingly, English learners who were initially more reluctant turned out to be more positive than others.

About half of the total number of respondents said that they had difficulty with Moodle, but also that they gained more confidence in using the computer (49.75%). On the contrary, 26.6% answered that they had not seen this improvement after a month of work on the platform. The most positive students are those of Computer Science (59.37%) and English (53.76%).

47.54% of the students said that this distance learning experience increased their level of awareness on the benefits of this modality, leading them for example to find other online courses for their self-development. On the contrary, however, for 30.05% of the students, the LMS was of no help. Again, English learners (52.69%) and Computer Science learners (50%) were the most positive.

Ultimately, the most critical students were those of IT. In particular, 40.26% of ITA students believe that they will never be able to use the LMS, while only 18.75% of CS students agree with such a radical statement.

With respect to the difficulties encountered, students' choices were classified according to the already mentioned dimensions in Table 6.

As Table 6 shows, the main problem was the Internet connection (57.6%), while the second was the difficulty to manage study time (52.2%).

Table 7. Negative aspects of the use of Moodle or aspects that should be improved

Dimension	Answer	No.
Student	I did not know how to use a computer	10
	Time management at home was very difficult for me	5
Lecturer	Lack of interaction and communication with the lecturer	27
Course	For some courses it is better to have face-to-face teaching	26
	There was need of adding video-lessons	24
	I had problems to hand over tasks, particularly through the Smartphone or I did not know how to do it	13
	Some lessons were not well prepared	12
	Lessons were not ready in due time	5
	There was need of adding video-conferences	3
Tecnology	Internet connection	115
	Lack of a Smartphone	26
	It was not possible to download the materials through the Smartphone	16
	Lack of a laptop	14
	Electric power outage	9
	Internet is expensive	4
System	Problems to access the platform	8
	I did not know when lessons started or when the materials were uploaded	5

Finally, the students were invited to express themselves with an open answer on the positive and negative aspects of using the LMS; it was also possible to choose whether to answer in English or Arabic. The responses were grouped, as in the previous table, according to the dimension. Answers scoring less than 3 were eliminated.

The open answers, in which the students were free to express themselves, are consistent with those to the previous questions and confirm that the main difficulty was the internet connection (Table 7).

Among the positive aspects related to the use of the LMS, the students highlighted the following ones (Table 8):

Table 8. Positive aspects about the LMS according to the students

Dimension	Answers	No.
Student	It facilitates optimization of time (time management)	40
	I overcame my fear to online studies and the computer/improvement of digital skills	34
	I can study at home or wherever I wish	20
	I was encouraged to conduct research through the internet	5
	I discovered new ways of teaching and learning	4
	I know now how to use the e-mail	3
Course	Simple access to lessons and to information	23
	Well organized lessons	5
	Good contents	3
	It helped to meet homework deadlines	3
System	Easy to use	19
	The LMS does not have any positive aspect	19
Environment	Saving in transport expenses	52
	Protection against COVID-19	5

4. Discussion

In the report "Education at a Glance", the OECD (2022) did not hesitate to underline how the COVID-19 pandemic has shown that raising the level of human capital training is one of the best protections against economic risks. Furthermore, the pandemic has revealed the inability of education systems to pursue the ideals of equality of exchange and inclusion both within and between countries. In other words, the pandemic has aggravated the global education crisis and has significantly reduced the progress made in achieving the sustainable development goal number four, quality education (UN, 2022).

The pandemic has made more blatant the digital gap between nations (UNESCO, 2021). North-South knowledge transfer should narrow this gap and support the sustainable development of human capital. There is need of further infrastructure developments, resources and national funding to mitigate the effects of pandemic-related education disruptions. The online educational experiences reported in this article are particularly meaningful and innovative in this sense. They reveal some challenges proper of LDCs which learners in developed countries do not have to face, some of them related to the logistics or the necessary infrastructure and other related to digital and language skills.

The experiences of the INSO and SudanINNOVATION projects demonstrate that in order to generate innovative processes capable of producing sustainable development through the enhancement of human capital, it is necessary to

create structures and/or identify local partners capable of ensuring continuity to those processes. The case of the creation of the technological incubator and the role of the CCST in its collaboration with the CNR-IRISS and the CAP are representative. After the end of the first project, the trained staff at the CCST (human resources), the incubator (physical structure) and the new academic program created to encompass the positive experience of the INSO project (stable learning structure) gave continuity and enlarged the initial impact of what was conceived as a training program for 138 university students.

Furthermore, this study confirms that in LDCs young people with high digital skills, even if they are a limited sector of the total population, are particularly suitable agents to become mediators of sustainable development processes. They represent the ideal category to take advantage of online training. In addition to this, digital skills are transversal to any productive sector and ICT based companies do not require large investments to be developed into SMEs.

Therefore, in addition to an English placement test, a digital skills test should also be conducted to guarantee a minimum of acquaintance with the necessary competences to follow an international online learning program. Some basic digital competences that could be tested are the use of the operative system, the capacity to search and select information through the internet, the use of the e-mail and the use of a Word processor.

Another important element is the presence of a physical tutor easily available to the students. Half of the students of the INSO project were from CCST where they had a computer lab and a tutor at their disposal. The other half, those coming from fourteen different universities, did not have a physical tutor and a computer lab close to them which made their support more complex.

It is also worth mentioning that CCST students, who benefitted from the two international projects, use the Internet more than the Sudanese national average (31% at the time of the survey according to Kemp (2020)); as Table 3 shows, only 9.36% have a laptop, while 55.17% access the web via Smartphone, which is certainly not the ideal study tool, both in terms of reading and word processing.

The complaint on the poor internet connection was less meaningful in our study than in the one carried out by Sabir and Kunna (2022) with students of six faculties of medicine located in Khartoum State. In their study 73% of them underlined this problem. This fact looks particularly relevant if we consider that students of medicine in Sudan usually belong to the highest social class. The same students presented as second challenge the incompetence of the teaching staff to deal with a digital platform. Students at CCST are less critical with the lecturers and just expressed the wish to have the communication with them improved (45.8%).

Although the majority of CCST students have an active email account, as Table 4 shows, there is a strong reluctance to use it regularly in official communications. Instead, they tend to prefer the creation of WhatsApp groups, in which not only to recall important communications, but to share files, tasks, explanations, doubts and questions. This can certainly be explained by the fact that the Smartphone is the main study tool; however, communication via WhatsApp suffers from the simplifications dictated by time, language and register typical of messaging services, leaving aside the need for the care in setting up the text of a formal email. Again, from the point of view of international collaboration or training programs, or in view of active search for a job, other online courses or scholarships, the correct use of e-mail is undoubtedly a basic skill to be trained.

Even the lecturers seemed more inclined to use WhatsApp as the most effective means of communication. The data collection and assessment of lecturers' digital skills would make it possible to structure shared strategies that aim to put them in the necessary conditions to better produce and manage the material for online courses, paying close attention to the remote monitoring systems of the student's activity, providing personalized guidance and support across synchronous and asynchronous systems. These skills would add value to their learning experience even in the case of face-to-face or hybrid courses.

5. Limitations, conclusions and recommendations

5.1 *Research limitations*

One of the limitations of this study is the lack of data on lecturers' digital skills before the introduction of distance learning at CCST, such as on the specific skills related to remote teaching and on lecturers' perception of this modality, which, according to Sun et al. (2008), can have a decisive impact on the level of learner satisfaction.

For the majority of CCST students, and especially those in graduate programs, Arabic is the language of study in primary and secondary school. The lack of data on the level of proficiency in English, also in reference to personnel, for example through the IELTS exams, allows us to have only a partial perspective on possible difficulties in using the LMS in English. For students enrolled in the BA in English Language and Literature, this hypothetical difficulty could be exacerbated with the introduction of a third language, Italian or Spanish, as required by the study plan. It is also worth mentioning that in most Sudanese universities, where the percentage of local students is much higher than in CCST, Arabic language is still more dominant, which makes the challenge for North-South international cooperation more demanding.

Other limitations of this study are that even if the three educational interventions took place in the same university, the students who benefitted from them were different; and that the e-learning experience during the COVID-19 lockdown was quite short except for the students of Italian language.

5.2 *Recommendations*

The study carried out after the Moodle experience at CCST highlights the importance of computer literacy courses in the first semester of undergraduate programs for non-ICT related programs. Therefore, in addition to an English placement test, a digital skills test should also be conducted to guarantee a minimum of acquaintance with the necessary competences to follow an international online learning program.

Considering the low general level in digital skills and English language and Sudan, the presence of a physical tutor is essential to ensure the success of any international educational project.

This research also shows how essential is to provide the students with tools for managing time and individual study, especially in a context such as the Sudanese one where schooling is still deeply linked to memorization.

5.3 *Conclusions*

The main problem students faced at CCST to follow online learning programs is connectivity (57.6%). This result is coherent with other studies carried out in LDCs (Aboagye et al., 2020; Sabir & Kunna, 2022). Nonetheless the second challenge has not to do with skills directly related to the use of the internet but with time management (52.2%). The third challenge that international online programs should consider with students in Sudan is the acquaintance with the use of the e-mail. These last two points do not appear in the above-mentioned studies carried out in LDC.

In spite of these challenges, the results of this study indicate that carefully designed online courses, rich in easily accessible resources, integrated methods of lesson delivery and summative and continuous assessment ensure adherence to learning objectives, as shown by the data analysis on the Italian course. In a first moment, students of a BSc in Computer Science have a better attitude towards an online course. Nonetheless, with the passing of time, the students of the BA in English Language and Literature were able to overcome their initial resistance.

The beneficiaries of the learning experience through the INSO project particularly appreciated the contents related to job search techniques, which is very relevant in a labour market that experiences so much difficulties to absorb the great demographic growth (2.4%). This point is common to many LDCs.

Moreover the ongoing war in Khartoum shows the importance of projects like SudanInnovation that educate to the preservation of cultural heritage in LDCs where instability may threaten it. Its destruction will not allow to transform it into an engine of sustainable development.

It is also evident that the students understand the potential of online education and that specific attention must be paid to the development of transversal skills to allow them to fully exploit the potential of any LMS in spite of the connection difficulties or electricity supply interruptions. Similar conclusions can be drawn for teaching staff members. Through a detailed analysis of their linguistic and digital background and of their strengths and weaknesses, it is possible to design a process of harmonization of continuous quality training that successfully implements the transition towards the provision of integrated courses.

The research also reveals that any international e-learning project with a LDC like Sudan should consider that most students do not own a personal laptop and access to the internet through their Smartphone. Just students in ICT based programs like a BSc in Computer Science are likely to own a laptop.

Conflict of interest

The authors of this study declare that there is no conflict of interest regarding the publication of this paper.

References

Abd El-Galil, T., & Alashwal, I. (2023, April 17). *Violence shuts Sudan's universities again countries consider evacuating students*. Al-Fanar Media. https://www.al-fanarmedia.org/2023/04/violence-shuts-sudans-universities-again-countries-consider-evacuating-students/

Aboagye, E., Yawson, J. A., & Appiah, K. N. (2020). COVID-19 and E-Learning: The challenges of students in tertiary institutions. *Social Education Research, 2*(1), 1-8. https://doi.org/10.37256/ser.212021422

Colosimo, M. (2019). Valutazione ed employability: percorsi formativi e valorizzazione del capitale umano in Sudan. In V. Boffo & L. Formenti (Eds.), *La Formazione in Età Adulta: processi e strategie* (*Epale journal on adult learning and continuing education)* (no. 5, pp. 12-16). Istituto Nazionale di Documentazione e Ricerca Educativa.

Cooper, A. (2023, May 17). *Precious Sudanese university archives destroyed by fire and looting in Omdurman*. The New Arab. https://www.newarab.com/news/sudanese-archives-destroyed-fire-and-looting-omdurman

De Waal, A. (2022, September 2). *The despotism of Isaias Afewerki*. The Baffler. https://thebaffler.com/latest/the-despotism-of-isaias-afewerki-de-waal

Global Fire Power. (2023). *2023 Sudan military strength*. https://www.globalfirepower.com/country-military-strength-detail.php?country_id=sudan#:~:text=For%202023%2C%20Sudan%20is%20ranked,0.0000%20is%20considered%20'perfect

Greco, S. (2012). Migrazioni e globalizzazione: il caso del Sudan. *I Diritti dell'uomo. Cronache e battaglie, 2*, 20-23.

Imad Al-Din Mohamed al-Hassan Ahmad. (2014). *Quality assurance and strategies of higher education*. Khartoum: University of Khartoum.

IMF. (2021). *Sudan poverty reduction strategy paper - Joint staff advisory note* (Report no. 21/145). International Monetary Fund.

Japanese International Cooperation (JICA). (2021, July). *Republic of Sudan data collection survey on youth employment promotion*. Final Report. https://openjicareport.jica.go.jp/pdf/12366746.pdf

Kemp, S. (2020, February 18). *Digital 2020: Sudan*. https://datareportal.com/reports/digital-2020-sudan

Khamis, M., Abdelrahman, I., Mohamed, M., & Tesfahun, B. (2021). *Virtual visit to the Kerma museum*. http://ccst.edu.sd/kerma/

Metwaly, A. (2023, May 5). *Sudan's museums and millenia of heritage, caught in the crossfire*. The Africa Report. https://www.theafricareport.com/305330/sudans-museums-and-millenia-of-heritage-caught-in-the-crossfire/

Mohamed Ali, I. (2023, March 25). *Why do students leave Sudanese universities and go abroad?* [original in Arabic]. Independent Arabia. https://www.independentarabia.com/node/434861/

Naranjo Alcaide, J. C., Meyer, J. B., Greco, S., & Abdalla A. Mohamed Ahmed, S. (2023). Youth, training and labor insertion in Sudan: Lessons from the INSO project. *Journal of Comparative & International Higher Education, 15*(1). https://doi.org/10.32674/jcihe.v15i1.4028

Naranjo Alcaide, J. C., & Molineri, I. (2021). La sfida della didattica a distanza in una Università Sudanese: la valutazione degli studenti e i risultati nei corsi di lingua italiana. *Italiano LinguaDue, 13*(2), 748-767. https://doi.org/10.54103/2037-3597/17167

Nuha, H. E. E., & Nizar, K. A. S. (2020). The impact of COVID-19 on Sudanese higher education system. *International Journal of Science and Research, 9*(7), 324-330.

OECD. (2022). *Education at a Glance 2022*. OECD Indicators. OECD Publishing. https://doi.org/10.1787/3197152b-en

Roza Linda, M., Thabrani, G., & Firman, F. (2020). The role of human capital and knowledge management in innovation. In Untar (Ed.), *Proceedings of the 8th International Conference of Entrepreneurship and Business Management* (pp. 261-267). https://doi.org/10.2991/aebmr.k.200626.046

Sabir, M., & Kunna, E. (2022). *Challenges of online medical education in Khartoum Sudan during COVID-19 pandemic 2021*. Research Square. https://doi.org/10.21203/rs.3.rs-1953414/v1. https://assets.researchsquare.com/files/rs-1953414/v1/ce11c241-814a-404c-9143-c5b6158acbd5.pdf?c=1662989332

Samia, S. O. M. N. (2011). *Technological change and skill development*. The case of Sudan. United Nations University.

Samia, S. O. M. N. (2022). *The Impact of COVID-19 on households and firms in the MENA region: the case of Sudan* (Research Papers, no. 250). Agence Française de Développement.

Sawahel, W. (2016, November 4). *Academic brain drain threatens university education* (African Edition, Issue 184). University World News. http://www.universityworldnews.com/article.php?story=2016110409304244
Sawahel, W. (2020, July 23). *Universities turn to online learning as pandemic continues*. University World News. Africa Edition. https://www.universityworldnews.com/post.php?story=20200723072151443
Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education, 4*(50), 1183-1202. https://doi.org/10.1016/j.compedu.2006.11.007
Tounsel, C. (2023, April 17). *Sudan crisis explained: What's behind the latest fighting and how it fits nation's troubled past*. The Conversation. https://theconversation.com/sudan-crisis-explained-whats-behind-the-latest-fighting-and-how-it-fits-nations-troubled-past-203985
The Global Economy. (2023). *Sudan: Human flight and brain drain*. https://www.theglobaleconomy.com/Sudan/human_flight_brain_drain_index/
UIS. (2023). *Sudan*. UNESCO Institute for Statistics. https://uis.unesco.org/en/country/sd
UN. (2015). Resolution adopted by the General Assembly on 25 September 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*. https://documents-dds-ny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement
UN. (2016). *Common country analysis for Sudan*. Desk Review. Development Studies and Research Institute of the University of Khartoum.
UN. (2022). *The sustainable development goals report 2022*. https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf
UNDP. (2022). *Human Development Report 2021/2022*. New York. https://hdr.undp.org/system/files/documents/global-report-document/hdr2021-22pdf_1.pdf
UNESCO. (2008). *Mother tongue matters: Local language as a key to effective learning*. Paris.
UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. Paris. https://unesdoc.unesco.org/ark:/48223/pf0000379707
UNFPA. (2022). *Sudan*. https://www.unfpa.org/data/SD
UNHCR. (2022). *Sudan*. https://www.unhcr.org/sudan.html
UNHCR. (2023). *Sudan*. https://www.unhcr.org/countries/sudan
United States Government. (2023). *Sudan and darfur sanctions*. U.S. Department of the Treasury. https://home.treasury.gov/policy-issues/financial-sanctions/sanctions-programs-and-country-information/sudan-and-darfur-sanctions
World Bank. (2020). *Economy profile of Sudan*. Doing Business 2020. https://www.doingbusiness.org/content/dam/doingBusiness/country/s/sudan/SDN.pdf
World Bank. (2023). *Population, total - Sudan*. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SD
World Economics. (2023). *Sudan's population growth rate*. https://www.worldeconomics.com/Demographics/Population-Annual-Growth-Rate/Sudan.aspx#:~:text=Sudan's%20Population%20Growth%20Rate%3A%202.4%25&text=This%20can%20be%20used%20to,in%20Africa%2C%20ahead%20of%20Algeria
Yin, R. K. (2018). *Case study research and applications: Design and method*. SAGE.