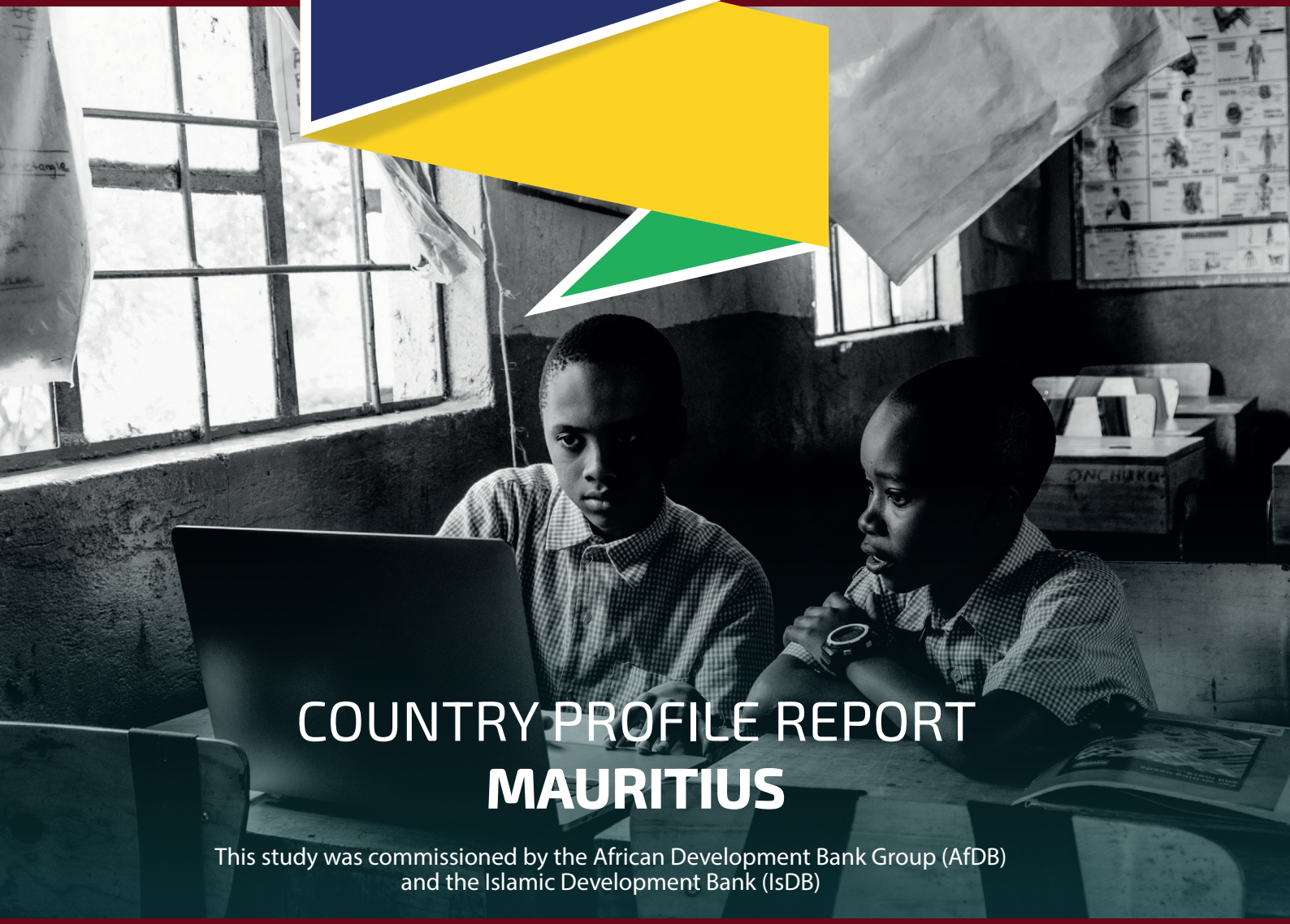
Ushirika wa Maendeleo ya Elimu Barani Afrika
الرابطة لأجل تطوير التربية في إفريقيا
Association for the Development of Education in Africa
Association pour le développement de l'éducation en Afrique
Associação para o Desenvolvimento da Educação em África

STUDY ON THE USE OF ICT IN EDUCATION AND REMOTE LEARNING DURING CRISES AND THE REQUIRED INVESTMENT FOR DIGITAL TRANSFORMATION FOR AFRICAN COUNTRIES



COUNTRY PROFILE REPORT
MAURITIUS

This study was commissioned by the African Development Bank Group (AfDB)
and the Islamic Development Bank (IsDB)

Ushirika wa Maendeleo ya Elimu Barani Afrika
الرابطة لأجل تطوير التربية في إفريقيا
Association for the Development of Education in Africa
Association pour le développement de l'éducation en Afrique
Associação para o Desenvolvimento da Educação em África

Study on the Use of ICT in Education and Remote Learning during Crises and the Required Investment for Digital Transformation for African Countries

MAURITIUS

Report produced by:
Association for the Development of Education in Africa (ADEA)

Study commissioned by:
Islamic Development Bank (IsDB)
African Development Bank Group (AfDB)

December 2022

ACKNOWLEDGEMENTS

The Association for the Development of Education in Africa (ADEA) expresses its deepest appreciation to the Islamic Development Bank (IsDB) and the African Development Bank Group (AfDB) for commissioning this study, in a collaborative endeavor in support of the advancement of educational outcomes in Africa, and for providing the strategic leadership throughout the study.

ADEA also acknowledges the resource person, Prof. Veronica McKay, who worked tirelessly to produce this country profile report.

ADEA wishes to thank the Technical Team of IsDB and AfDB comprised of Jawara Gaye, Lead Education Specialist - IsDB; Ben Abdelkarim Oussama, Principal Education Economist - AfDB; Sameh Hussein, Senior Technical Cooperation Coordinator/Africa & Latin America - IsDB; Isatou Cham, Lead Specialist Policies - IsDB; Kadir Basboga, Senior Regional Integration & Trade Promotion Economist - IsDB; and Sissao Moumine, Senior Education Economist - AfDB; Jessica Muganza, Senior Education, ICT and Digital Officer - AfDB; Michael Onobote, Senior Education Officer, ICT & Innovation Expert - AfDB for the invaluable technical review comments and inputs. The overall strategic guidance was provided by Idrissa Dia, Director Economic & Social Infrastructure - IsDB; Dr Martha Phiri, Director, Human Capital, Youth and Skills Development Department - AfDB; Hendrina Chalwe Doroba, Manager Education & Skills Development Division, AfDB; Riad Ragueb Ahmad, Director, Cooperation & Capacity Development Department - IsDB; Ammar Abdo Ahmed, Manager, Human Development Division - IsDB; and Syed Hassan Alsagoff, Manager, Science Technology & Innovation - IsDB.

Furthermore, ADEA wishes to express its sincere gratitude to Dr Roopesh Kevin Sungkur, country focal person, University of Mauritius, for his invaluable support for the study.

ADEA and the commissioning partners express sincere gratitude to the Mastercard Foundation led by James McIntyre, for the invaluable technical review and feedback throughout the study process.

ABBREVIATIONS

AUC	African Union Commission
CERT-MU	Computer Emergency Response Team of Mauritius
CPD	Continuous Professional Development
CPSE	Competitiveness and Public Sector Efficiency
DGTS	Digital Government Transformation Strategy
DYEP	Digital Youth Engagement Programme
EDB	Economic Development Board
EHRSP	Education and Human Resources Strategy Plan
EMIS	Education Management Information System
GB	Gigabyte
GOC	Government Online Centre
GTES	Graduate Training for Employment Scheme
HEC	Higher Education Commission
HSC	Higher School Certificate
HIC	High Income Country
HRDC	Human Resource Development Council
IC3	Internet and Computing Core Certification
ITU	International Telecommunication Union
LCSS	Learner-Centred Credit System
LMS	Learning Management Systems
MBL	Multimedia Based Learning
MES	Mauritius Examination Syndicate
MIE	Mauritius Institute of Education
MoETEST	Ministry of Education, Tertiary Education, Science and Technology
MRIC	Mauritius Research and Innovation Council
MTCI	Ministry of Technology, Communication & Innovation
NCB	National Computer Board
NICTSP	National ICT Strategic Plan
NPCC	National Productivity and Competitiveness Council
NSDP	National Skills Development Programme
ODL	Open and Distance Learning
OSS	Open-Source Software
OU	Open University
PIAP	Public Internet Access Point
PML	Polytechnics Mauritius Ltd
PSAC	Primary School Achievement Certificate
PSBTS	Public Sector Business Transformation Strategy
SC	School Certificate
SEN	Special Education Needs
SENA	Special Education Needs Authority
SIDS	Small Island Developing State
SIMIS	School Integrated Management Information System
SME	Small and Medium Enterprise
STEM	Science, Technology, Engineering and Mathematics
TVET	Technical and Vocational Education and Training
UdM	Université des Mascareignes
UKZN	University of KwaZulu Natal
ZEP	Zones d'Education Prioritaires'/ Priority Education Zones

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ANNEXES

EXECUTIVE SUMMARY

Mauritius is a middle-income country that has made good strides in education as well as in low and high tech. A small island state of about 1.27 million population for 2040 square kilometres, it has transitioned from a monocrop economy to a diversified economy and is termed as “Africa’s best development success story” by the World Bank (World Bank, 2022).

Much of its success is due to solid investment in education and human resource development since the early days of its independence in 1968. Investment in infrastructure, tourism, financial and business services have contributed to its economic growth in the past decades and a gross domestic product of 7.4% (GDP in 2021 according to the Mauritius Economic Development Board).

Yet, the country struggles to recover the economic growth it experienced in the 1970s and 1980s. The country, while it has declared free universal primary and secondary education and more recently fee free tertiary education for undergraduate level, must grapple with rising unemployment, school dropouts and disparities in the quality of education. Human capital development necessitates solid foundations and good learning outcomes.

To address the diverse challenges and build the resilience of its sectors, including the education sector, the country seeks to extend its economic base, have a broad-based ICT sector and enable a knowledge economy. This calls for a re-engineering of the education system, and as COVID-19 has shown, building resilience through digitalisation. The transition to online learning has accelerated the adoption of technology and digital devices to support teaching and learning in a lifelong learning perspective and holistic system of education.

Mauritius has long sought to use digital solutions to enhance the quality of its education delivery. It has equipped primary and secondary schools with high-speed connectivity in line with the Government's vision of accelerating the transformation of Mauritius into an ICT hub and in developing ICT into a major pillar of the economy.

More work needs to be done to address the digital divide and changing world of work to provide equitable opportunities for lifelong learning and skills development. Taking advantage of the existing strengths of its national educational policy, Mauritius can establish a new basis through ODL solutions to expand the accessibility and quality of their educational systems to various vulnerable groups of learners, including people with disabilities and those that miss out of schooling and education.

1. INTRODUCTION

The first phase of this consultancy involved an extensive literature search to identify relevant extant information to inform the data gathering process for the preparation of country reports over a 5-day period.

The reports are structured to include:

- National policies, strategies and programmes that exist in the country for the use of ICT in education.

- A brief description of the current level and types of ICT infrastructure being used in the various education sectors including primary, secondary, technical and vocational education and training, tertiary and non-formal sub-sectors.
- A list of the major initiatives underway.
- A list of major partners.
- Identification and description of factors that enable and constrain the use of ICT.
- The role of ICT to enable the continuation of teaching and learning.

Data collection was mainly done via desk research, using published sources on the Internet. Limited primary data were collected through telephone and e-mail discussions with country-based contacts, where available to the consultant. This was because country teams that were to consist of policymakers and researchers with ground knowledge, were not initially set up or organised as anticipated, Prior to the preparation of the final report, drafts of individual country reports, including the present Mauritius country report, will be submitted to the Association for the Development of Education in Africa (ADEA) for review and comment.

The presentation of a literature review without gathering primary data and information from the country is a limitation of secondary data collection processes. However, since this forms the initial stage of a more comprehensive study, this limitation will be addressed by the gathering of primary data in the latter stage of the study.

1.1. The review and survey process

This country profile forms the initial stage of a mixed methods data collection process employed to gather secondary data for the ICT in Education project. This first stage of the study entails a careful review of secondary documents gathered from a range of sources including public government items dealing with the country's economic and social, legal framework, ICT infrastructure, the availability of ICT tools within the country's education sector system strategy as well as teachers and students' capabilities.

The development of the country profile is based on a review of secondary literary sources provides an initial profile that offers a baseline and frame of reference for understanding the key issues, for the country's experiences, priorities and challenges regarding ICT and remote learning strategy specifically as has been accelerated by the COVID-19 experience. The literature sources assist in identifying information gaps that will inform the second phase of the study which involves a primary data collection process. To this end, the country profiles inform the development of instruments as well as provide a backdrop for the interpretation of the data collection comprising surveys and focus interviews to be conducted in the second phase of the study.

This review of literature provides a background to what policy initiatives are in place, budgetary allocations, key challenges, and lessons learnt. It will also show the country's interpretation and response regarding ICT in Education, remote learning, and COVID-19 with implications for the country's resiliency levels and the required investment to attain a standard level of resilience. In addition, the literature review provides initial information about the partners engaged in this area and will inform the detailed partner mapping, for which the primary research activities will enable the identification of further key expert informants and partners to provide ways forward for the study.

Essentially the ICT in education study relies on the use of both primary and secondary data collection for profiling and suggesting proposals for the use of ICT in education in African countries subsequent to the COVID-19 pandemic, across the subsectors of basic education, TVET and higher education specifically focusing on: (1) existence and breadth of ICT policies and strategies; (2) availability and utilisation of ICT infrastructure in learning facilities; (3) the level of the workforce's digital competence including learners' abilities; (4) the availability of electronic systems for learning and assessments; (5) the existence of e-education materials; (6) partners engaged in supporting the use of digital technology in education; (7) challenges related to implementing e-education; (8) and examples of success stories and good practices.

Ultimately the data gathered per country from this mixed methods study will be analysed according to the following thematic areas: (1) common SWOT analysis on the use of ICT in education and remote learning; (2) required enabling factors to support the strong national resilience to future crisis; (3) the key gaps concerning ICT infrastructure, e-learning systems, the ICT literacy of both learners and students, and e-curricula; (4) opportunities for initiating and enhancing regional programs for e-education; (5) key partners and stakeholders currently engaged in supporting the use of digital technology per country, area of support they are engaged in; and (6) best practices that might be replicated.

1.2. Limitations of the study

There are obvious limitations of studies utilising secondary data. Data sources are themselves limited and those available might be incomplete and not current. In this study, the subsequent primary data collection process using interviews with key informants and partners as well as the administration of surveys, is intended to ensure that the limitations are minimised.

2. BACKGROUND

2.1. Overview

Mauritius has been fast-tracking its ICT global competitive strategies and has been successful on all scores. Following the model of the Singaporean experience, the Mauritian government has been visionary in its promotion of its country as a "cyber island," a hub for the southern African region with a diversified economy. Mauritius has attempted to promote ICTs in schools since the late 1990s which is reflected in its national ICT policy (2007), a segment of which is dedicated to education. The country currently holds the 61st position of 134 countries on the Digital Readiness Index, and as shown in Figure 1 has several accolades and international indices achieved for its advanced ICT sector. In all cases, except for digital innovation, Mauritius is regarded as first in Africa.

The country is a Small Island Developing State (SIDS) of 2040 square kilometres, with a population of around 1.27 million (January 2022). It provisionally attained High-Income Country (HIC) status in 2019, but rapidly reverted to Middle-Income Country status in 2020 because of the COVID-19 pandemic on its economy. The temporary World Bank HIC graduation is nonetheless noteworthy in the country's economic development and its transition from a remote monocrop economy to "Africa's best development success story" as described by the World Bank (World Bank, 2022).

Figure 1: International indices

Source: Digital Mauritius 2030 Strategic Plan

Since its independence in 1968, the economy has evolved from an exclusively agriculture-based economy to a diversified economy based on textile manufacturing, an industrial zone, tourism, and successful public-private sectors collaboration in the 1970s. The country's investment in education, infrastructure, financial sector, and business services accounts for its good international rankings. For instance, about 850 ICT/BPO companies employed around 30,000 workers and contributed to 7.4% of the country's gross domestic product (GDP) in 2021 (Mauritius Economic Development Board, 2022).

Yet, over the last decade or so, its economic growth has struggled to reach the level it had during the economic 'miracle' years of the 1970s and 1980s at a time when monocrop sugar production fuelled growth. The stagnation is partly due to weaker investment, global trade market competitiveness and rising unemployment. The country has lost its edge and competitiveness in many sectors whereas investment efforts in new or non-traditional sectors remained sparse. Between 2009 and 2019, exports fell from 57 to 40 percent of the GDP. The main export sectors including tourism, textile and business services suffered losses in market share. During that same period, private sector investment was mainly in traditional sectors and was around 14 percent of the GDP (pre-COVID period). In 2015-19, half of private investment was in real estate, while investment in tourism, retail, manufacturing, and agriculture declined. Investment in non-traditional sectors was mainly in the ICT sector (Figure 2). Foreign Direct Investment (FDI) flows oscillated around 4 percent of the GDP over that period, with about 2 percent of the GDP accounted for by the sale of high-end real estate occupied mostly by foreign residents.

Furthermore, due to its dependence on tourism, the island has severely suffered economically from the impact of COVID-19. In 2020, recession was at 14.9 percent. Growth is expected to lift in 2022 with the reopening of borders. The COVID-19 shock presents an opportunity for Mauritius to "recalibrate its growth model including with the reallocation of resources towards more productive firms", suggests the World Bank. It gives the retail sector as an example where new digitally enabled business models expanded during the two lockdowns (World Bank, 2022).

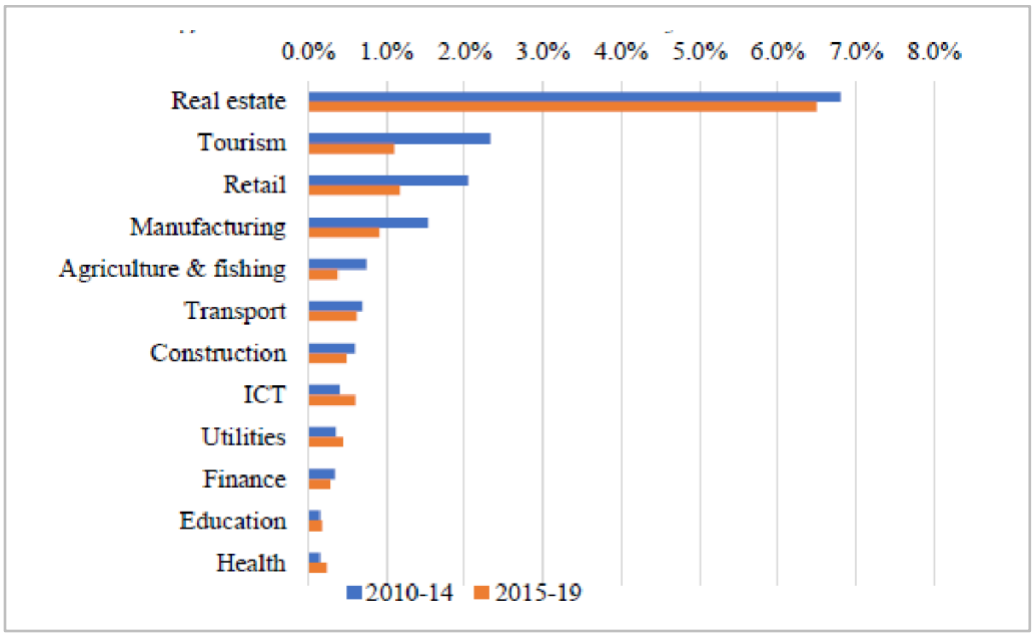


Figure 2: Private Investment GDP by Sector

Source: World Bank (2021) based on data from Statistics Mauritius

Besides natural disasters including pandemics, cyclones and flash floods, Mauritius is highly vulnerable to fluctuations in the global trading system. The Government therefore seeks to broaden the economic base to better absorb the impact of exogenous shocks and build resilience. It has placed emphasis on sectors such as the land base oceanic industry, the seafood hub, the real estate sector, the pharmaceutical industry, the financial sector, a diversified tourism sector, a broad-based ICT sector as well as the emergence of a knowledge economy, which all call for a re-engineering of the education system. The Education and Human Resource Strategy for the period 2008-2020 and post 2020 provide the frameworks for these new developments while allowing for flexibility and adaptation to changes that might occur, including post-COVID19 recovery.

3. REVIEW AND SURVEY HIGHLIGHTS

The Government of Mauritius plans to integrate the use of digital technology in the daily life of every citizen by using ICT for government services, businesses, and lifestyles (MTCI, 2018a). The digital economy could contribute up to 10% of the annual GDP annually with creation of approximately 50,000 jobs by 2030. In 2019, the ICT sector contributed to 5.7% of the GDP[1]. A robust ICT sector requires skilled human resources. The Government of Mauritius therefore brought changes to the education system to respond to the emerging needs. Consequently, education policies were revised, and more demand was placed on teachers and school principals[2]. The Education and Human Resources Strategy Plan 2008-2020 made provision for flexible systems and structures that that allow learners to acquire new skills within a lifelong learning framework. That means ensuring that the accreditation and qualification systems allow learners to receive credits for experience, upskilling or

[1] Mauritius ICT Indicators Portal - Local indicators (ncb.mu)

[2] International Journal of Learning, Teaching and Educational Research Special Issue, Vol. 13, No. 4, pp. 14-19, October 2015.

knowledge gained, whether in the classroom, in the workplace or other settings (EHRSP 2008-2020: 12).

ICT infrastructure and ICT indicators, including mobile phone and internet access and usage, fixed broadband penetration, all interact to potentially decrease education, social and economic inequalities. Mauritius is one of only four countries in Africa together with Egypt, Namibia, and Tunisia where the price of one gigabyte (GB) of data is affordable to three-fourths of the population (AUC/OECD, 2021). Affordable internet is defined as the cost of one gigabyte of mobile prepaid broadband being below 5% of the average monthly income of the household.

Table 1 lists some core ICT indicators for Mauritius and further International Telecommunication Union (ITU) indicators are discussed in the latter part of this study.

Table 1: Indicators for the ICT Sector

Core ICT Indicators for Mauritius	
Contribution to GDP (end 2019)	5.7%
Growth Rate (end 2019)	4.8%
Broadband penetration (Jan 2022)	87%
No of internet users (Jan 2022)	1,027,900
Mobile phone penetration (2020)	150%

According to World Bank, mobile phone penetration (as a percentage of population) reached 151 percent in 2022 in Mauritius - which was 2.31 percent more than in 2021. The digital economy has strong foundations to build upon with an ICT sector that positions itself as the 3rd pillar of the economy, supported by a robust digital infrastructure. Earlier liberalisation of the telecommunications sector saw new players joining the industry and providing competitive connectivity rates. Consequently, Mauritius is well positioned in terms of access to telecommunications and broadband services with a broadband penetration of 87 percent (World Bank, 2022).

The Digital Government Transformation Strategy 2018-2022 (DGTS) provides directions for digital governance and for accelerated public sector digitalisation. The aim is to enhance effectiveness and efficiency of operations in the public sector and to provide better service to citizens. The DGTS overall objective is to transform Mauritius into a SMART island by 2030 (MTCI, 2018). The Strategy document states that "Through harnessing of opportunities for digital transformation in the Public Sector, the DGTS is aligned with, and goes together with the Public Sector Business Transformation Strategy (PSBTS) for achieving Government's Vision 2030. On a higher note, the DGTS provides the Government with digital policies to attain all 17 Sustainable Development Goals" (DGTS; page IV).

In the critical area of education and skills development, a comprehensive school reform, the introduction of fee free tertiary education, the creation of Polytechnics for practice-oriented and technical qualifications in Information and Communications Technology (ICT) are noteworthy. The effective usage of ICT in education has the capacity to improve learning and teaching and to reform educational processes. ICT can allow greater flexibility and mobility of learners and educators, as well as improve the quality of education. ICT has a great potential of making lifelong learning more readily available for everybody.

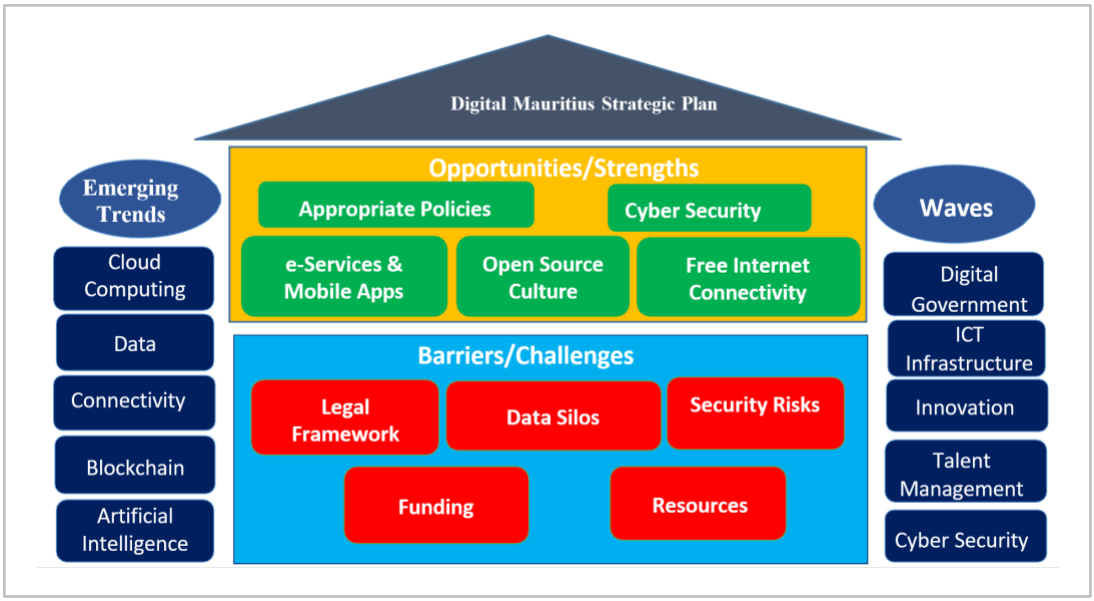


Figure 3: The digital strategic plan

Source: Digital Mauritius 2030 Strategic Plan

4. EDUCATION SECTOR

4.1. The System of Education in Mauritius

Mauritius has an education system that follows the British system since the country was a former British colony. It consists of a 2+6+5+2 system of formal education, categorised into four main sectors – pre-primary, primary, secondary, and tertiary. It also caters for learners that for one reason or another, are outside of mainstream education and for school leavers, with pre-vocational and vocational education and training.

Table 2: Education System in Mauritius

Stage	Age	Status	Pre-requisites	Class	Exams
Pre-primary	3-5 Years	None	Year I Year II Year III		
Primary	5-11 Years	Compulsory	Pre-Primary Education	Standard I Standard II Standard III Standard IV Standard V Standard VI	Certificate of Primary Education
Lower Secondary	12-16 Years	Compulsory	Certificate of Primary Education	Form I Form II Form III	Form III Certificate

Stage	Age	Status	Pre-requisites	Class	Exams
Upper Secondary	17-20 Years	Optional	Form III Certificate for School Certificate School Certificate for Higher School Certificate	Form IV Form V Lower VI Upper VI	School Certificate (O Level) Higher School Certificate (A Level)
Tertiary	18+ Years	Optional	Higher School Certificate		Leads to Bachelor's, Master's, PhD, and other academic degrees.

Students have benefitted from Universal Secondary Education since 1976. Free education was extended to post-secondary level in 2019. The policy is applicable for undergraduate level in public Higher Education Institutions (HEIs). Indirect fees have also been addressed with the introduction of free transport for all students in July 2005. Textbooks for students of Grades 1 to 9 have been free since 2020. However, the pre-primary schools are still mostly privately owned (70.1%). Mauritius has invested in education, both in terms of infrastructure and human resources, including subsidising an important part of the private education sector.

Primary education ends with a national examination which is the Primary School Achievement Certificate (PSAC). Assessment leading to PSAC also comprises a School-Based Assessment component consisting of two modular assessments at the end of Grade 5 and beginning of third term of Grade 6. Students passing PSAC gain admittance to secondary schools, and those with excellent results are admitted in national secondary schools starting from Grade 7 (Form I) to Grade 12 (Form VI). The National Assessment at Grade 9 is carried out in the third year of Secondary education and students are streamed according to the subjects they choose. The Cambridge School Certificate (SC) examination takes place at the end of Form 5 (fifth year of study at secondary school level). Students who pass the exam pursue another two years of study leading to the Higher School Certificate (HSC). Alternatively, students who do not wish to follow the academic stream can opt for technical and vocational training and education (TVET) which allows them to complete the compulsory phases of education while preparing for employability.

Tertiary education offers extend beyond local institutions as considerable number of Mauritian students either go overseas for their studies or opt for open and distance learning mode. Tertiary institutions include colleges, universities, Institutes of Technology/Polytechnic and other technical institutions. The country's main HEIs are those overseen by the Higher Education Commission (HEC), namely, the University of Mauritius, University of Technology, Mauritius, Mahatma Gandhi Institute, Open University of Mauritius, Université des Mascareignes, Rabindranath Tagore Institute, Fashion and Design Institute, Mauritius Institute of Training and Development and Mauritius Institute of Education. ("Higher Education Commission") The HEC also has the mandate to regulate 44 (as of June 2021) private HEIs through institutional registration and programme accreditation.

The Ministry of Education, Tertiary Education, Science and Technology (MoETEST) is responsible for the education sector. The MoETEST presently operates six Technical Institutions. It also has under its aegis three campuses that form part of the Polytechnics Mauritius Limited (PML). The Mauritius Qualifications Authority (MQA) is the regulator of the Technical and Vocational Education and Training (TVET) sector. It also develops and maintains the National Qualifications Framework (NQF). The MQA is responsible for ensuring the quality of all training provided either by the state or the private sector. It [3]. The Mauritius Qualification Authority. The Higher Education Commission (HEC) was set up under the HE (Higher Education) Act (2017) and came into operation in January 2020. It is the regulatory body for HEIs (Higher Education Institutions) and oversees the higher education sector.

4.2. School population and enrolment rates

There were 789 pre-primary schools in October 2021 with a population of 23,603 children – a decrease of 9.8%, from 26,162 in March 2020. Girls represented 48.8% of the pre-primary school population. The Gross Enrolment Ratio (pre-primary enrolment as a percentage of the population aged 4 and 5 years) is 92.5% compared to 102.0% in 2020. The average ratio was 13 pupils per teacher.

As of October 2021, there were 319 primary schools (302 in the Island of Mauritius and 17 in Rodrigues) with 84,129 pupils (49.7% were girls). The Gross Enrolment Ratio (primary enrolment as a percentage of the population aged 6 to 11 years) is 99.9% and the pupil/teacher ratio is 18.

The majority (221) of the schools were run by government, 63% of the primary school population was enrolled in government schools and the remaining was in private aided and non-aided schools.

All children achieving Primary Grade 6 move to Grade 7 in a secondary school to complete the last 3 years of the nine-year basic education cycle. Pupils who have not reached the minimum standards at the PSAC assessment integrate an extended programme in a secondary school. The programme allows them to follow an adapted curriculum and complete the basic education cursus in four years instead of three. As of October 2021, there were 178 secondary schools, out of which 143 were offering both the regular and the extended programmes from Grades 7 to 9+. At the end of Grade 9, student continue their studies leading to Cambridge O/A level qualifications in either the same secondary school or in an Academy.

Out of the 178 schools dispensing secondary Regular and Extended education, 170 were in the Island of Mauritius and 8 in Rodrigues. State administered schools numbered 69, while the other 109 were private aided and non-aided schools. Secondary education enrolment decreased by 4,327 from 107,049 in 2020 to 102,722 in 2021. Some 43.8% of the secondary school population was in state schools and 56.2% in private (aided and unaided) schools. Gross Enrolment Ratio (secondary education enrolment as a percentage of the population aged 12 to 19 years) was 71.9% with a pupil/teacher ratio of 11.

[3] TVET (govmu.org)

5. ICT INFRASTRUCTURE FOR EDUCATION IN MAURITIUS

5.1. ICT infrastructure in schools

In March 2020, out of the 833 pre-primary schools in the Republic of Mauritius, 504 (61%) had computers in a bid to promote school readiness and digital skills. The pre-primary schools were provided with digital pedagogical tool to support teaching and learning.

All primary and secondary schools were equipped with computers. Availability of internet access for students in schools was as follows: 19% in pre-primary, 63% in primary and 100% in secondary[4].

The Government Online Centre (GOC), operational since May 2005, is a centralised data centre that supports e-Government initiatives. GOC also provides Internet access to over 180 secondary schools and 265 primary schools and Internet & E-mail facilities to over 8,000 employees of Ministries and Departments, making the institution the 2nd largest Email Provider in Mauritius. With the setting up of a National Internet Exchange Point (NIXP) on the GOC platform, Internet Service Providers (ISPs) in Mauritius can peer through to GOC so that local bandwidth is contained in Mauritius thereby saving on international bandwidth.

In line with the eGovernment Strategy 2013 - 2017, several eGovernment projects have been implemented including e-Education with the introduction of interactive projectors in primary schools through the Sankore project. Through SchoolNet II, Internet links and wireless connectivity were deployed in more than 150 sites in Mauritius and Rodrigues comprising Secondary State Schools, Grant-aided Secondary Schools, and Public Libraries among others (November 2017). Whereas to support the Early Digital Learning Programme and to modernise teaching and learning using ICT tools, tablet computers distribution to Grade I, II students and educators started as from October 2017.

5.2. ICT infrastructure in TVET

In 2015, the government decided to set up three polytechnics campuses distinct from universities. The two main reasons that guided that decision were the increasing unemployment of university graduates and the dire shortage of middle management and technical skills. The Polytechnics Mauritius Ltd (PML) was established in 2017 to bridge the gap between low and high skills by using an unconventional approach. The PML was set up as a state-owned enterprise registered as a private company but with 100% government shareholding. As a private company, the PML cannot award diplomas or degrees. All its programmes are therefore offered on a franchise basis from relevant institutions in Australia, Canada, Malaysia, Switzerland, Singapore, and Mauritius. The quality of each programme is consequently assured by the external awarding institution. The PML has three campuses spread across the island. Each campus occupies a modern, well-equipped building and covers a specific area: health sciences and nursing; IT and emerging technologies, and tourism and hospitality. The PML offers two- to three-year courses that can be completed on a full-time or part-time basis, at diploma level, such as the diploma in IT (cyber security) awarded by the University Malaysia of Computer Science and Engineering, as well as a diploma in Interactive and Digital Media.

[4] EDUCATION STATISTICS – 2020 https://statsmauritius.govmu.org/Documents/Statistics/ESI/2020/EI1543/Edu_Yr20.pdf

5.3. ICT infrastructure in higher education

HEIs in Mauritius are well equipped in infrastructure and ICT. For example, the University of Mauritius has a Department of Information and Communication Technologies equipped with some 40 computers with software for students to conduct lab work associated with the ICT programmes and coursed offered by the department. The Digital Technology Lab which comes under the Department of Digital Technologies is also well equipped with 35 PCs according to the University's website, while the Software and Information Systems Lab benefits from some 40 computers. The University consists of two other well equipped specialised technology laboratories: one for ICT projects and one for robotics[5]. Those Departments and specialised laboratories come under the Faculty of Information, Communication and Digital Technologies (FoICDT) that was established to develop the human resource required to make Information and Communication Technology (ICT) sector the main pillar of the Mauritian economy.

On the high-end spectrum of technology and innovation, a team led by the Mauritius Research and Innovation Council (MRIC) in consultation with the University of Mauritius (UoM), the University of Technology, the Mauritius Sugar Industry Research Institute, and the Mauritius Oceanography Institute, designed a *Mauritian CubeSat*. The team also benefited from international expertise through collaboration with Clyde Space (UK); TeleSpazio (France) and ASTOS Solutions (Germany). The proposed CubeSat satellite will be equipped with an infrared thermal imaging camera to gather spatial and temporal data of land and ocean. The nanosatellite will also constitute a platform to test inter-island connectivity by broadcasting updates to remote islands of Mauritius. This CubeSat experiment could lead to a large-scale solution for inter-island communication. The satellite was launched in 2022.

In 2021, the Faculty of Information, Communication and Digital Technologies (FoICDT) of the University of Mauritius launched a Robotics Lab to boost innovation, research, and development. The goal is to generate solutions to pressing problems of national interest with focus on the use of robotics technologies. To promote a culture of IT in innovative sectors of development, the Government of Mauritius offers 15 scholarships at master's level in Digital Technologies and five at PhD level[6].

Besides a strong focus on core ICT programmes, the University of Mauritius offers online or blended learning courses. It has a dedicated centre, the Centre for Innovative and Lifelong Learning (CILL) which was established in 2014. The Centre develops short courses as well as full programmes that are delivered by means of e-learning or blended learning. It also equips the university academic staff with the necessary tools to integrate technology in their academic activities.

The Open University of Mauritius has an Engineering and Technology Services Unit that is responsible for the ICT infrastructure of the institution. This entails ensuring that the staff and students have the required ICT devices and equipment for online and blended learning. The unit also oversee the provision of Internet and Wi-Fi.

[5] Faculty of Information, Communication & Digital Technologies - Projects Lab (uom.ac.mu)

[6] https://education.govmu.org/Pages/Major-Achievements.aspx

5.4. ICT infrastructure for non-formal education and lifelong learning

The objective of the Community Empowerment Programme (CEP) is to facilitate the process for the community to make use of ICT to fully participate in the socio-economic development of Mauritius. The CEP is in line with the Government programme to encourage the development of local content and creativity. The CEP consists of the following projects: Wi-Fi Mauritius with 350 locations in public places having been equipped with free Wi-Fi hotspots with 10 MB Internet connection through Optical Fibre. Previously, under the Community Empowerment Programme, the National Computer Board (NCB) had set up Computer Clubs on a regional basis to provide free access to ICT tools and Internet in collaboration with Microsoft and Mauritius Telecom Foundation with the aim to provide free access to ICT tools and Internet. The Wi-Fi locations have been chosen based on the existing sites of Computer Clubs, Public Internet Access Points (PIAPs), Priority Education Zones (ZEP) schools, etc and their existing lines have been used to provide Wi-Fi. Another project is that of setting up of Learning Corners in Rodrigues. The purpose of this project is to provide free access to ICT tools and Internet to Rodriguans. The Learning Corners add to the development of Rodrigues by facilitating the democratisation of ICTs to contribute to the empowerment of the community using ICTs and free access to broadband Internet. It helps to provide information and communication infrastructure and promote ICT for educational, personal, and social development by providing free Internet access. Each Learning Corner is equipped with three computers and free Internet access and is open to the public. In addition, access to ICT infrastructure and Internet has been accelerated by the set-up of Public Internet Access Points (PIAPs) in the 95 post offices around the island. 5 PIAPs are also available in Rodrigues. This measure will result in a further increase in ICT and Internet penetration of Mauritian citizens. More than 315,000 registrations have been noted in the PIAPs.

6. ICT POLICIES FOR EDUCATION IN MAURITIUS

6.1. General Observations

The Minister of Education presented an ICT Strategy for the Education Sector in 2018. This strategy spans the pre-primary, primary, secondary, and tertiary education subsectors and has four ICT areas of focus: 1) infrastructure and connectivity; 2) enhanced teaching/learning and pedagogical content development; 3) education management; and 4) capacity-building and professional development. Each area of focus has projects implemented with partners, such as the Open University of Mauritius, the Commonwealth of Learning (COL), and the National Council of Education Research and Training (NCERT) of India.

6.2. National ICT Policies

The 2007 National ICT Policy (2007:11) focused on the integration of ICT in schools based on the following indicators:

a. The curricula at primary and secondary school levels will be reviewed to improve the quality of education for Science and Technology and introduce new learning methods.
b. The ICT base of primary and secondary schools will be improved, and the use of e-learning increased; and
c. Teachers will be trained with the necessary ICT skills to be able to use ICT in the teaching process.

6.3. Education Sector ICT Policies and Implementation Plan

During the 1980s, the government proposed to use technology to enhance the quality of education by improving the course and instructional materials as well as upgrading the teacher training programmes. However, the precise role and type of technology were not clearly indicated. The 1997 Master Plan included more technical-oriented subjects in the curriculum. It was only in 2008 that schools were computerised with PC tablet and computers, when the Educational and Human Resources Strategy Plan 2008-2020 (EHRSP 2008-2020) gave significant importance to the integration of ICT in the school curriculum. The then Ministry of Education and Human Resources (MOEHR) highlighted a plan to embed technology in the education system by equipping schools with IT facilities by the end of 2010, thus providing students with access to modern technology whilst training educators in ICT (EHRSP 2008-2020).

The Strategic Framework of the EHRSP 2008-2020 incorporated ICT in education in the eight sub-sectors from pre-primary to tertiary education levels, as captured and summarised in the following table. While the strategic goals of some sub-sectors e.g., TVET and Tertiary Education do not explicitly refer to ICT to achieve those goals, it will be necessary to consider technology enabled education. This involves considering a new paradigm of education and training that follows a lifelong learning approach, from early childhood to adult learning.

Table 3: Education Sub-sectors in relation to ICT strategy

Sub-sectors	Key strategic goals as relevant to ICT
1. Early childhood care and education (ECCE) for children aged 3-5 years	Embed technology in the system.
2. Primary Education	Information and Communications Technology and essential Life Skills for personal development and lifelong learning
3. Secondary Education with prevocational education as an integral part of secondary schooling	Introduce support technology in the system
4. Opportunities for continuous professional development of school staff through provision of lifelong opportunities; as well as for all education sectors staff (pre-service, in-service, and flexible modes of professional development).	• Further strengthen and develop Distance Education. • Strengthen MIE to be an institution of excellence in Teacher Education, Research and Curriculum Development.
5. Technical and Vocational Education and Training (TVET) to foster lifelong employability. Promote a lifelong learning environment by upskilling and knowledge development, including for adaptation to evolving technology and world of work.	• Improve articulation between TVET and general education. • Enhance the quality and relevance of TVET. • Make Mauritius a Regional Hub for TVET.

Sub-sectors	Key strategic goals as relevant to ICT
6. Tertiary Education sub-sector aims to make Mauritius a knowledge Hub that will be able to serve the region and act as a centre for higher learning and excellence.	• Increase and widen access and ensure equity. • Enhance quality and relevance. • Create an effective national knowledge and innovation system. • Internationalise the Mauritian Tertiary Education.
7. Human resource development as essential to shape the country's future through lifelong learning and "humanpowerment." To fulfil the ambition of the country as a knowledge economy requires a human resource development system. Such system should be responsive to the needs of the labour market and prepare the human resource component to adapt to changing demands. Training and upskilling are therefore required to set the foundations for "humanpowerment" and build a creative and competent human resource base. It requires a lifelong learning approach.	• Transform Mauritius into a Knowledge Economy. • Develop and implement a lifelong learning policy.
8. System Management Reform: Transforming the ministry to improve its management and performance through its governance, accountability and achievement structures that will co-ordinate the provision of quality educational services throughout the system.	• Build an effective and efficient education sector. • Use state-of-the-art technology to transform education management. • Ensure quality assurance for education and training programmes.

Source: EHRSP 2008-2020

The EHRSP 2008-2020 noted several inefficiencies of the education system such as low student retention and high attrition rates, as well as the low quality of teaching and learning. The most cited 'inefficiencies' of the current education system are the high percentage of students failing and/or repeating the PSAC and a concerning attrition rate of children who lack numeracy and literacy skills. PSAC pass rates have improved from 64.3% in 1999 to 75.19% in 2018, while pass rates for the School Certificate went from 74.6% in 2002 to 85.67% in 2020/21, and rates for the Higher School Certificate went from 75.8% in 2002 to 89.99% in 2021 (with significantly higher pass rates for girls than for boys in all three cases).

The Gross Tertiary Enrolment Ratio (GTER)[7] for 2019 was about 48.0 %, which indicates that more students should complete secondary school and enrol into tertiary education. Most tertiary education students (83.7%) enrolled in local tertiary education institutions in both public-funded institutions (48.5%) and private institutions (35.2%). 16.3% of the students were enrolled in overseas tertiary

[7] Tertiary education enrolment as a percentage of the population aged 20 to 24 years.

education institutions. As of December 2019, the total number of students (part-time and full-time) enrolled in tertiary-level programmes (including Distance Education) was 49,205 compared to 47,398 in December 2018, representing an increase of 3.8% (Statistics Mauritius, 2020).

Regarding Special Education Needs (SEN), the EHRSP stressed that it is important that SEN policy guidelines and strategic framework progress along well defined goals and targets so that, by 2020, all SEN children have access to relevant, high-quality education. The number of students enrolled in the 71 special schools stood at 2,731 (of whom 66.4% were boys) according to March 2020 data. This represents a decrease of 2.1% compared to 2,790 in 2019. The three most frequent types of impairment among the pupils were intellectual impairment (27.6%), dyslexia (20.8%) and autism (10.4%) (Statistics Mauritius, 2020).

6.4. ICT areas of focus/clusters

The ICT Strategy for the Education Sector cluster (2018) on 'Infrastructure and Connectivity' enabled the Early Digital Learning Project (EDLP) for Grades 1 and 2. The project was a collaborative endeavour between the Mauritius Institute of Education (MIE), the Mahatma Gandhi Institute (MGI) and EDCIL, India. It integrates ICT into teaching and learning using adapted tablets in the primary education subsector. These tablets contain digital pedagogical contents such as videos and e-books, interactive animations, hands-on activities, drawing and creativity tools. The strategy requires that all primary and secondary schools be equipped with desktop computers in computer labs. The EDLP will promote an early culture of IT usage and practice as well as improve learning outcomes while being adaptive to learners' developmental level and learning needs. The Ministry reported in its major achievements for 2020 that the Early Digital Learning Programme "has been successfully implemented in Grades 1 to 3"[8].

In 2018, the Ministry commissioned and distributed 26,800 tablets and headsets across all primary schools, along with 250 wireless projectors and screens and 1,340 rack chargers, which is a reasonable distribution for a small state. Moreover, all primary and secondary schools are equipped with desktop computers in computer labs.

As regards the secondary education subsector, students benefitted from the Student Support Programme (http://ssp.moemu.org) that was launched in 2018. The digital platform provides free educational resources for Grades 7 and 8. The objective is to inculcate a culture of autonomous learning among students. Resources available include links to relevant websites, e-presentations, and self-assessment tools adapted to the National Curriculum Framework for lower secondary school level. The Open University of Mauritius, MIE, MGI and the National Council of Education Research and Training (NCERT), India jointly developed the Student Support Programme. Television is another medium of instruction used in education: the public service Mauritius Broadcasting Corporation (MBC) provides a channel and airtime for the diffusion of videos on the subject areas.

THE ICT Strategy focus on 'Infrastructure and Connectivity,' plans to enhance connectivity in secondary schools from the present 2 Mbps to 10 Mbps and to extend wireless connectivity to 160 secondary schools (State and Private). It was anticipated that a total of 276 primary schools would be connected to high-speed broadband internet by end 2018 and Wi-Fi hotspots would be made

[8] https://education.govmu.org/Pages/Major-Achievements.aspx

available in the future. The Ministry reported in 2020, that the project consists of the deployment of fast and reliable Wi-Fi "whilst connected to a state-of-art high-speed wide area network interconnecting primary schools to the Government Online Centre (GOC) for seamlessly access to online educational content", and that the 276 primary schools, 264 in Mauritius and 15 in Rodrigues, have effectively received wireless connectivity[9].

Cluster two of the ICT Strategy concerns 'enhanced teaching/learning and pedagogical content development.' With regards to primary education, it includes the teaching of ICT as a non-core subject with two sessions per week. Higher Education Institutions (HEIs) will develop a National Open Education Resources (OER) Policy with the support of the Commonwealth of Learning (COL).

One project, under the third focus area of 'education management,' will develop an Education Management Information System (EMIS) which will include an e-Timetable Software and a Campus Management System (eLearning Africa Report, 2019). The integrated Campus Management System (CMS) will be implemented to enhance internal and external collaboration as well as to improve the efficiency of the administrative system. As reported by the Ministry, the e-timetabling software has been initiated "to ease school administration by harmonising the way timetables are worked out across all secondary schools." All state secondary schools have been provided with a licensed software, and the rectors and deputy Rectors have received training in its utilisation.

Capacity-building and Professional Development – Cluster four – englobes the training of staff (academics, educators, and administrative staff), and enlistment of the support of key stakeholders including Microsoft, Oracle, EDCIL, NCERT, World Bank, COL, MBC and UNESCO[10].

7. ICT IN PRE-PRIMARY, PRIMARY AND SECONDARY SCHOOLS

7.1. Equipment and connectivity

"Between 2020 and 2021, ICT access in the country changed as follows:" ("ICT_Yr21 - statsmauritius.govmu.org"):

- mobile cellular phone subscriptions per 100 inhabitants - from 151.1to 156.0.
- internet subscriptions per 100 inhabitants - from 130.2 to 143.3; and
- fixed telephone lines per 100 inhabitants - from 37.8 to 37.1.

In 2021, International Bandwidth usage increased to 211,312 Megabytes per second (Mbytes/s) from 144,973 in 2020. The usage per inhabitant in 2021 went up by 46.0% to reach 167,192 bits per second from 114,510 in 2020. 75% of primary schools had internet access for students for study purposes against 67% in 2020. At secondary level, 100% schools have internet access for students for study purposes since 2018. In both 2020 and 2021, the ratio of students per computer was 13 for primary level and 10 for secondary level. The percentage of students who enrolled in ICT or an ICT-related field at tertiary level was around 9.0% in 2021 compared to 8.3% in 2020.

[9] https://education.govmu.org/Pages/Major-Achievements.aspx

[10] http://www.govmu.org/English/News/Pages/ICT-Strategy-for-the-Mauritius%E2%80%99s-Education-Sector-presented-by-Education-Minister.aspx

The Computer Emergency Response Team of Mauritius (CERT-MU), a division of the National Computer Board, is promoting cyber security issues at the national level. CERT-MU serves as a focal point in Mauritius for computer security incident reporting and Response. Mauritius is placed 6th globally and first in Africa based on the ITU's Cyber Security Index. Services offered by CERT-MU include advising parents on the issues of Child Online Safety including Social Networking sites.

7.2. Teacher Professional Development and Training Programmes

The MIE, responsible for teacher professional development and Continuous Professional Development (CPD), recognises in its 2018-2022 Strategic Plan that opening access to higher education and lifelong learning is a common aim of all institutions of higher learning. In capacitating itself to respond to the demands of providing CPD through blended modes of delivery, the MIE has acquired the appropriate technology. However, the challenge is not only at the level of expanding the services of a multi-faceted and polyvalent virtual platform to all students and staff; it is equally situated in the institution's ability to mobilise resources and engagement at both institutional and national levels to use ICT and open learning as a leverage for educational change. This means developing ICT resources in ways that will allow the MIE to use its virtual portal for curriculum development and research.

The MIE therefore aims to provide an innovative system for the provision of highly effective online technological product that meets the expectation of learners. It therefore proposes to provide technical and pedagogical support to all its academic staff for the provision of online and blended mode of teaching and learning; integrate the use of technology within the pedagogical approach and assessment processes used in teacher education; create a depository of digital materials and resources for all schools through the MIE's Massive Online platform.

7.3. E-learning materials

The Mauritius Institute of Education's (MIE) has a Massively Empowered Classroom or Virtual Campus that aims to provide a network of digital learning resource. The virtual campus was launched in February 2017 and was developed by Microsoft Research in collaboration with the Learning Factory of the MIE. It allows users - to upload and download resources that they have produced. The platform also supports e-books, digital learning resources, presentations, videos etc. that are freely available to users who register on the website.

Another example is the special education needs (SEN) Unit of the MoETEST that played an instrumental role in ensuring the continuity of learning for students with disabilities – this having positive spinoffs for mainstream learners as well. The ministry sent an expression of interest to all SEN teachers who wished to participate in the production of educational videos. Through the Mauritius Institute of Education (MIE) materials for virtual learning during lockdown was developed. All materials were vetted for quality. In addition, the online learning materials incorporated diagnostic and formative questions, along with a self-assessment. The evaluation element of the learning tools and videos consisted of multiple choice or structured questions that students were to answer on their own in a set time before being given the solution; this allowed them to immediately be informed if they had successfully answered or not. Other videos, aimed at improving fine motor skills, included tests to ensure that students were able to synthesize their knowledge and produce desired final outcomes. These videos were broadcast on the national television on weekdays on specific channels at various

times of the day to maximise reach and efficiency. This further facilitated access to learning for students who did not have mobile devices and/or internet connectivity in their homes. The videos were also available on the MIE portal.

The country had prepared an 'Online Learning Strategy' or 'Home Schooling Programme – Let's get Digital' prior to the lockdown in Mauritius. A set of procedures guided the implementation of this innovative approach to teaching and learning. The initial phase involved the verification and updating of contact details of all parents, teachers, school administration, and paramedical teams. In certain specific cases, the Zoom application was also used by schoolteachers for communicating with some parents. With a view to support all learners in an inclusive and equitable manner, teachers prepared homework to be done during the confinement period and submitted hard copies of those to learners, following up through phone calls as an alternative way to reach parents who did not have access to WhatsApp or Zoom to monitor the progress of those learners.

The educational activities consisted of parent–child engagement activities, fine and gross motor exercise tasks, games, empowerment, and fun activities and were done under the guidance of the school team in collaboration with parents. It is interesting to note that similar efforts were made for learners with disabilities who were in the pre-primary and pre-vocational sections. Upon the official announcement of a complete lockdown, ODL was initiated by the respective organizations where teachers sent the timetables of all classes to the parents and solicited their support during those sessions. The same philosophy of the timetables during school time was practised so as not to overly unsettle the learners. The materials developed could be of assistance to other countries in the region especially at the foundation phase where most countries have the same themes.

8. ICT ACTIVITIES AND INITIATIVES IN HIGHER EDUCATION IN MAURITIUS

8.1. Technical/vocational education and training

The **Strategic Plan 2019 – 2022** of the Human Resource Development Council (HRDC) establishes a prioritised roadmap for the Council to better steer its course and growth towards fostering human resource and skills development for national socio-economic growth. The Council objectives are to support skills development at national level, for instance through initiatives that optimise existing skills as well as initiatives that develop new skills to meet changes and demand from multiple stakeholders. The Strategy steers the HRDC to better respond to skills-related changes in the labour market.

The Human Resource Development Council (HRDC) conducted a survey of key skills required to meet the needs on the economic sector under its programme on Skills Studies in 2017/2018. Findings indicated a lack of Science, Technology, Engineering and Mathematics (STEM) skills across all the economic sectors. Secondary data from the Mauritius Examination Syndicate (MES) also showed a decline in enrolment in STEM subjects at secondary education level and subsequently at tertiary education level. The lack of STEM skills development through STEM subjects taught at school leads to mismatch of STEM skills and difficulty in filling available job opportunities[11].

[11] https://www.hrdc.mu/index.php/projects/national-projects#aim-and-objectives

The Government's vision of promoting a Techno-entrepreneurship culture has incited a parastatal body operating under the aegis of the Ministry of Technology, Communication, and Innovation (MTCI), the National Computer Board (NCB), to reengineer its ICT Incubator centre into a Technopreneurship unit. The unit will promote Entrepreneurship in the ICT sector and establish an 'innovative start-up Nation.' Initiatives will include exploring emerging technologies to develop a pool of entrepreneurs in the sector as well as encourage creativity and innovative approaches to improve lifestyle through ICT usage. One of the unit's programmes is 'TechideaSpace' which assists students, young IT professionals, academics, and researchers as well as aspiring ICT start-ups to implement their projects and start their business. The nascent entrepreneurs have access to Microsoft development tools and to information about available financing mechanisms for ICT projects.

To boost creativity and innovation, the National Computer Board (NCB) organised an ICT Innovative Business Idea competition that invited submission of ideas for ICT tools that can provide access to innovative and smart services and improve individual lives through innovative services/ solutions to improve access to smart services using technology.

The Strategic Plan 2021-2025 of **the National Productivity and Competitiveness Council (NPCC)** has for theme 'Building a Resilient Tomorrow'. One of the projects is '**Enterprise Go Digital,'** through which the NPCC promotes the adoption of 4th Industrial Revolution technologies by enterprises. The project's objective is to enable Small and Medium Enterprises (SMEs) and mid-market enterprises to engage in digital transformation and increase their competitiveness and productivity. Digitalisation should also enable them to improve their resilience by adopting a new business model that integrates a new generation ICT services, products, or solutions. The NPCC contends that innovation is essential to enterprise survival and resilience, and enterprises should therefore be open to collaboration with external parties to seek innovative solutions and products. Such approach would fast-track innovation and create new pathways to growth.

The Economic Development Board (EDB) is a trail blazer in the economic landscape. Its overarching objective is to ensure greater coherence and effectiveness in policy implementation for sustainable and inclusive growth. The aim is to put the country on an economic leading to a high-income economy status. Setup in 2018, the EDB recognises education and ICT as key sectors and drivers of innovation-driven economy driven by a leading education hub. The EDB values the ICT/BPO industry as a key driver of the economy as it provides employment to some 30,000 people while contributing around 7.4% to the GDP contribution (figures for 2021). Mauritius counts around 850 ICT-BPO based enterprises, which represents one of the richest technology ecosystems in Africa. ICT/BPO industry is vibrant and consists of technology start-ups as well as multinationals that provide for instance digital services, technical support, and applications development[12].

8.2. Universities

The University of Mauritius pioneered ICT in education by launching an eLearning initiative in 2001 through its Virtual Centre for Innovative Learning Technologies. However, the University has wrestled to promote the uptake of innovative technology-enabled pedagogies by its academics. In 2017, the University's Council approved a technology-enabled learning policy that set the basis for a Learner-

[12] https://www.edbmauritius.org/ict

Centred Credit System (LCCS) and a plan to diversify revenue streams through online learning provisions over the African region.

That same year (2017), the University of Mauritius and Huawei Technologies (Mauritius) Co Limited signed an agreement for the implementation of a Huawei Authorised Information and Network Academy (HAINA). As a part of the University, the Academy will provide Huawei Certified Training Programmes to students and in-service professionals. HAINA is a not-for-profit partnership programme that authorises universities and colleges to deliver Huawei ICT career certification courses. The training programme will enhance local ICT education, build knowledge, and create more career and work opportunities in ICT. Under this collaboration, Huawei has sponsored two lab kits, one for a Switching and Routing course and one for a Cloud course to an amount of USD 40,600. The equipment and devices have been installed in 2018. Two instructors have been trained in South Africa to deliver the Huawei Networking Curriculum and four instructors have been trained to deliver the Huawei Cloud course[13].

The Open University of Mauritius (OUM) is the only Open and Distance Learning (ODL) university in the country. A public institution established in July 2012, it offers undergraduate and post graduate degree programmes through open and distance learning. The University builds on the foundations of the Mauritius College of the Air, established in 1971 to offer a distance education programmes in Mauritius. The College integrated the Open University and pursued the long tradition of flexible educational pathways through distance education for learners who cannot attend courses in person. Its intent is to enhance access to flexible and quality higher education at affordable cost. The provision of education through ODL and blended learning is therefore the best equitable option to reach all learners. The OUM delivers a range of courses and programmes including short courses, employability skills courses, foundation level programmes, certificate/diploma programmes, undergraduate and postgraduate programmes, doctoral programmes as well as customised courses for the private and public sectors.

The Mauritius Institute of Education (MIE) is a HEI (Higher Educational Institutions) with the mandate for teacher education and teacher continuous development, curriculum development and educational research.

The **Université des Mascareignes (UdM)** was established in 2012 as a result of a partnership agreement with the University of Limoges (France) and the Ministry of Tertiary Education, Science, Research and Technology of the Republic of Mauritius.

The newest public university in Mauritius, the UdM provides undergraduate and postgraduate programmes in Sustainable Development and Engineering, in Business and Management and in Information and Communication Technology (ICT). Most of the degrees awarded are dual degrees with the Université de Limoges. Research degrees are also offered at its Doctoral School and a recent research area consists in exploring the application of multimedia-based learning to improve creativity, continuous learning and autonomous learning in Health Education in lower primary schools. The research started in December 2019 and will be carried out until 2024 in partnership with the University of KwaZulu Natal (KZN). It sets out to explore the scopes of Multimedia Based Learning (MBL) as a new learning trend and its challenges for primary teachers and learners.

[13] 21st Century Teaching and Learning with Technology: February 2020 (vcilt.blogspot.com)

9. ICT IN NON-FORMAL EDUCATION AND LIFELONG LEARNING IN MAURITIUS

9.1. General observations

9.1.1. Universal ICT education programme

The National Computer Board (NCB) operating under the aegis of the Ministry of Technology, Communication & Innovation has been implementing the Universal ICT Education Programme (UIEP) since September 2006. One of the priorities of the programme is the introduction of the internationally acknowledged Internet and Computing Core Certification (IC3) course with a view of making it the benchmark for digital literacy and proficiency in Mauritius. The programme provides training to all, including students and members of the public, on the IC3 course. Interested participants must buy an IC3 Training card that costs about USD12 (Rs75). The course duration is 45 hours. Courses are delivered in State Secondary Schools after school hours and during weekends where they can make use of IT facilities that would otherwise remain unutilised. Over 250,000 people have received training in IC3.

9.1.2. Digital Youth Engagement Programme Project

As announced in the Budget Speech 2017-2018, the National Computer Board (NCB) is implementing the 'Digital Youth Engagement Programme (DYEP). The programme consists of introductory courses on coding and targets young people. The NCB operates cyber caravans to deliver the training sessions. In collaboration with the Ministry of education, the NCB plans to introduce Coding in primary schools for Grade 4 and Grade 5. Pupils will receive a 15-hour training delivered in the Cyber Caravans, which will proceed to various primary schools around the island. The early introduction of Coding has for objective of sparking the interest of the young learners for STEM and that they will later opt to study Science and Computer subjects. Course materials are accessible from an Open-Source coding platform (Code.org). The Cyber Caravans are equipped with diverse IT equipment including PCs, laptops, Raspberry Pi and tablets which allow the learners to access online course materials. About 1,588 participants have the DYEP training.

10. ICT, COVID-19 AND EDUCATION IN MAURITIUS

10.1. COVID-19 Lessons Learned

10.1.1. COVID-19 Act 2020

The COVID-19 (Miscellaneous Provisions) Act 2020 (the “COVID-19 Act 2020”) was passed in the Mauritian Assembly on 15 May 2020 and gazetted in the Government Gazette of Mauritius No. 57 of 16 May 2020. The Act amended the Education Act, replacing the word “schools” by the words “educational institutions.” The Act added the following new subsection: “Any closure, in case of infectious diseases occurring in epidemic forms, shall not be limited to the epidemic period but may extend to such further period, as the Minister may determine." It also inserted a new section specific to the provision of distance education during any closure or for any required period. The minister would then have authority to ‘order any educational institution to provide distance education and

online learning programmes, including broadcast lessons' (PMO, 2020). The Act clearly sets distance education as the preferred mode of delivery. It further elaborates on the role of the educators by specifying that "the teaching staff and other personnel of the educational institutions shall be required to engage in, produce and conduct, distance education and online learning programmes, including broadcast lessons; and the employees of the Ministry, and of any of its statutory bodies as may be designated, shall be required to contribute to, administer, monitor and supervise the conduct of such programmes."

Distance education (DE) is defined as the delivery of educational programmes by remote mode using diverse technology. It can be a complement or an alternative for in-person learning. The Act defines educational institutions as schools or institutions that caters for pre-primary, primary, secondary, technical, and vocational and tertiary education; as well as for Special Education Needs (SEN). The Government therefore decided on different modes of instruction and course delivery, including blended learning, to address any closure or non-access to educational institutions. It further instructs the dispensing of distance education and online learning programmes (including broadcast lessons) through relevant technologies. The teaching staff are to actively participate in the delivery of programmes either from their educational institution, their residence, or any approved location. Institutions should maintain a register with contact details of staff, of managers of secondary institutions and of students' responsible parties. The contact details would be used for the purpose of distance education and online learning or for any other educational purpose.

10.1.2. Shift to online learning

Soon after the first lockdown announcement in March 2020, the Ministry of Education moved pre-primary, primary, secondary, and tertiary institutions to online teaching and learning. Staff were assisted to adopt the new mode of teaching, and the government approved a distribution of some 2572 tablets to children of poor households.

During the lockdowns, the country set up multiple strategies and online programmes to ensure the continuity of learning within a holistic environment. The Mauritius Broadcasting Corporation (MBC) catered for Grades 1 to 9, with different timings allocated to each grade for the daily broadcast of educational programmes. Grades 10-13 (Forms IV-VI) accessed online teaching on platforms such as Microsoft Teams with their educators. The Government designed a digital space for safe interaction and communication between parents and teachers. The space allowed parents and learners to raise difficulties they may have regarding the syllabus, and to find answers.

At tertiary education level, lecturers opted to use Google Classroom for their students as it is easily accessible through any device, has a simple structure suitable for new users and allows effective communication and sharing. Moodle Learning Management Systems (LMS) were also used. The University of Mauritius moved up to 50% of all modules to online learning for better accessibility. Universities also conducted their final year exams online.

Special Education Needs Resource and Development Centres for 'disabled' children conducted online learning for their students. One-to-one sessions were organised via platforms such as WhatsApp and Skype, and physiotherapist sessions for students with hearing and visual impairment were organised via Zoom.

10.1.3. Closures and responses

Schools were closed as from 19 March 2020 and reopened on 01 July 2020. Some school were closed temporarily as from 5 July 2021 because they were in Red Zones or had positive cases of COVID-19. These schools were closed temporarily for disinfection and cleaning prior reopening rapidly. In cases of temporary school closure, arrangements were made for educational programmes to be broadcast on TV for Grades 1 to 9 and for online teaching to be provided for Grades 10 to 13, so as not to interrupt the teaching and learning process. The 0.01% population that could not access the broadcast channels were households that did not have television and internet services. After the first lockdown, which was to end of May 2020, the government announced that all educational institutions would resume face-to-face learning on the 1st of August 2020. Other school closures took place as needed, including in November 2021.

Several end-of-year exams could not take place (grades 1-5, 7,8, 10 and 12), though the School Certificate (SC) and Higher School Certificate (HSC) examinations were held during the second wave of the pandemic (*Source*: Communiqué from the Ministry of Education). There was nonetheless a good learning rate of 99.9% for Grades 1 to 9, according to the Mauritius Examination Syndicate.

The Primary School Achievement Certificate (PSAC) examination had a marginally higher pass rate of 73.91% for the year 2020-2021, as compared to 2019-2020, which was 73.86% (*Source*: Mauritius Examination Syndicate): an indication that the transition to diverse modes of delivery including online learning was effective.

On the downside, while an academic year usually runs for ten months, the academic year 2020-2021 ran for 18 months and put considerable strain on the educators. Interactions were sometimes difficult through online spaces. Some learners had difficulty to adapt to the online environments. The situation however encouraged more parental involvement in their children's learning process. 50% of the population were involved in their children's activities and spent at least five hours weekly to support them. In conclusion while COVID-19 could have been a threat to the educational sector, 90% of the households were satisfied with the new mode of learning (*Source*: Statistics of Mauritius).

10.2. Access and inclusion

The Constitution of Mauritius (1968, and its amendment in 2016) contains a non–discrimination provision based on race, place of origin, political opinion, colour, creed, or sex (Section 3), without explicitly addressing the right to education. The Equal Opportunities Act (2008) guaranteed it in practice and states that no education institution can deny or limit access to education unless the person requires special services or facilities. The Government of Mauritius, which ratified the UN Convention on the Rights of Persons with Disabilities (CRPD) in 2010, states that all its citizens should have equal opportunities and that there should be no discrimination in society.

The Education and Human Resources Strategy Plan 2008–2020 reiterates the right of learners with disabilities to be included in regular school systems at all education levels of education. The government provides learning opportunities to persons with disabilities including access to modern ICT solutions, such as Braille displays for students with visual impairments. Private companies, as part of the legislation on corporate social responsibility, are required to contribute 2 per cent of their after–tax profit to support duly approved NGOs (Non-Governmental Organisations). Educational support and training are priority areas of intervention as per the 10th Schedule of the Income Tax Act

1995[14], and more could be done to provide access to education to learners with disabilities, especially to bridge the digital gap with Internet connectivity and assistive technology. it is also important to provide these learners with accessible ICT tools and inclusive devices, at no cost.

During the COVID–19 pandemic, the Special Education Needs (SEN) unit of the Ministry of Education, Tertiary Education, Science and Technology (MoETEST) provided guidelines to SEN institutions to progress towards attainment for inclusive, equitable, and effective education system. Recommendations related to capacity building and training sessions for teachers of SEN learners to deliver online teaching. A module on ICT was included, for example, in every SEN training programme run by the Mauritius Institute of Education (MIE) for SEN personnel. In addition, the Ministry worked with educators to develop study programmes which were broadcast by the Mauritius Broadcasting Corporation (MBC), the national channel. However, students with disabilities felt that the resources they received were not adapted to their needs, especially those that had sensory and autism impairments (UNESCO IITE, 2021, Impact Study).

During the 2021 lockdown, SEN learners took part in examinations supported by the Mauritius Examinations Syndicate which provided readers/writers and extra time (Source: Analytical report. COVID-19 and inclusive open and distance learning solutions, UNESCO IITE 2021).

Enhanced training in ICT and distance education technologies for teachers of students with disabilities is essential. In crises like COVID-19, learners with special needs are often left further behind, receive less assistance and non-specialised educators. Another constraint is that many teachers lack specialised ICT skills and knowledge to engaged with learners with diverse types of disabilities. If ICT-based learning programmes are not made accessible, or students do not have assistive devices to enable their adequate participation and accommodate their learning needs, they will be at considerable risk of exclusion from education.

11. FACTORS ENABLING AND CONSTRAINING ICT USE IN EDUCATION

11.1. The impact of COVID–19 on the education of persons with disabilities

The most relevant educational tools, as identified by respondents of a UNESCO Impact Study on emerging practices in inclusive digital learning for students with disabilities during COVID-19, were videos and e–books (UNESCO IITE, 2021, Impact Study). Broadcast programmes did not have much impact and did not equalise learning for all learners. The study showed that WhatsApp was found to be easy to use, accessible and popular among parents. The tool enabled a smooth transition from traditional face-to-face teaching to ODL during the lockdowns. ICT for distance learning was useful to share recorded lessons, audio and video files, multimedia presentations, electronic textbooks, and educational materials. Technology also allowed educators to conduct live classes and learners could carry out activities offered on the educational platforms.

More complex ODL solutions consisted in the use of special software for some persons with disabilities, and the use of Microsoft Teams and Zoom, which parents found inaccessible or difficult to use. A brief analysis showed a good level of motivation among students for the use of modern

[14] https://www.mra.mu/download/CSRGuide.pdf

technologies. Most students appreciated the utility of ICT in their learning process and felt it enabled them to reach their educational objectives rapidly. ICT also allowed more control of learning. It can also render learning easier as learners with disabilities like to use technology and are therefore motivated to achieve their educational goals (UNESCO IITE, 2021, Impact Study). Respondents to the UNESCO study agreed that learners with disabilities, once they acquire confidence in using adapted technological tools, will use them regularly (UNESCO IITE, Analytical report. COVID-19 and inclusive open and distance learning solutions).

11.2. Facilitators and barriers to ODL during the COVID–19 pandemic

The main barriers to the effective use of ODL solutions for students, including those with disabilities (as identified by the UNESCO IITE Analytical report [2021]) are as follows:

- lack of knowledge about assistive devices and their effective use in ODL solutions,
- lack of internet connection and/or digital devices,
- lack of sufficient digital skills and ICT competence,
- lack of time for professional development,
- lack of knowledge about the capabilities and potential of mobile applications in teaching and learning, such as education technology innovations,
- lack of time to interact with colleagues,
- lack of support from the supervisor/management of the school/centre for the use of ODL solutions.

Respondents to the UNESCO study reported that there are strong links between support for the use of ODL and the speed of accomplishment of tasks by students with disabilities using ICT (lack of support reduces the speed of ICT–enabled tasks). There are negative links between lack of time to prepare for classes and students' control over their learning (lack of time to plan and prepare classes has had a negative impact on students' control over their education) (Source: Analytical report. COVID-19 and inclusive open and distance learning solutions).

While these barriers are relevant for learners with special needs, they can be extrapolated to all learners.

11.3. SWOC Analysis as determined by the Mauritius Digital Framework (2022)

The SWOC analysis based on desk review and various sources is shown in Figure 4.

Strengths	Weaknesses
• Government's support to boost Talent Management through compulsory education. • Government's support through the introduction of the Nine-Year Schooling. • The Human Resource Development Council to establish linkages between the	• Low ICT Enrolment at secondary and tertiary levels. • Skills Mismatch to be tackled. • Training in some niche areas. • Women Participation to be improved (Work from home policy).

education and training and the workplace to ensure alignment with academic Institutions (Universities/Polytechnics/Civil Service College/Training centres etc.) of good standard • Association of Professional bodies for engineers, accountants etc. • Setting up of incubators • Safe Cable/Broad Band Access telecommunication • Access to regional markets • Linkages with regional and international organizations/universities • High Literacy Rate • Multilingualism • Political stability • ICT/BPO sector with a workforce of 20,000 employees • Mauritius ranks 1st in Africa in ICT/BPO sector • The HSC Pro (a technical route to HSC in IT) to close the skills gap between the requirements of the labour market and the skills with which students who complete their HSC leave school	• Talent Management Policy non-existent. • Collaboration among research organizations needs to be strengthened. • Public-private partnerships to be enhanced. • Lack of library facilities with modern communication technologies. • Lack of Human Capital. • Continuous Learning Culture needs to be promoted. • Geographically remote. • Lack of incentives/rewards for quality work.
Opportunities	**Challenges**
• Reinforcement of talent management priorities on a national basis. • Providing opportunities for achieving excellence in talent management. • Promotion of talent management spirit. • Provision of incentives/rewards for quality work. • Creation of regional centres of excellence in specific fields. • Regional collaboration.	• Brain Drain. • Lack of expertise in specific/niche ICT areas (Robotics, Artificial Intelligence etc.). • Fast-paced technological progress in the world. • Growing demand of skilled workforce. • Labour shortages in the ICT sector that is expected to continue or worsen over the next five years, where capacity

• Public sector/private sector Linkages. • Possibility to be a talent management hub in the region. • Linkages with large/foreign enterprises • ICT to access market and technological information. • Career Development Stairway for the ICT sector. • National Skills Development Programme (NSDP) to train unemployed youth in high demand areas. • Graduate Training for Employment Scheme (GTES) to enhance the employability prospects of unemployed graduates. • Promotion of ICT literacy to the community at large and creates awareness on applications and uses of ICT to build up talent by the National Computer Board.	development is needed in both technical and soft skills (World Bank Group, 2017).

Figure 4: SWOC analysis based on desk review and various sources

12. ICT IN EDUCATION IN MAURITIUS: A WAY FORWARD

12.1. Current ICT Initiatives and education projects

ICT Initiatives are currently ongoing at national level in the areas of education (Universal ICT Education Programme, Education through ICT, Digital Youth Engagement Programme), Digital Divide (Community Empowerment Programme, Public Internet Access Points, Cyber Caravan Project, Community Web Portal), eGovernment (Government Online Services and eServices, Mauritius National Identity Card, Public Key Infrastructure, eJudiciary Programme, Crime Occurrence Tracking System, ePayment Project, eHealth, ePrison, National ICT Strategic Plan, eGoverment Strategy Report, Mauritius e-Registry Project), Cyber Security (National Computer Emergency Response Team, Critical Information Infrastructure Framework, National Cyber Security Strategy), Entrepreneurship (NCB Technopreneur Unit), Green IT (National Green IT Policy and Strategy, eWaste Policy and Strategy) and Open Source Policy and Strategy.

12.2. Overview of the ICT4E Partner Mapping and Intervention

Mauritius has strong linkages with **UNESCO Institute for Information Technologies in Education (UNESCO IITE)** and other international organisations/institutions. UNESCO IITE has two major focuses on Mauritius in its programme of activities for 2021-22. In 2021, UNESCO IITE reported to its

Governing Board (GB) that the COVID-19 pandemic presents a unique opportunity to strengthen collaboration with multisectoral partners globally. In 2020, IITE practically focussed most of its programmatic activities on responses to the COVID-19 impact. Since the 19th Session of GB in November 2020, IITE brought some changes to its programme to focus more on reopening of schools and universities after lockdowns through projects, especially extrabudgetary projects developed during the pandemic. The UNESCO Institute supports two key projects in Mauritius: the Chengdu project, Integrating Artificial Intelligence and Digital Innovations to Strengthen Inclusion and Equity of Education in Africa. The project benefits from support by the Chinese National Commission for UNESCO and the Chengdu Culture and Tourism Development Group. The other project is the Weidong project for TVET Schools: Building Competence and Innovative Pedagogy for Future Schools with ICT supported by Weidong Education Cloud. The UNESCO IITE also regularly conducts capacity development training sessions within an OpenEMIS framework for Ministry staff and educators, to strengthen the national education management information system (EMIS) and institutional capacities for monitoring progress in Education 2030 agenda. The technical assistance included integrating EMIS training in the Mauritius Institute of Education (MIE) and IT infrastructure development in all education institutions. In 2019, IITE conducted an EMIS needs assessment and designed a school integrated management information system (SIMIS). Findings and recommendations included the incorporation of individual student progress tracking system, including classroom assessment. Follow up support included online courses and webinars for EMIS IT administrators: between July and September 2022, eight sessions on managing educational data at the national, zonal and schools levels, using OpenEMIS Cloud edition, were held.

The Chengdu Project on *Integrating Artificial Intelligence (AI) and Digital Innovations to Strengthen Inclusion and Equity of Education in Africa* has conducted comprehensive needs assessments among major stakeholders in Mauritius. It sought to identify the challenges and opportunities that individual learners and educational institutions faced through the pandemic. The project contributes to strengthening the national EMIS for decision-making and IT technical capacity building. Through the project, UNESCO IITE finalised the evaluation of the present technical and academic readiness of national education systems to enable ICT-based learning for the most vulnerable students, particularly for people with disabilities.

The project will include teacher training programmes: ‘Introduction to inclusive education with ICT’ and ‘Open and Distance learning solutions for students with disabilities, upon approval of projected course materials by UNESCO IITE. It is expected that each course will comprise two online webinars: one introductory session with a presentation of course materials and another focused meeting dedicated to course-related Q&A, analysis of independent work performed by trainees between the two webinars. The course assignments are intended to be practice-oriented and performance-driven. The Chengdu Project is implemented through the Chengdu Culture and Tourism Development Group LLC (China).

The Sankore Project is one of several schemes of the Government over the years using ICT and digitisation to transform education. The digital concept was introduced in April 2011 under a partnership of the French and British governments across selected countries in Africa. It consisted in digitisation of classrooms in schools and private educational institutions. The institutions were equipped with low-cost technological equipment such as interactive projectors and laptops. The MIE was responsible for its implementation and started off the project through its Centre for Open and Distance Learning (CODL). "The CODL is responsible for the deployment of all e-learning projects of the MIE." (“Sustaining Technology in classrooms under the Sankoré ... - ResearchGate”) The Sankore

aims to bring qualitative change and classrooms are provided with interactive projectors, laptops, infrared pens. Institutions also have access to a platform for sharing digital educational resources. Teachers are trained in using interactive projector and the Sankoré software suite. As part of the project, a *Learning Factory–Mauritius* based at the MIE, produces learning resources. The Learning Factory is operated by graduates in Education Technologies who were previously practicing primary school teachers. The Centre for Open and Distance Learning (CODL) therefore designs and deploys educational resources as well as educates in the use of digital classroom equipment.

The Governments of France and the United Kingdom have active cooperation agreements with Mauritius. General budget support for the economic reform of the Government of Mauritius is provided by the **World Bank, the Agence Française de Développement (AFD), African Development Bank and the European Commission (EC).** The World Bank 2021 report recommends that Mauritius: "Introduce[s] digital skills training across the board", with focus on the development of digital skills, from basic to tertiary education. ICT should be taught as a cross-curricular discipline and not as a standalone subject. The World Bank recommends a project-based approach. Teachers should receive training in digital pedagogical practices and integration of ICT in lessons plans. At TVET and higher education levels, teacher training programmes should be designed to address industrial needs and development. "Assessments of digital skills for the labour market, and of digital literacy, will be critical to make necessary curricular changes, ensure minimum proficiency levels of digital skills, and better balance private sector needs", with the World Bank able to provide support in conducting digital skills assessments as well as to develop digital skills through private providers (e.g., Andela, Moringa, Le Wagon, etc). During 2014 – 2015 the **World Bank** funded an Open Data Readiness Assessment (ODRA) for Mauritius.

The Cyber Resilience for Development (Cyber4Dev) aims to strengthen cybersecurity policy, increase cybersecurity incident response capabilities and foster networks of cyber expertise and cooperation. Cyber Resilience for Development (Cyber4Dev) is an European Union (EU) funded project of a duration of 42 months in several countries in Asia and Africa. The project is delivered by NI-CO (Northern Ireland Cooperation Overseas) in partnership with government agencies from Estonia, the United Kingdom and the Netherlands. Cyber4Dev will increase the cyber resilience of partner countries while promoting an inclusive multi-stakeholder and rights-based approach and ensuring compliance with the rule of law and good governance principles for citizens to benefit from an open, free, secure and resilient cyberspace. The EU previously allocated €63.4 million for ICT-related projects including a National Open-Source Policy, Strategy and Action Plan to develop strategies and plans for reinforcing the use of Open-Source Software (OSS). The technical support came under the EDF10 (2008 – 2013). The objective was to improve efficiency within the Mauritian public sector and, indirectly, the private ICT sector, Small and Medium Enterprises (SMEs), and boosts local capacity and local knowledge communities[15].

The Digital for Development (D4D) Hub is another form of global digital cooperation the European Union (EU) that Mauritius could take advantage from. The initiative aligns digital initiatives for increased impact and adopts a multi-stakeholder platform to promote international partnerships on digital transformation between the EU and partner countries in different regions including in Africa. It adopts a human-centric approach to digital transformation, facilitating dialogues and sharing of expertise.

[15] 2010 - 2018 IST-Africa Consortium Page 106 of 195.

The ACP Science and Technology Programme, an EU programme for cooperation between the European Union and the ACP region (Africa, Caribbean, Pacific) supports Small Island Developing States (SIDS) through transfer of technology, information exchange and networking.

France Telecom (Orange Labs) funded a project to provide a tool that supports Machine to Machine interaction for pervasive computing. The ubiquitous computing application includes exploration of a tool for real time web-based interaction with physical sensors. Such tool will help programmers and engineers with basic or no knowledge of electronics or cross-platform language C++ to remotely access sensors on programmable boards by means of a secure web API.

The African Development Bank Group under the Middle-Income (MIC) Grant funded the review of the National ICT Strategic Plan (NICTSP) 2007–2011. It was one of three activities carried out under the Competitiveness and Public Sector Efficiency (CPSE) programme (2009-2014). The CPSE aimed to sustain growth and employment and aligned with the country's long-term development objectives of economic development.

The UN Environment Programme (UNEP) supported a sustainable public procurement policy. The Sustainable Public Procurement (SPP) is a tool that allows governments to leverage public spending to promote social, environmental, and economic policies. The Government of Mauritius recognises that procurement decisions by public bodies have inherent actual and future social, public, health, environmental and economic impacts both locally and globally.

The Agence Française de Développement (AFD) provides technical and financial assistance to the Human Resource Development Council (HRDC) to develop and implement the National Skills Development Strategy (NSDS) 2020-2024. The main aim of the NSDS is to strengthen the effectiveness and efficiency of the skills development system to make it more responsive to the evolving skills needs and challenges.

The **Agence Universitaire de la Francophonie (AUF)** plans to open an integrated space of AUF services in the fields of digital technology, employability and entrepreneurship.

As we can see from the above, support for ICT and innovative technological activities has primarily been from the European Commission (FP7, EDF10, EDF11 ACP), India (Cyber City and IT Education projects), African Development Bank, World Bank, Canada, and France, as well as from UN agencies.

12.3. Moving Forward on Implementation of ICT in Education

More work needs to be done to address the digital divide and changing world of work to provide equitable opportunities for lifelong learning and skills development. Taking advantage of the existing strengths of the national educational policy, Mauritius can establish a new basis through ODL solutions to expand the accessibility and quality of their educational systems to various vulnerable groups of learners, including people with disabilities, children and youth that drop out of school.

For effective use of digital devices, tools and resources, it is necessary to sustain continuous development and upskilling of teachers in digital skills. The ability of teachers to identify the appropriate tools and resources to improve learning outcomes should be developed. Parents should receive guidance on the use of technology to support their children's learning. It should however be

clear that digital technology does not replace traditional face to face learning but is a supplement to it.

Some challenges remain, especially regarding education for persons with disabilities who require specific assistive technologies. Training opportunities should be provided to SEN teachers, especially in terms of ICT competencies and high–tech assistive solutions.

As noted in the MoETEST report for 2020-21, major challenges and way forward for the education sector include building resilience and ensuring continuity in education by engaging educators to conduct online teaching. Students should therefore have necessary tools to follow online classes. It also entails intensifying online teaching and learning through collaborative platforms and improving the Online Learning Management System of the Higher Education Institutions, as a preparedness measure in case of future school closures.

The consolidation of education, technology and TVET is an important step forward. The use of Information Communication Technologies (ICTs) for the management and delivery of TVET will enable a responsive, demand driven TVET system.

The country benefits from high-speed internet connection which enables learners to engage in digital learning at home as well as in educational institutions, through formal, informal, and non-formal learning. Voluntary use of internet and digital learning increases the learning time and positively impacts on learning attainment. The benefits therefore include short term outcomes include greater control on the learning process and faster acquisition of knowledge.

Given that Mauritius has several development partners and international partners keen to support its economic development, including its efforts to establish itself as a regional ICT and cyber hub, it should harmonise and align its diverse digital initiatives for accelerated impact.

The digital sector not only provides a pool of jobs for skilled young people, but its positive externalities also influence many other sectors where they improve productivity, contributing indirectly to job creation.

13. PRIMARY RESEARCH: FINDINGS AND RECOMMENDATIONS

13.1. Introduction

This second part of the report, as a sequel to the literature review presented in Part 1, presents the findings and interpretations deduced from the primary research conducted as a component of the investigation into the integration of ICT in education. As mentioned in Part 1 this ADEA study is conducted as part of the larger study of 30 African countries (all of which are members of the Islamic Development Bank and the African Development Bank). This large-scale country study seeks to explore the use of ICT in education during a crisis with a view to providing actionable recommendations for the needed investment in digital infrastructure and curriculum development.

The specific objectives of the large-scale African study are to:

1. Gather information that will support the design of ICT-oriented education policies and strategies in the member countries.
2. Identify opportunities and challenges in the target country and its ability to harness and support the use of ICT across basic education (from pre-school to secondary school), and in the post-school sector including TVET and higher education.
3. Identify the curricula changes required for the adoption of ICT in the education levels mentioned above.
4. Enhance regional cooperation in digital education to improve economic competitiveness of Africa.

The Secondary and Primary data collection focused on the following aspects for all the education levels (basic education, TVET and higher education) in all the countries studied:

- Existence and level of ICT infrastructure.
- Existence and breadth of ICT policies and strategies.
- Level of digital competence of the workforce.
- Existence of cross-country e-education programs and challenges related to implementing e-education.
- The utilization level of ICT infrastructure in learning facilities.
- Challenges experienced in ICT implementation.
- Availability of ICT for learning.
- The ICT abilities and training needs of the workforce and the students.
- Partners currently engaged in supporting the use of digital technology in education and the areas of support in which they are engaged.
- SWOT analysis of the use of ICT in education.
- To gather experiences of good and challenging practices in the use of ICT in education.
- To identify critical needs and gaps in using digital technologies in terms of ICT and other infrastructure and pedagogic requirements.
- Prioritising needs for improving ICT in education.

13.2. Methodological Approach

This primary research component followed a mixed-methods research approach, which is often considered to be a “value-add approach” since it relies on the “mixing” of both quantitative and qualitative methods, as well as secondary and primary data with the merged sources of data better able to respond to the research questions of a study.

The study utilised a mixed-methods approach conducted in two phases:

- The first phase undertook a desk review and analysis of the relevant literature from government and institutional websites. The desk study also considered national and international studies that reviewed changes in the post-schooling sector after the onset of the pandemic.
- The second phase entailed a questionnaire administered to a predefined sample. The investigation followed a “concurrent mixed” or “multi-methodological” approach, gathering and mixing qualitative and quantitative data and integrating these to offer a more nuanced understanding of the integration of ICT into the education sector in the target country, and to better understand the impact of the pandemic.

Mixed-methods research entails the gathering and merging of data from various sources and draws on the complementary strengths of the data sources to gain an enriched understanding. The approach used here relies on collecting both quantitative and qualitative data and mixing these against the backdrop of the broad literature review conducted for Part 1 of this study.

The approach takes advantage of "mixed-methods contingency theory", which allows for the coexistence of quantitative and qualitative research approaches, enabling the researcher to answer questions from a number of vantage points and to fill in the gaps that emerge when one methodology does not provide all the information required. It is argued that the mixing of methods in one study can explore the research objectives and answer research questions from various perspectives.

This methodological choice is especially relevant to understanding and identifying both weaknesses (needs) and best practices, describing and explaining the interaction between contextual conditions, actions and education policy in order to understand the use of ICT in education before, during, and after the COVID-19 pandemic period, and to provide recommendations for the proposed investment in digital infrastructure, policy change and curriculum development.

13.2.1. Research design for primary data gathering

The previous section of this report entailed the collection of secondary data drawn from relevant literary sources. This review was conducted with the intention of providing a frame of reference for understanding the key issues, the countries' priorities, challenges and experiences regarding ICT and remote learning based on the COVID-19 experience. The literature review also assisted in identifying research questions and informed the design of the primary data collection tools whilst providing a backdrop for the interpretation of these findings.

This latter section refers to the gathering of primary data sources to ensure a collection of comprehensive country-level data on the status, needs and gaps in the use of ICT in education and remote learning in the countries under investigation, in pursuit of understanding their use of ICT across the education subsectors before, during, and after the COVID-19 pandemic.

13.2.2. Country focal points

ADEAs appointment of country focal points in each of the countries played a critical role in enabling access to the Ministries and to the various subsectors, to source relevant literature and administer the surveys and interviews in line with the three instruments developed for this study.

Following a start-up team meeting the country focal person located in Mauritius was responsible for identifying the sample and then sending the Google link to the questionnaire and the KII form to the identified sample in terms of the sampling stratification protocol. The focal person was also responsible for facilitating the focus group discussions.

Primary data collection was conducted as follows, with the adoption of semi-structured questionnaires (written or oral) through individual Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs):

- Key Informant Interviews were used to obtain in-depth oral or written information from key individual respondents. Due to restrictions as a result of the COVID-19 pandemic and the large number of target countries, three scenarios to conduct semi-structured interviews were possible: i) Face-to-face; ii) Online, one-on-one interviews (e.g., Zoom, Teams, Skype, Google Meet); or iii) Written questionnaires (emailed or paper-based). In the case of written responses, when required – these were captured on the relevant Google Form for ease of analysis.
- Focus Group Discussions typically brought together a group of up to 12 targeted participants. The process in this case comprised semi-structured questions developed for the respondent group and presented and captured on the FGD Google form. FGDs are used to understand multiple viewpoints and different perceptions and perspectives on the topic, as understood through the group's collective voice. The country focal persons facilitated the group discussions, ensuring that all participants had an opportunity to engage, and steered the discussion in the direction required to ensure the questions were answered. Thereafter the focal person was required to compile the FGDs responses onto the Google form for ease of administering and analysing.
- A Google form questionnaire was administered to the identified sample. The survey comprised 60 questions which were a mix between quantitative short answer responses (using Likert-scale type questions, multiple choice or fixed answer responses.) Each of the sections concluded with open-ended questions with the survey including 12 long-answer responses which were usually explanations for the section of questions. The open-ended questions allowed the respondents latitude to reflect on the topics being explored and were useful in interpreting the quantitative findings.

13.2.3. The use of web-based platforms

Due to time constraints and the current COVID-19 environment, virtual engagements played a significant role in the process, with the web-based Google form used for the questionnaire and Teams and Zoom platforms for KIIs and FGDs.

Online or web-based survey tools have become common data gathering instruments especially since the onset of COVID-19. Web-based technology offers advantages for designing surveys and obtaining respondent feedback. The origin of web-based surveys can be traced back to the methodology used for postal surveys, with online research tools successfully and efficiently transcending their predecessor as a tool of choice for a vast range fields of study particularly since the onset of the pandemic.

With the exponential growth in mobile technology the web-user population has increased resulting in web-based survey tools becoming one of the most widely used data gathering methods. Google forms offer ease of design allowing respondents to "click" their responses to multiple-choice or Likert scale questions and to type in notes where open-ended responses were required. The design tool allowed questions to be streamed for various respondent types – allowing for some common questions and some specific questions that are streamed to different respondents making a distinction, for example, between government officials, students, and parents.

Similarly, the KII and FGD allowed for modification of appropriate questions for the different targeted sample groups in order to encourage participants to express their thoughts and provide detailed descriptions of their perceptions in response to the various questions posed.

13.2.4. Sampling for the KIIs and FDGs

Multistage sampling was applied, and for the participants of KIIs and FDGs and a snowball approach and purposive sampling was conducted with a view to ensure a practical level of coverage in order to capture the needs and aspirations of the various levels. Moreover, ADEA utilised its existing networks with the country focal points facilitating access to relevant government institutions.

The following respondent nomenclature was defined to ensure sufficiency of the sample:

- International and regional development partners.
- Relevant Government line ministries and heads of institutions and training facilities.
- Policymakers, Technical leads and Implementers, faculty, chairpersons (curriculum developers, statistics, planning, financing, ICT).
- Decentralized education authorities (officials).
- Heads or designated officials of teacher unions, teacher associations, and parent teacher associations.
- Head teachers and teachers/trainers from primary and secondary public and private schools, TVET and higher education institutions.
- Learners from the above identified schools/institutions and their parents.
- ICT development partners, private sector, telecoms, and civil society organizations who have an interest in ICT in education.

The focus groups aimed to explore both the existing and aspirational infrastructure, and the following possible advocacy for various stages of readiness:

- Pre-integration and baseline contexts and advocacy needed
- Transitional arrangements and related advocacy
- Development of implementation, skills and abilities
- Expansion of usage
- Scaling up for system-wide integration.

Note on the sample: This study does not claim that the findings are representative of, or generalisable to, the general population, however, the qualitative responses elicit many insights and experience trends that can enrich considerations for implementation. The findings represent “voices” of the various subsectors in education, from government officials, educators and learners, and are used interpretively against the backdrop of the previous literature review. The following subsections refer to the findings from both the questionnaire and the interviews. The literature review and the various modes of interviews explored the ICT ecosystems as is discussed below.

13.2.5. Field testing

Following the internal review and approval between ADEA, IsDB and AfDB, the survey instruments and interview guides were field-tested by focal point persons who were broadly engaged in this research (across 30 countries) in order to:

- Explore the adequacy of the questions as they relate to the research topic;
- Ensure that the content of the interview is appropriate for the target population;
- Identify if there are confusing and misunderstood items, or items which should be included;

- Enable adaptations and enhancements of the tools as needed;
- Suggest considerations – not initially planned;
- Test the duration of the KIIs/FGDs;
- Allow researchers to practice under real conditions; and
- Confirm the readiness of the tool.

13.2.6. Primary qualitative data analysis strategy

The data analysis aimed to draw lessons, challenges, recommendations, and prioritised areas for IsDB and AfDB investment and related cost estimations. The analysis of the impact and gaps of gender and inclusiveness in ICT in education is also key in informing targeted investment opportunities towards access and quality learning and skills for all groups, with a focus on basic education, TVET and higher education levels.

The analysis identified the common strengths, weaknesses, opportunities, and threats pertaining to the use of ICT in education and remote learning, and highlighted the enabling factors required to support national digital learning initiatives and aimed to identify the potential capacities within the workforce to streamline training interventions.

13.2.7. Raw data management (data cleaning)

One of the advantages of web-based surveys lies in the ability to collect data. However, like all captured data the process needed to undergo cleaning-up and organising into meaningful units of analysis. This entails:

- Transcription of KIIs and FGDs with the responses being input into the Google form format by the respondent, in the case of KIIs, and by the fieldworker/note taker in the case of FGDs.
- Detecting missing data, anomalies, unusable or irrelevant information.
- Excluding duplicate, incomplete and ambiguous content.
- Organising data according to relevant categories. Data analysis design.

The raw data obtained from KIIs and FDGs (semi-structured questionnaire) were collected and processed by coding, analysis and interpretation of results. It is important to note that these operations are complementary and do not follow a linear path but take a progressive, iterative and recursive form, as the different countries may have followed differing forms of sequencing as a result of the iterative process.

A descriptive and interpretive approach through the manual analysis of qualitative data was conducted. It is in fact a content analysis which involved reading each of the responses independently, coding them by topic and collecting key statements for purposes of quotation. The data were organised on a spreadsheet according to the theme. While the researcher had preconceived ideas of the themes the application of a search process for key concepts and themes the study also allowed the themes to emerge through the engagement with the text. The categories were examined to identify themes and subthemes.

In this study, the researcher followed an innovative abductive approach, listening to the intermingled voices (of learners, parents or teachers), and listening to what the respondents were expressing (whilst listening to the researcher's own voice against the backdrop of understanding the context

(McKay 2021: Mabunda & McKay 2021)). This guided the interpretation of text and the determination of themes.

13.2.8. Limitations of the study

Since the survey and many of the interviews were conducted either on a web platform or as a web-based questionnaire, there was an inherent bias in the selection of the sample which was limited to "users" who in themselves constituted a particular stratification. To avert this, the fieldworker was requested to invite "non-users" for physical meetings and to conduct interviews telephonically so that answers could be gathered and keyed in by the fieldworker.

With the time and resource constraints of any research study, the sample for this study was not sufficiently large enough for the findings to be generalisable. Moreover the predominance of university students in the sample is acknowledged as a bias. However, from the findings obtained it may be claimed that the study met the criteria for adequacy of information, despite the bias, as it was sufficient for saturation to be reached across the various stratifications of the sample.

As with all studies, the limitations need to be articulated. They pertain to

- Country contextual incidences such as strikes, holidays and also survey fatigue amongst officials.
- Cost estimation of digital learning systems in an African context.
- COVID-19 protocol causing limited travel and physical interactions.
- The lack of accurate and updated data.
- Government bureaucracies in terms of tedious procedures to conduct interviews or receive official documents for review.
- The limited size of the sample.
- The student bias in this sample.
- The inherent bias of a study using web-based interviews or surveys.

13.2.9. Ethical considerations

At the start of each KII or FGD, an oral or written explanation was communicated to the participants to explain the research, assure the participants of confidentiality, and seek informed consent. Participants were aware that of the voluntary nature of the study and that they could withdraw or withhold a response if they so wished. Similarly the questionnaire allowed the respondents the possibility of not responding to some or all questions should they so choose. Lastly, respondents were assured of the security of data collected and data protection.

13.3. The Sample

This section considers the responses to the questionnaire and to the focus groups (FG) and key informant interviews (KII) which were both captured on the respective KII or FG Google form. The following subsections refer to the findings from both the questionnaire and the interviews.

13.4. Respondents to the questionnaire: Sample

As shown below, a total of 92 respondents answered the questionnaire. The breakdown of these respondents is shown below with students/learners comprising 75%. The category of “other” (8%) reflected consultants working in the field of ICT. The remaining 17% government officials and educators from TVET, schooling, universities.

The sample reflects trends and may not be generalised, however, the qualitative responses elicit many insights and experiences trends that can guide implementation. The breakdown of the sample was as follows:

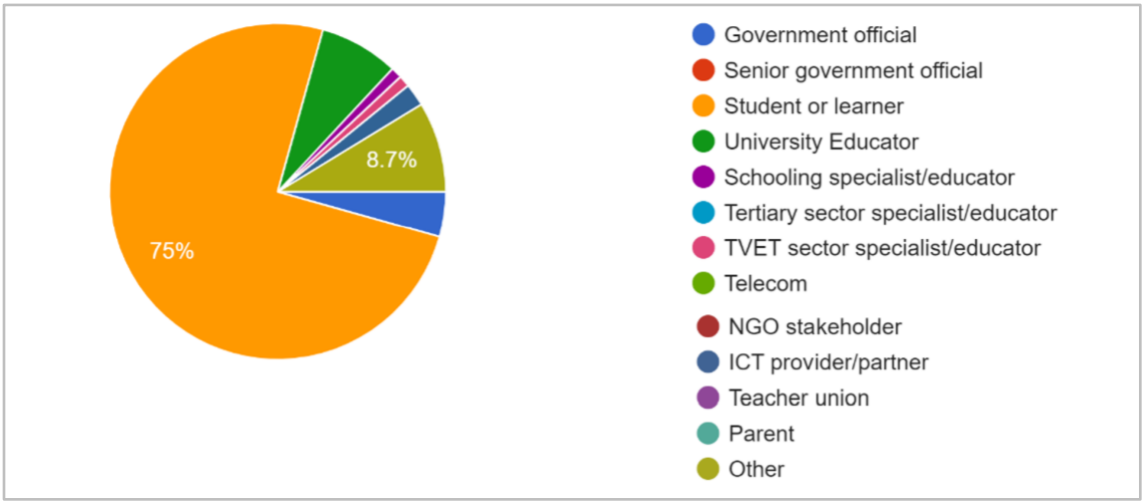


Figure 5: Breakdown of the respondents who completed the questionnaire

13.5. The KII/FG Sample

A total of 39 focus groups and Key Informant interviews were conducted. The following Figure shows the breakdown of respondents by education subsector:

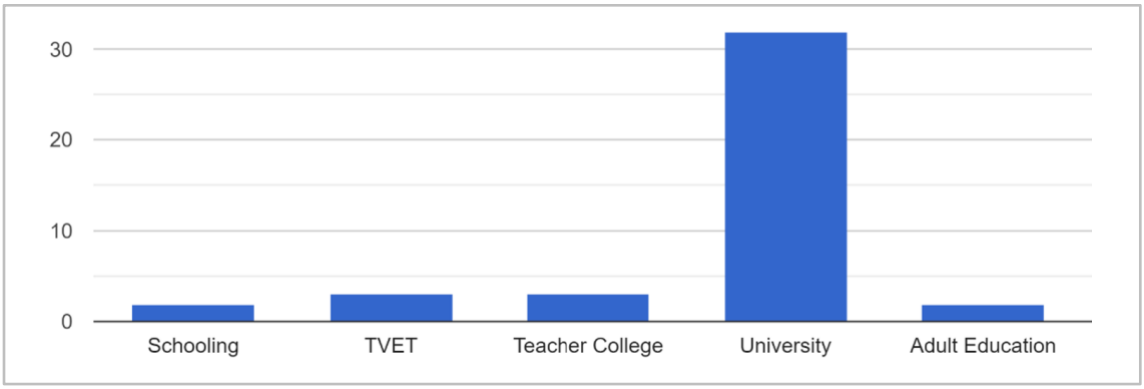


Figure 6: Breakdown of KII/FG participants by sector

It is recognised that the sample is biased towards university students however the feedback from those in the other subsectors is focused on to ensure that these voices are represented. As explained in the methodology above, the study does not claim to be generalisable rather it aims at providing trends that may have some utility for practice.

14. PRE-COVID-19 TEACHING MODALITIES

An analysis of the interview responses reflects limited use of ICT in education prior to the onset of the pandemic. The following trends by sector were found that the following modalities were used prior to COVID-19:

Schooling:

Within the schooling sector, the pre-COVID-19 situation comprised mainly of traditional contact classes although the schools had access to ICT. The following two responses reflect the situation in schooling.

- Prior to Covid-19 pandemic, the trend was mostly for face-to-face classes.
- ICT was beginning to grow in schools with the distribution of tablets and the usage of smart boards in schools.

Universities:

Generally, Universities had already made extensive use of ICT prior to the pandemic – some used ICT for teaching and some for extra-curricular activities. However, one respondent indicated “there was very low ICT usage and no E-learning”.

Some interviewees mentioned that ICT was used as a communication tool and that their institutions had Learning Management System and platforms such as Microsoft Teams were already used to a “small extent” prior to the pandemic. However, it was pointed out that “there were no online classes – Google classroom was used by lecturers to only to post lecture notes, and “usually, ICT was used for communication between university, teachers and students mainly to communicate students’ results, give feedback, and to announce events”.

The use conferencing platforms and learner management systems were not common; however, online sites were used for making available learning content and other related activities. The use of ICT for teaching and learning was mentioned by some interviewees as follows:

- Lectures were mostly face-to-face with some use of online platform and e-learning tools and classes were conducted by face-to-face mode only prior to Covid. However, our lecturers and students had used the Class 365 platform for learning purposes.
- ICT was mainly used for research and to consolidate knowledge shared in face-to-face classes
- ICT was used for disseminating documents.
- Sometimes we had online meetings.

TVET:

TVET officials referred to the importance of the TVET ICT cluster that was available for the sector but stressed the practical nature of TVET offerings:

- TVET by its nature is about hands-on training but TVET students are adept to using platforms.
- A good balance between online and face-to-face is mandatory

Distance Universities:

As expected, distance institutions made use of ICT as embedded in their strategies and respondents indicated that they had already been involved in using ICT for the delivery of courses.

- We used a Moodle LMS for learning materials and online assessments. All our learners are given a free tablet upon enrolment.
- There was extensive use of ICT to support distance learning.

Others referred to an eclectic situation stating that:

- There was no general trend as such – it depended on the context.
- There was a lot of self-learning via free websites, such as UTube.

One respondent pointed to the resistance to using ICT in his institution, indicating that while "ICT was picking-up, there was resistance to adopting online delivery of lectures from both staff and students" – this suggesting a need for more advocacy among both staff and students.

15. ENSURING THE CONTINUATION OF TEACHING AND LEARNING DURING THE PANDEMIC

The interview schedule required respondents to describe the strategy that was in place to ensure the continuation of teaching and learning during the Covid-pandemic. As is shown in this transcript, the transition in Mauritius was possible because of the prior policies and infrastructure already in place. This was explained by a ministry official as follows: "Most of the institutions shifted to online delivery mode during the pandemic. The robust infrastructure is a policy decision that helped the smooth transition from face to face to virtual mode".

Other Ministry of Education officials point out:

- The strategy was first to get first-hand information about educators and students. The purpose of gathering this data was to set up a communication platform where participants can connect and collaborate in real time.
- The preferred platform, decided by the Ministry of Education, Tertiary Education, Science and Technology (Mauritius), was [to use] MS Teams.
- For grades 1-9, educational programmes were broadcasted on the National TV channels.
- The Ministry of Education has resources on its website and the SSP provides a lot of useful resources for educators to use.

Further strategies were employed in schools:

- TV channels dedicated to classes for all subjects during some hours of the day for the primary school students and for higher education facilities, zoom or google meet classes and use of WhatsApp, emails or Google Classroom to facilitate the communication between students and teachers.
- Online classes via Zoom and videos from Mauritius College of the Air were presented on TV.
- During the pandemic, all educational institutions adapted quite rapidly by using online platforms such as Zoom and Google Meet to conduct online sessions.

16. ICT POLICY AND INFRASTRUCTURE

The extent of ICT implementation is influenced by the infrastructure in place. A cluster of questions in the questionnaire required officials to indicate the extent to which they considered the ICT in education policy to be implemented across the various subsectors.

16.1. ICT in schooling

The following figures reflect the views of government officials and practitioners on the extent of ICT access across the different education subsectors.

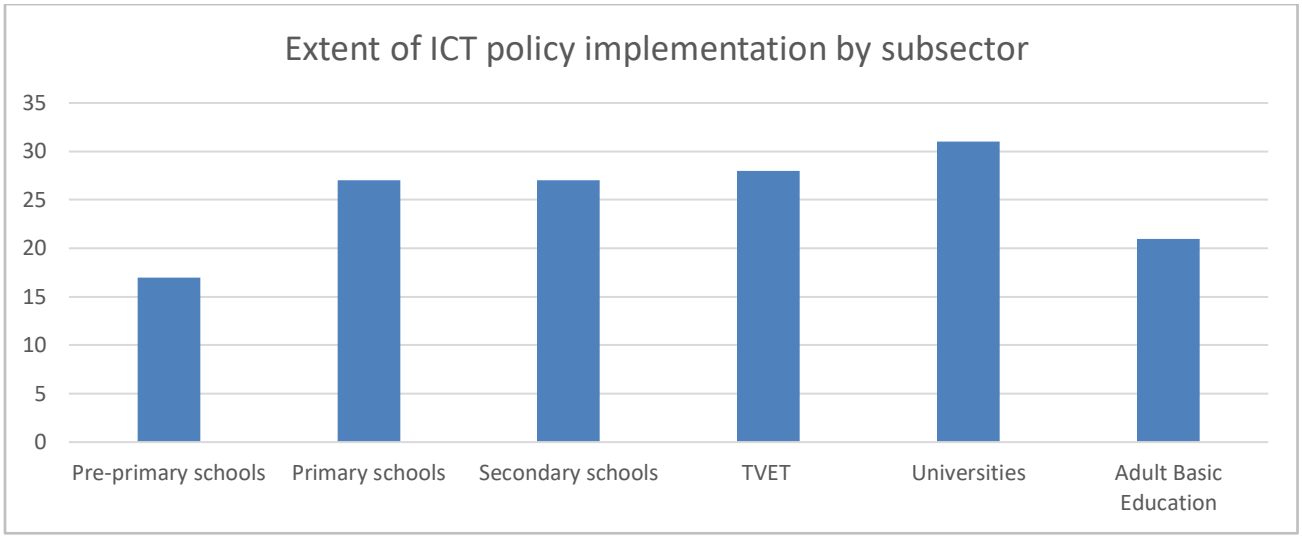


Figure 7: The extent to which ICT is implemented by education subsector

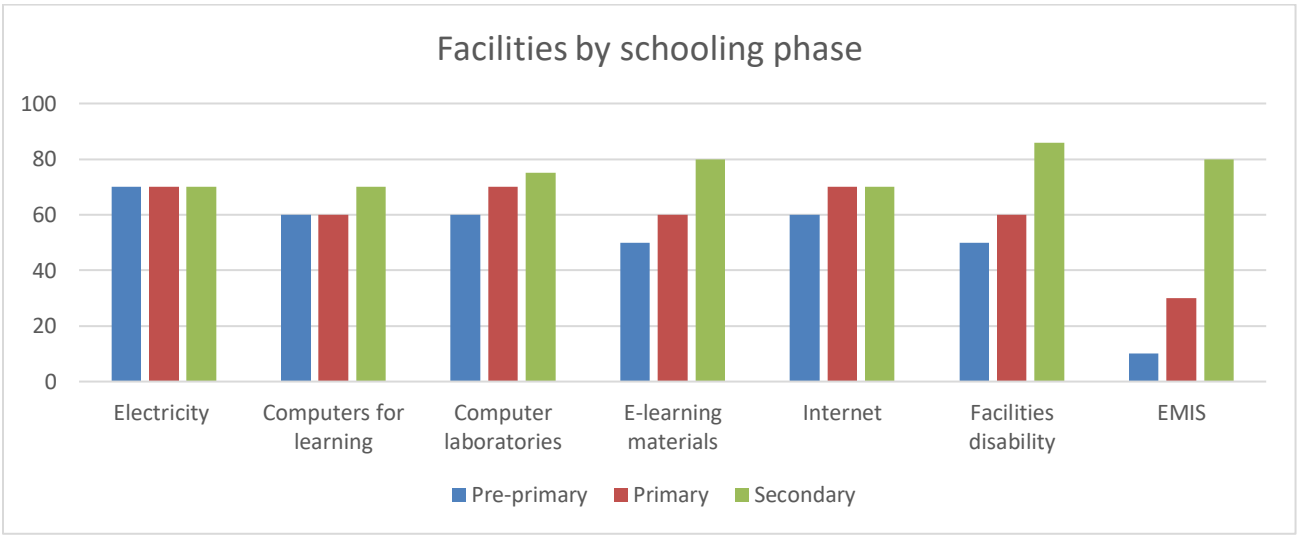


Figure 8: Availability of ICT facilities by schooling phase

16.2. ICT in TVET and Universities

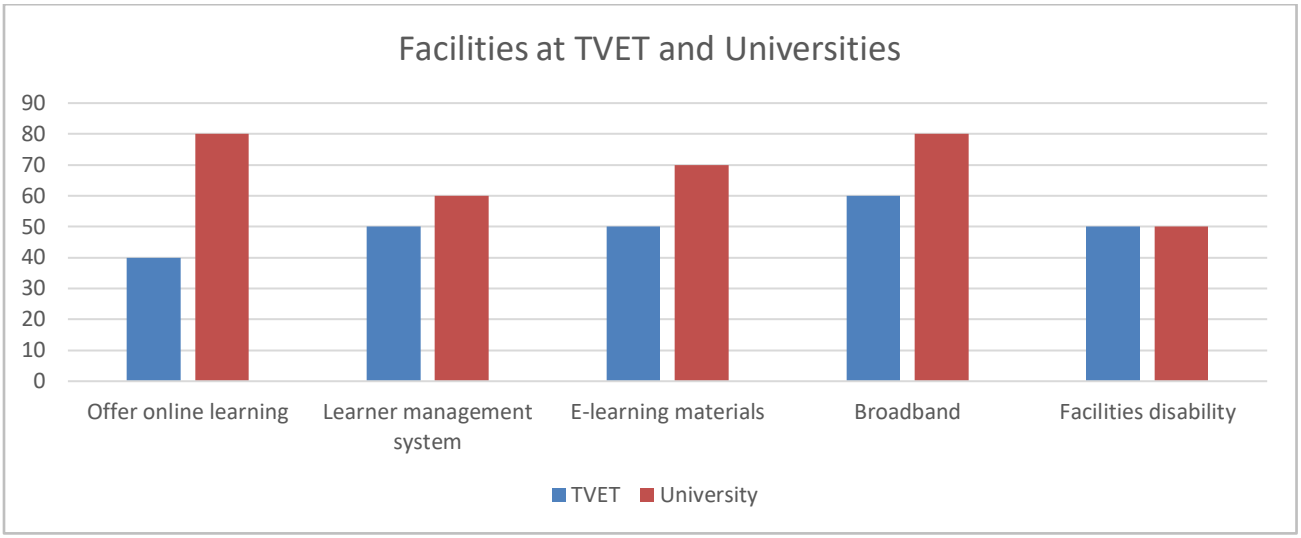


Figure 9: Availability of ICT facilities in TVET and universities

While the estimates show perceptions, rather than official statistics, it is clear that TVET institutions lag behind with regard to the use of ICT in education and that the implementation of policy reflects the availability of resources.

16.3. The use of ICT across the sector before and after COVID-19

The following charts reflect the perceptions of the use of ICT in education before and after the onset of the COVID-19 pandemic. It is clear (as indicated by the orange and green bars that subsequent to the pandemic the majority of schools had adopted the use of ICT, that learners and teachers had acquired ICT skills, and that TVETs and universities used ICT for teaching and learning. Changes were also made to the national curricula which prescribed ICT utilisation.

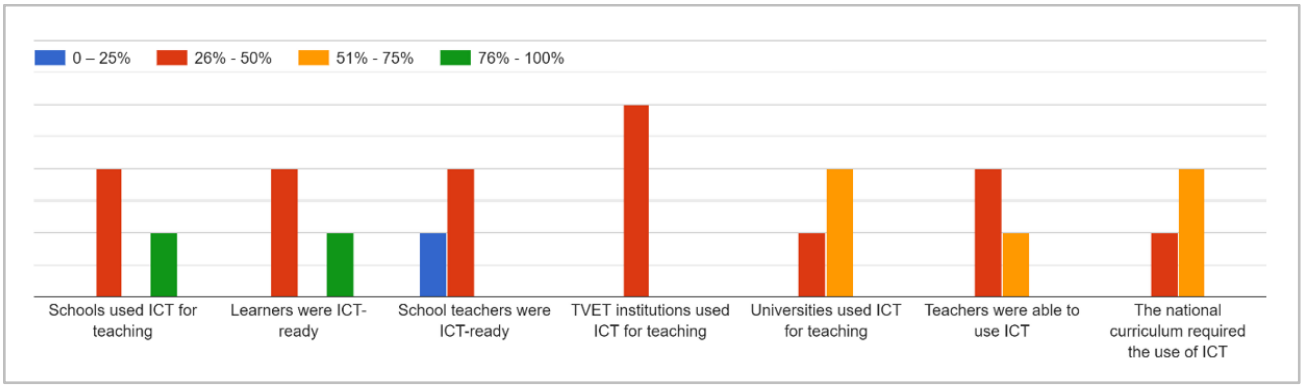


Figure 10: Use of ICT in education prior to Covid-19

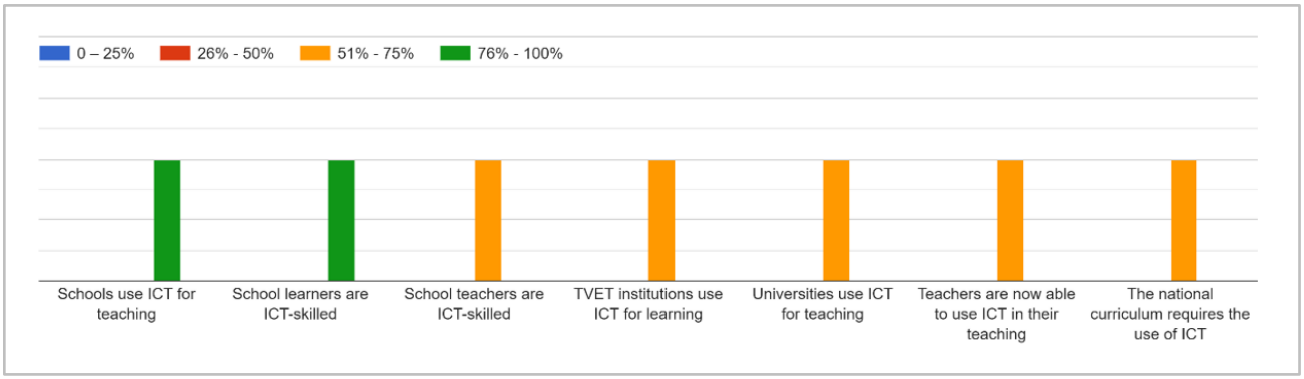


Figure 11: Use of ICT in education after the onset of Covid-19

17. THE TRANSITION TO ONLINE LEARNING SUBSEQUENT TO COVID-19

The interviews corroborated these views showing that after the onset of the use of ICT and the implementation of online learning was accelerated across the education sector. An analysis of the interviews gave rise to the following themes and subthemes:

Universities and the use of ICT after the onset of the pandemic:

- Online classes and Online assessments
- Posting of notes online (Google classroom)
- Google Meet and Zoom was being used to conduct lectures. Assignments were given to ensure that students understand the modules
- Online classes, Google Classroom, Google Meet, Zoom lectures (online courses), online presentations, interactive online classes
- MOOCs have been in use in my sector for long before COVID, so the transition was smooth
- Blended learning was used: Lectures were conducted online with learners at home. Tests and laboratories were held on campus.
- All classes, tutorials and lab sessions were done online using Zoom and Google Meet.
- Online lectures on Zoom/Google Meet. Online materials and discussions on Google Classroom.
- Use of online platforms like Google Classroom and Google Meet.

TVETs and the use of ICT:

The TVET respondents referred to their use of online learning both prior to and after the onset of the pandemic. “Given that we have a dedicated ICT cluster and well-established online platform we are able to continue providing same quality education through these platforms” … “We found that this was a good practice for TVET students as they are more adept to such systems”. However, as was commonly stated by respondents from the TVET sector “a TVET institution, hands-on training is crucial thus a good balance between online and face-to-face is mandatory>”.

Consideration for lower socio-economic students:

One of the themes that was prevalent in the responses from educators in the schooling system as that despite Mauritius’s well-resourced schooling sector, there were challenges pertaining to the socio-economic status (SES) of students. “We used Class 365 and Zoom for online classes. For those

students who did not have access to internet, free WiFi packages were provided to them". In addition, schooling relied on the use of WhatsApp and SMS for sharing of notes and information thus ensuring that lower SES students were not disadvantaged further.

Administrative uses:

One of the respondents referred to the shift to online portals for administrative purposes.

> Administrative portals were made available online so that lecturers could still upload marks and so on, from home.

The need to train the workforce and learners:

Some respondents explained that despite having the necessary infrastructure, training needed to be provided:

> We already had our online LMS to help us continuing our delivery. However, we had to use other software like Zoom, Google Meet or even Microsoft Teams to support further the online delivery. Recently we changed to Blackboard Ultra for a single platform for all our online delivery (or even offline) of our courses. We trained our academics and even students to use the online tools. Guidelines needed to be created for them.
>
> Learning Management System and communication tools such as Microsoft Teams were already implemented and used before COVID, however some students and tutors needed guidance. The tools were extensively used.

Synchronous and asynchronous teaching:

The reference to on- and off-line learning shows the use of both modes of teaching. This was well explained by the following quotation which shows how recordings were used for asynchronous teaching while breakout rooms were used for synchronous teaching. We shifted to full online teaching with recording, and we used of breakout rooms for group activities and discussions. Students could use the recording later or they could use the recording if they missed a class.

Assessments:

Many different tools and technologies were used for tests, assignments, for delivering lectures, for presentations. However, practicals needed to remain hand-on and students had to attend practical classes. They way that we assessed students needed to change. We had to use Blooms taxonomy and set high order questions that students could not just copy from a book or from someone else. There is still a need for more rigorous monitoring [proctoring] of students during assessments.

Resources:

Respondents referred to a range of online resources that were used for online learning. "We used online videos that explain concepts in simple terms and illustrations, online video tutorials to learn programming or implement new features, the use of e-learning platforms like Linked In Learning, Khan Academy also helped. There are many good videos on Utube that could be used. Use was made of OER and other online materials".

18. VIEWS ON THE TRANSITION TO ONLINE LEARNING

The questionnaire requested respondents (government officials, IT sector and subsectors of educators) to describe how they experienced the transition to online teaching and learning.

The following represent some of the explanations:

Government officials:

- In schooling, the strategy was first to get first-hand information about educators and students. The purpose of gathering this data was to setup a communication platform where participant can connect and collaborate in real time. The preferred platform, decided by the Ministry of Education, Tertiary Education, Science and Technology was MS Teams. For grades 1-9, educational programmes were broadcasted on the National TV channels. Also, the Ministry of Education has on its website, the SSP provides a lot of useful resources for educators to use.
- In the education sector, online learning became the new norm. From pre-primary to university institutions, all students had their classes online.
- Technology has been evolving at a very rapid pace and there are efficient communication tools available to communicate virtually.
- Teaching and learning were carried out solely online and recorded on a dedicated system.

IT Sector representative:

- ICT is the future prospect on the world itself.
- I'm involved in the ICT sector. Since face-to-face interaction was not possible during the pandemic , the courses were presented online.

Educators:

- As an educator and as a parent, I feel ICTs were effective as it enabled students to keep in touch and complete the necessary syllabus even though they were not able to be physically present in classes.
- Educational programmes were presented on TV.
- ICT can allow students to monitor and manage their own learning, think critically and creatively, solve simulated real-world problems, work collaboratively, engage in ethical decision-making, and adopt a global perspective towards issues and ideas.
- Children at a younger age can be taught about ICT and the usage of various technologies that could be helpful in their studies. This could increase their preference toward ICT more at the early stage of their education. ICT is a field where there is constant evolution each year, students from any educational level should be given access to necessary ICT equipment with the aim to enhance their academic performance.
- Proper syllabus planning is needed for all younger students. As a prior primary educator, I noticed the lack of information for teachers. Apart from providing textbooks only, a proper syllabus with precision about modules for teachers could help in advanced learning for young kids because as a fact, children nowadays learn very quickly. If they are to learn the same

thing thought the year and the next year too, they get bored and lose interest in the class. Also, the time (period) allotted for ICT class is very little. As children start to get more involved, the period is over.

TVET officials:

- The pandemic changed the educational ecosystem but we as a TVET institutions have been able to overcome the challenges by using online teaching and our LMS platform which has been very efficient. We also used a range of online communication tools.

University lecturers:

- VoIP applications though Teleconferencing and videoconferencing were used
- At the University, all lectures, tutorials and lab sessions were conducted online. We used Google Meet and Zoom for interacting live with students. The sessions were recorded and made available to students. Lectures notes were made available via Google Classroom.
- Classes were delivered online, and assessment were conducted online
- For higher education, during the COVID-19 pandemic, all classes were shifted to the online mode, delivered through Zoom sessions. Google Classrooms were created whereby students were required to log in. Lectures materials were posted on google classroom. Some lecturers used google meet to conduct the sessions, while others used zoom
- We needed to train and equip academics to deliver online , to use Zoom , Microsoft Teams , Google Classroom and WhatsApp

18.1. Officials' views on whether online learning was a success or not

The survey required stakeholders to express their "personal" views on whether online learning had been successful or not. As shown below, only one of the respondents indicated that it was "not successful". Others gave up to a 90% successful score or gave their viewpoints as follows:

- Not successful.
- On a scale of 1-10, I would say 7 because even though we can still learn through online meetings, face-to-face meetings will always be more appropriate in terms of exchange of opinions/ discussions.
- Very successful. The outcomes were successful. Learning and online classes were done.
- A must during the pandemic and the implementation was successful.
- In general, quite successful let's say 90%
- The extent of success for the implementation depends on the module taught, the lecturers' skills, knowledge and expertise, as well as the mindset and maturity of the students. Every cohort was different based on the synergy between the students and the lecturer. We could adopt the approach with different cohorts, and each of them would yield different results.
- On the positive side, the increased use of ICT has prompted more independent learning. There can be a greater transmission of the written or recorded materials.
- Since the lectures were held online, they could be recorded, and students could access them later, especially for revision purposes. ICT has been of immense help to help us in navigating through COVID-19. Despite the social distancing restrictions during the pandemic, ICT has made it possible to continue with the dissemination of knowledge and education.

- Since it is difficult to accurately assess the success of the implementation, as a completely subjective opinion, I would say it is slightly above average.
- Many tools were used: Ms Teams, G classroom, Moodle ... so very successful.
- The strategy adopted was well accepted
- The implementation was quite successful
- Mostly successful with the vast majority of student able to follow their classes.
- The implementation was very successful.
- The syllabus was fully covered.

The interviews gave further insights into how officials and educators perceived the transition:

- The transition proceeded quite well since, if laptops were available, switching to online learning using these devices not that difficult.
- It was indeed of great success of the use of Google Classroom, Google Meet and also Zoom was used to deliver learning materials. Initially it was challenging but with time the use of ICT was adopted by the educational sector.
- I would say we know the problems and are all working towards finding a solution. But the results will take a long time to be seen if a good and the most suitable solutions are not implemented correctly.
- We aimed to make Mauritius a cyber island by improving the use of ICT in education.
- While ICT Education must be applied, it must be only theoretically oriented. Education should help the learners to become better persons and contribute in one way and the other in the development of the country. [It should therefore include values and other developmental skills.]

Some of the respondents expressed the view that educators were being overworked and that there was a need for the sector to hire IT experts with needed skills to assist with online programmes, training and seminars. They could be used to provide ICT advocacy and to help to build sustainable ICT skills in institutions. This, it was indicated is not a task for teachers who do not have such high-level skills.

19. POLICY ANALYSES

19.1. Social justice agenda of policies

The questionnaire required respondents to rate the extent to which policies took account of the social justice agenda. A Likert scale was used for these questions. As shown in the figure below, participants regarded policies as taking mostly a moderate account of issues of equity while policies focused on gender and geographic challenges to a moderate-to-large extent. Their views clearly reflect that policies do not adequately focus on learners with special needs thus signalling an area for improvement. However, as shown in Part 1 of this report, attention was given to assisting learners and parents of learners with disabilities.

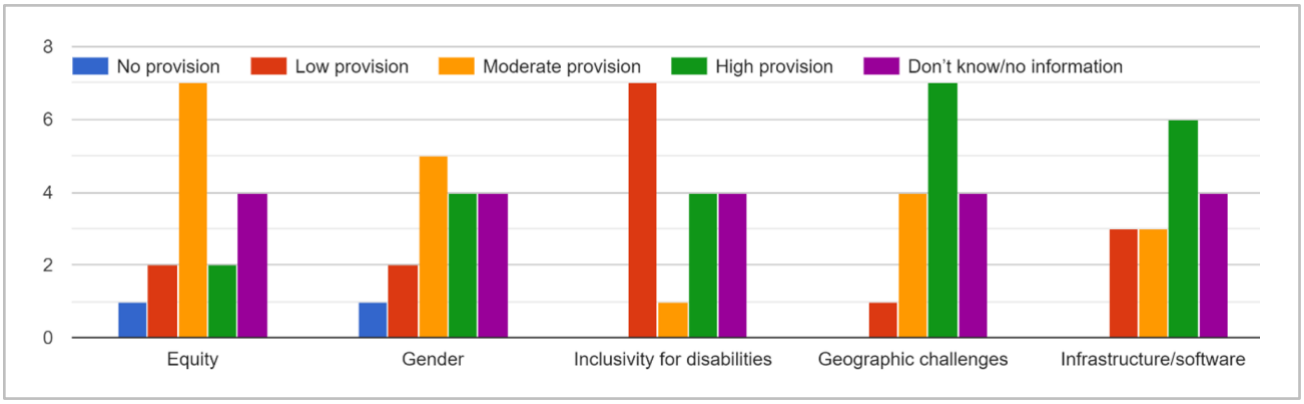


Figure 12: Policy and the social justice agenda

19.2. Workforce capacitation

Respondents were required to respond to the question of whether policies in place focused on building the capacity of different segments of the education sector. As shown below there was a high degree of concurrence that the policy required training for staff and students. However, as shown in the Figure 14, policy did not always translate to practice – suggesting lower levels of training for pre-service teachers as well as low levels of in-service training.

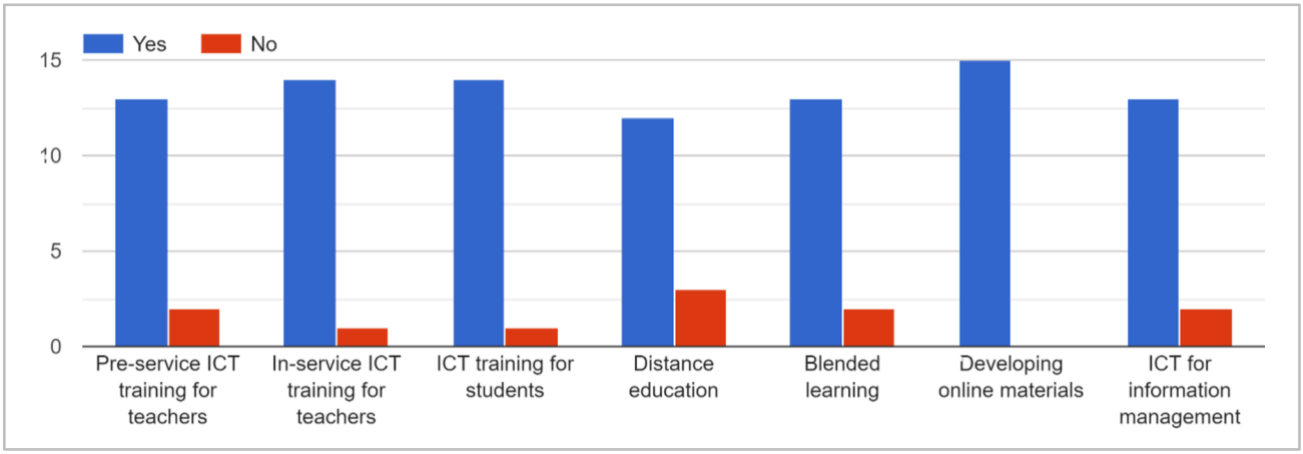


Figure 13: The extent to which policy makes provision for workforce capacity development

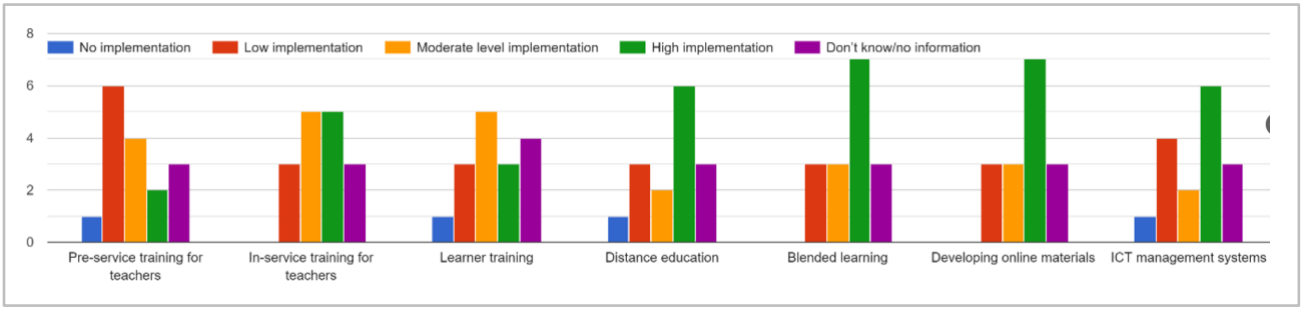


Figure 14: The extent to which training was being implmemented

Suggestions for improving implementation included more financial support for implementation. Moreover, the findings suggest the need to (re-)conduct a needs analysis to determine current training needs.

One respondent from the TVET sector pointed out that:

> There should be a separate policy for TVET as we focus more on practical components which offers enormous challenges to be conducted online.

Another, a government official, pointed out that:

> In line with the Government's vision to transform Mauritius into a Knowledge Hub, we aim at diversifying our programme towards distance learning and hybridization. More financial support for implementation

As one of the respondents indicated:

> Improvement can be achieved through training, awareness, education and developing the right mindset. The levels of implementation are low because of the lack of the above.

There was broad concurrence that ICT offered many affordances for learning. Some respondents pointed to the generation gap and the associated preferences, as well as the knowledge gap which exists indicating that "sometimes it is difficult to assess the preferences of the students accurately to shape the lecturing materials in a way which truly captures their attention and effectively transmits the knowledge that needs to be transmitted". With the high consumption of platforms such as TikTok or even YouTube, we see that people tend to have a decreasing attention span ... so, if the information can be interestingly transmitted in bite sizes, then yes, the use of ICT could definitely enhance learning. The key is for lecturers to be updated on the potential of ICT and how they can effectively apply that in the teaching process. Likewise, there is a need for the lecturers to have an understanding of students' preferences and expectations.

19.3. Policy provision for the use of ICT across the following sectors

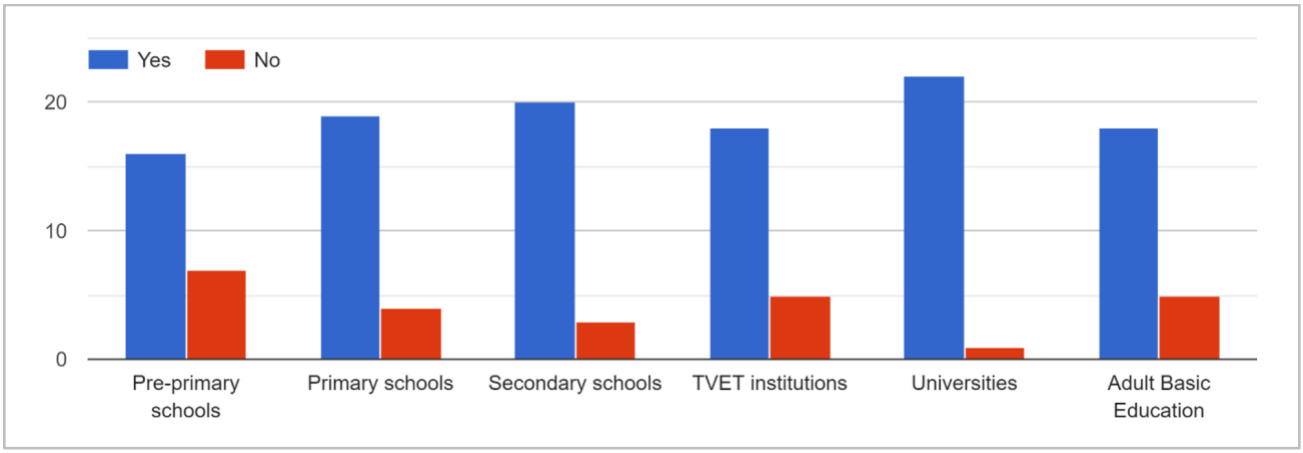


Figure 15: Policy provision for the use of ICT across the following sectors

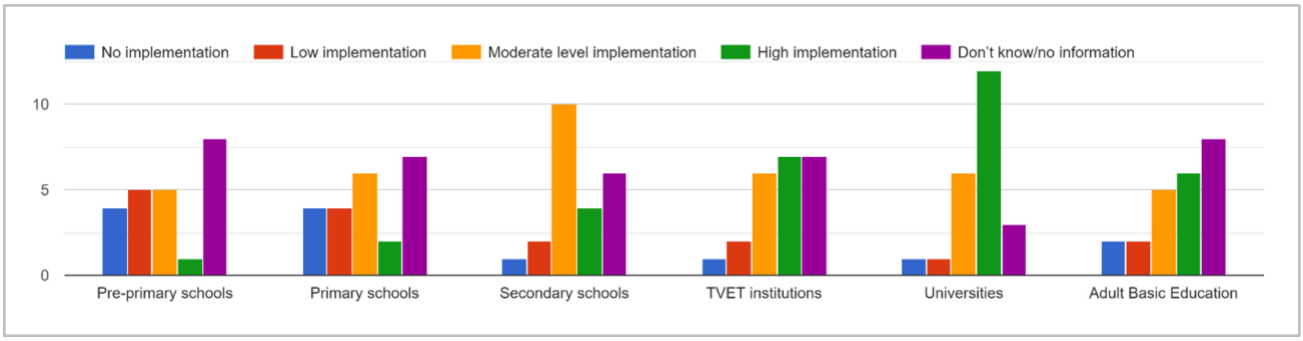


Figure 16: The extent to which ICT is being implemented across subsectors

It is clear from the charts that universities have extensive ICT practices in learning with moderate implementation in TVET and secondary schools. Proposals for improvement referred to the need to "decrease digital divide" ensuring that students and educators had access to devices and connectivity with recommendations to improve internet facilities and offer more training for both educators and students.

19.4. Policies in relation to e-materials

As shown below, while policies make provision for e-learning materials and learner management systems. However, there was only moderate implementation with most materials with most materials internationally produced – suggesting the need for continental or regional development of e-learning materials.

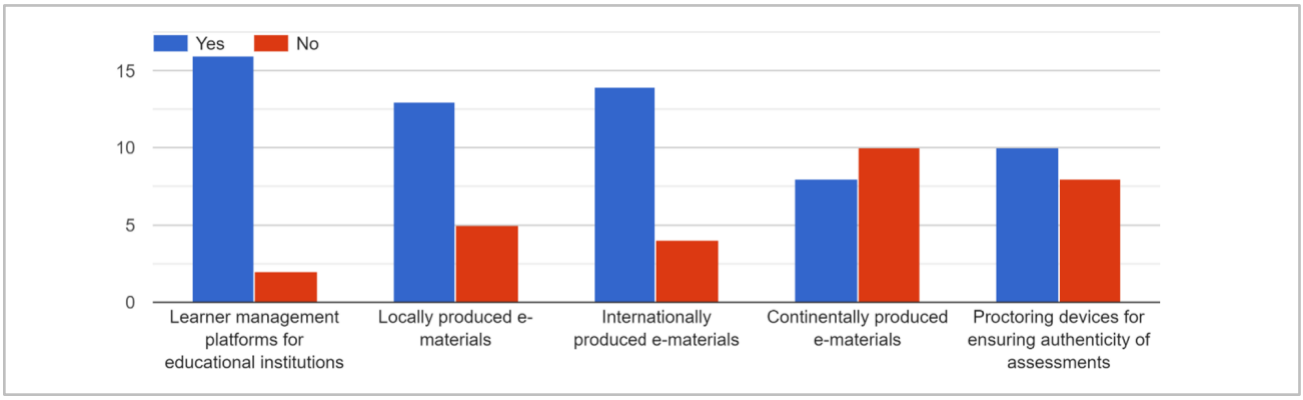


Figure 17: Policy provision for e-learning materials

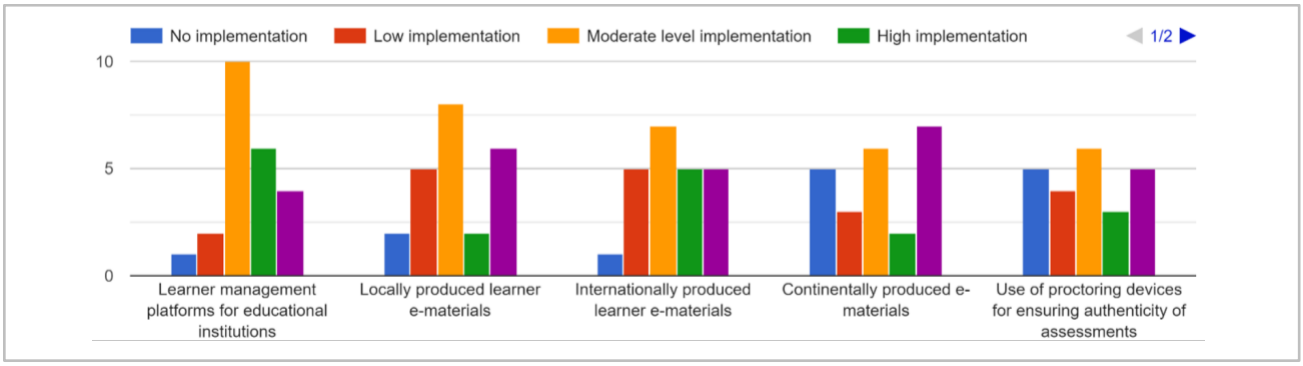


Figure 18: Usage of e-materials

As suggestions for improvements, some of the officials recommended better coordination among the different stake holders and the need for a platform need to set up to bring together all stakeholders concerned" with suggestions for "more collaboration required between all parties involved".

19.5. Management of ICT in education

Respondents were also required to indicate the extent to which policies made provision for the entire process of managing ICT in education. They were required to first indicate whether the policy made provision and thereafter to rate the implementation on a scale from none too high.

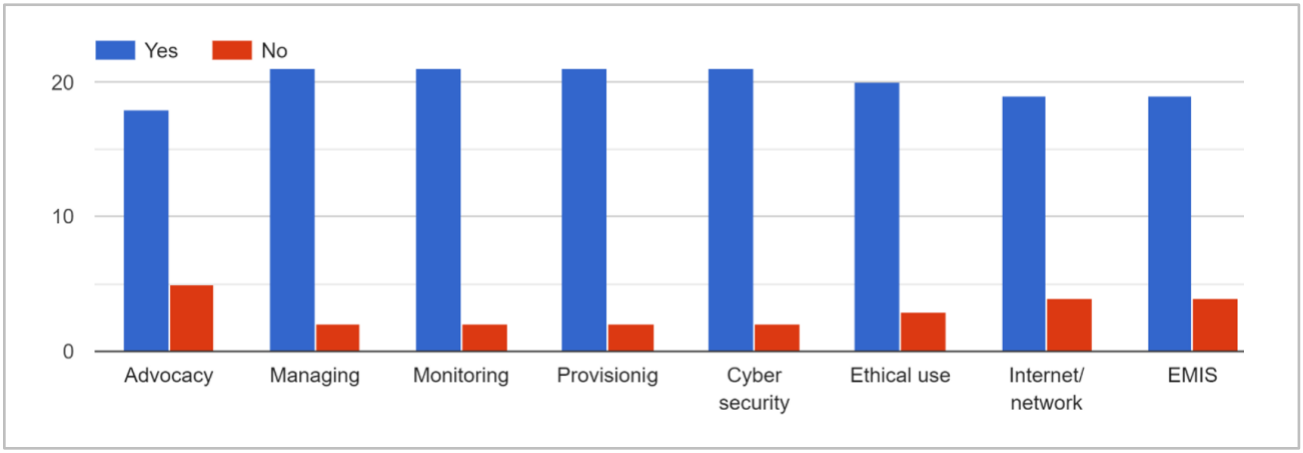


Figure 19: Policy provision for managing ICT in education

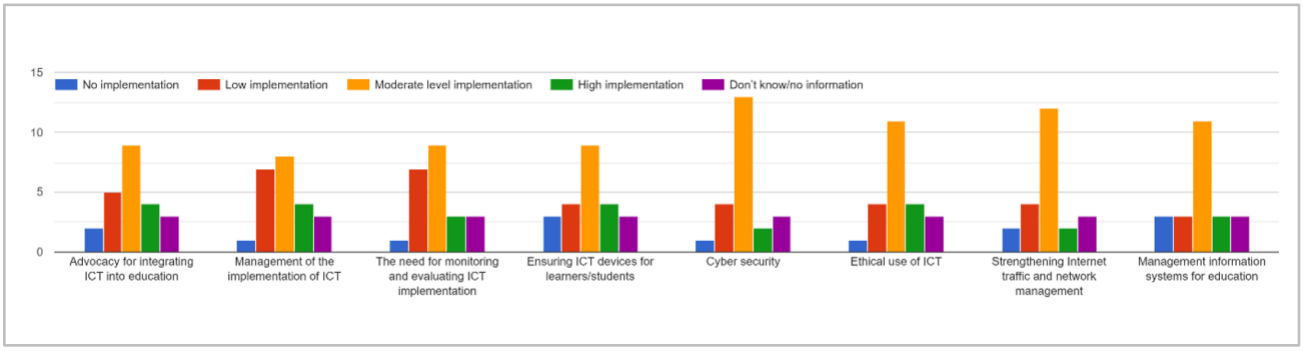


Figure 20: Extent to which ICT is managed

In explaining their ratings, respondents referred to the existing elements of online learning in TVET programmes as well as in the recruitment of ICT teachers for primary schools. They pointed out that national advocacy campaigns should be implemented to reach the entire sector to obtain general commitment to delivery.

19.6. General assessment of the level of educators' ICT skills

Respondents were required to rank the skills of educators across various ICT ability levels:

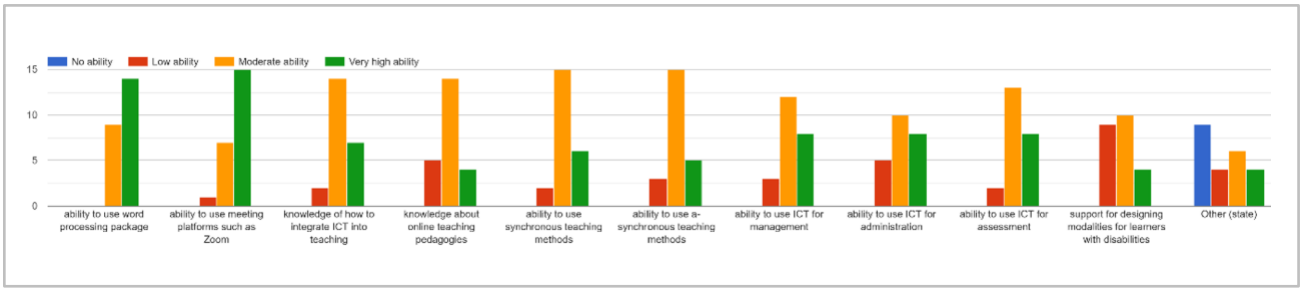


Figure 21: Perceived levels of ICT skills across various domains

While these were mostly moderate to high, the following assessments by learners/students suggest that there was generally an increase in skills across the sector – both of learners themselves as well as among educators.

Before COVID-19	Two years after the onset of COVID-19

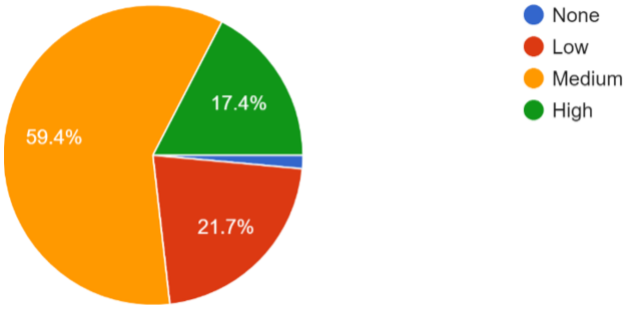
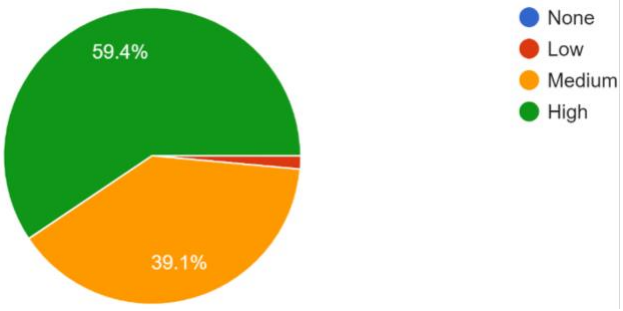

	

Figure 22: Students' assessment of their own ICT abilities	**Figure 23: Students' assessment of their own ICT abilities**

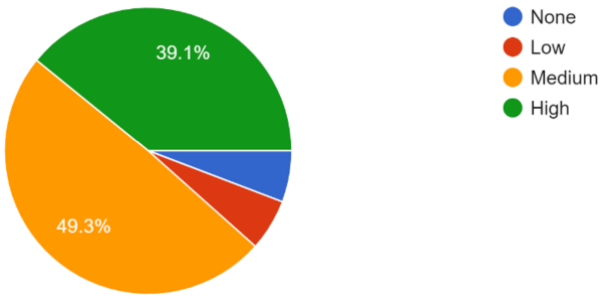
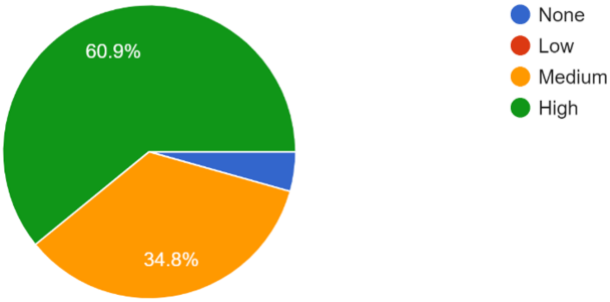

	

Figure 24: Students' assessment of their educators' ICT abilities	**Figure 25: Students' assessment of their educators' ICT abilities**

20. STUDENTS' EXPERIENCES OF ONLINE LEARNING

The questionnaire requested learners and students to describe their experiences online the shift to online learning.

The following chart shows the 5 most common modalities used by students for learning.

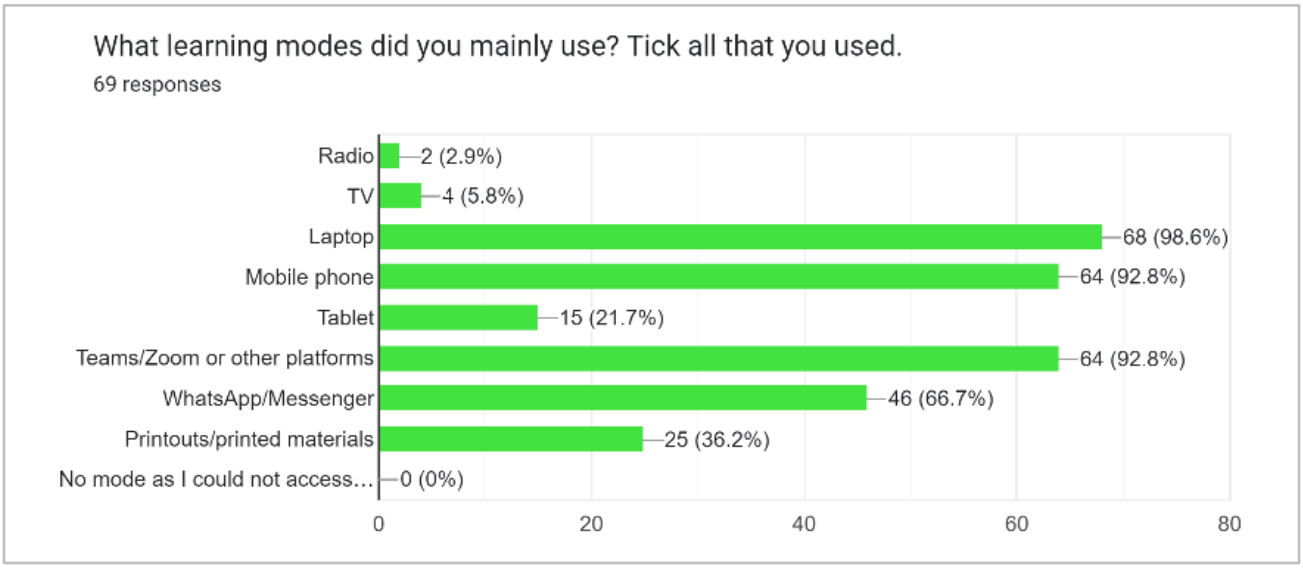


Figure 26: Most common modes of learning

As shown above, laptops, mobile phones and MS or Zoom platforms were most frequently used. The use of social media was also highly used by learners.

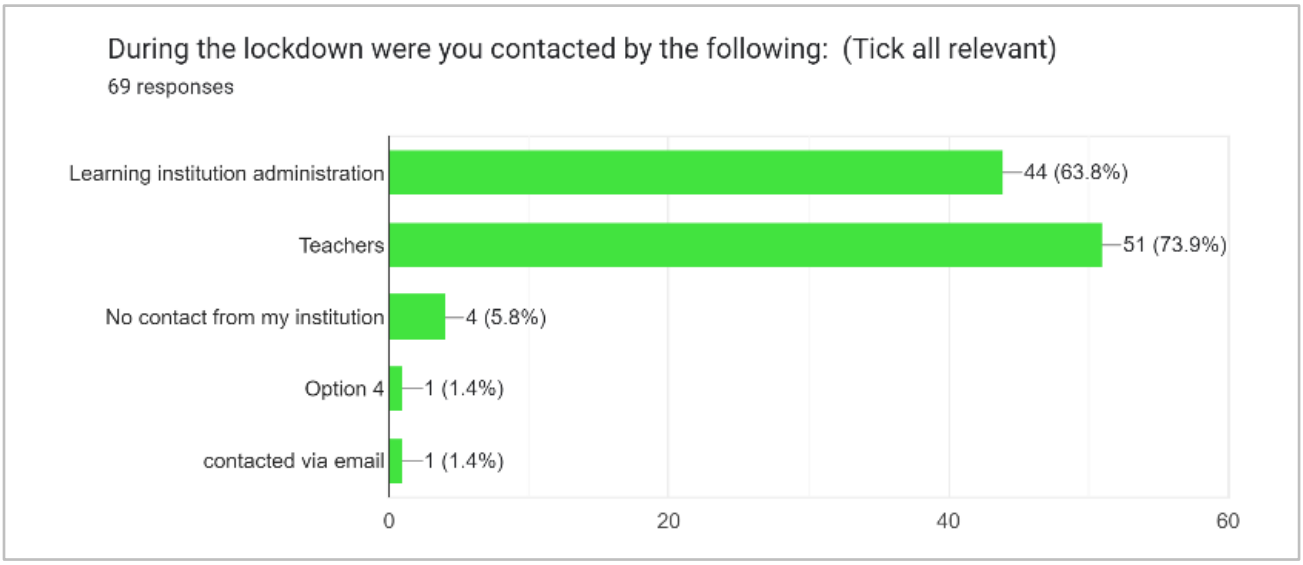


Figure 27: Contact with the learning institution

The most common contact learners had was with their teachers suggesting a high level of educator-learner engagement in the learning process. This was followed by their being contacted by administrators.

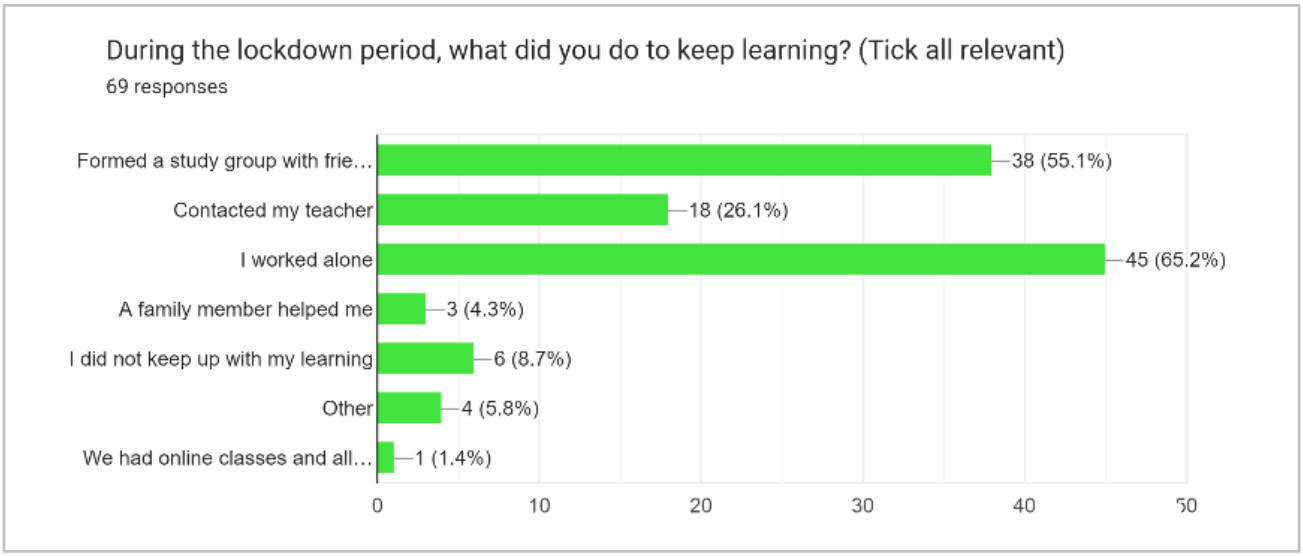


Figure 28: Sources of motivation during learning

With the high number of university students in this group it was not surprising that students worked autonomously or alone. The majority formed study groups or relied on their educators for motivation. However, it is important to note that close on 9% of this sample "did not keep up with their learning" suggesting that digital modes may need additional forms of student support to avert learner attrition.

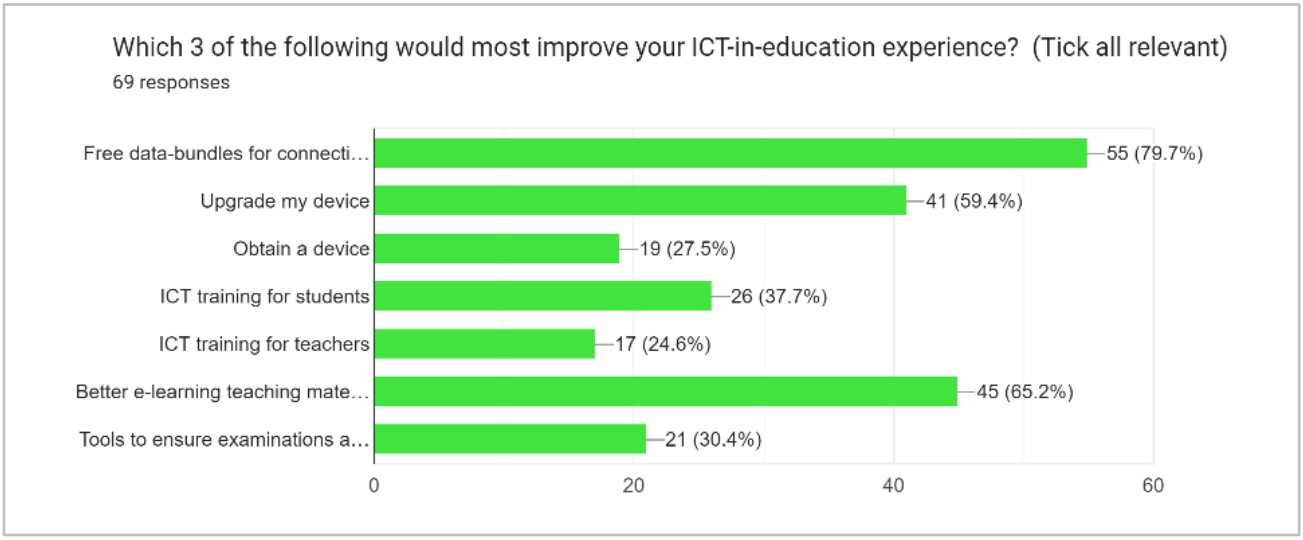


Figure 29: What would improve learning experiences

Students referred to the need for free data bundles for learning and better e-learning materials as important for improving learning. Upgrading of devices was also cited as being important by 60% of learners.

20.1. Students' positive experiences of online learning

The questionnaire allowed for open-ended responses on how to improve online learning experiences. These were coded and the following chart shows the main categories of learners' responses with regard to their "positive learning experiences":

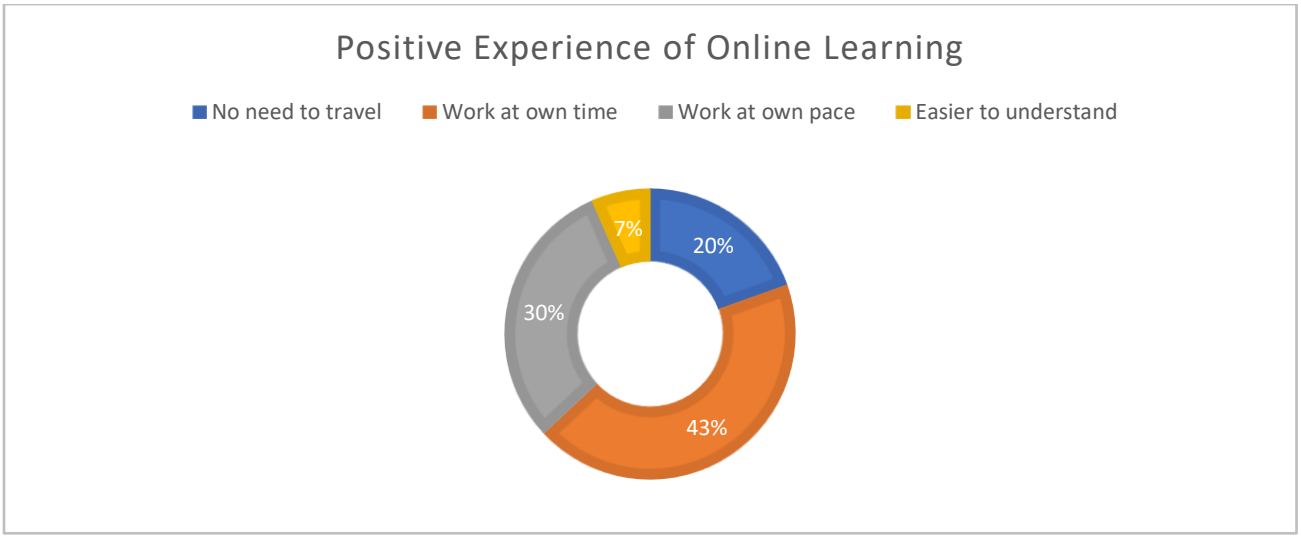


Figure 30: Students' positive experiences of online learning

The following are examples of the comments that learners/students which reflect the categories shown in the chart above.

Learner convenience:

> I did not have to worry about getting up early to go to school, also didn`t have to worry about catching the bus. Although classes were done remotely, we could still interact with our teachers via online platforms. It was less tiring than physically going to classes.
>
> Internet classes save time, and saving time is important to me. The studies are structured much better than I expected. No need to travel long distances for 1-hour sessions. I could learn at my convenient time.
>
> The classes were online and scheduled after working hours. I had enough time to prepare for classes.
>
> Part-time courses usually finish late. Through remote learning, there were no need to travel to university and that is a huge advantage.
>
> Could learn anywhere, whether it is in my bedroom or the living room.
>
> I could learn more at my own pace and this helped me manage my time more effectively.
>
> Distance learning is contributing to the field of education. It offers us experience to learn through new technologies, methods, and approaches and gain knowledge and practical experience. It presents more geographic flexibility. Also, we do not have to travel thus saving time. We can do our homework and assignments at its convenience.

Pedagogically sound:

Some learners referred to the positive pedagogical process indicating:

> Even during remote learning, students participated in class.
>
> Every student was given with equal attention in class.
>
> Teachers were more attentive to students' problems so i was able to clear out doubts more easily.

> Lecturers were good at explaining in their material.
>
> The materials are very well explained, and the lecturers are good.
>
> Online Discussions With fellow students and lecturers.
>
> Some teachers could explain to us individually which was great as I got to learn about the lesson well. And ask questions easily. We got to know our teacher better.

Permanent record:

Others referred to the permanent record of learning and also to the importance of a-synchronous learning:

> I could take screenshots of some notes which would have otherwise not been possible via face-to-face mode.
>
> I could have access to the lecture explanation video anytime since lectures could be recorded.
>
> I could easily follow my online classes and if permission is given I would also record the online sessions so that later on I can re-watch them especially during exam periods.
>
> Zoom conference with the screen sharing option was great where we could follow a demo that helps better understanding and also the teacher /facilitator could monitor the works of learners.
>
> Easily access lectures for learning and/or watching some lecturers' recordings over and over again when revising has been a great help to my learning process.

One respondent pointed out that it is difficult to know when students are facing difficulties as it is difficult to get students to participate in discussions. It was further noted that practical learning could not be done online.

Learner collaboration:

Learner collaboration also featured highly as learners became accustomed to online virtual engagements:

> Collaboration among students with tools such as Google Docs or Mentimeter.
>
> I had a communication lecture where all the students were involved in the class. Making us discover what we don't know by asking us questions or other things and get our attention.

And as one learner explained:

> There was no need to wake up early!

20.2. Students' negative experiences of online learning

The following chart shows the main categories of negative learning experiences as described by students:

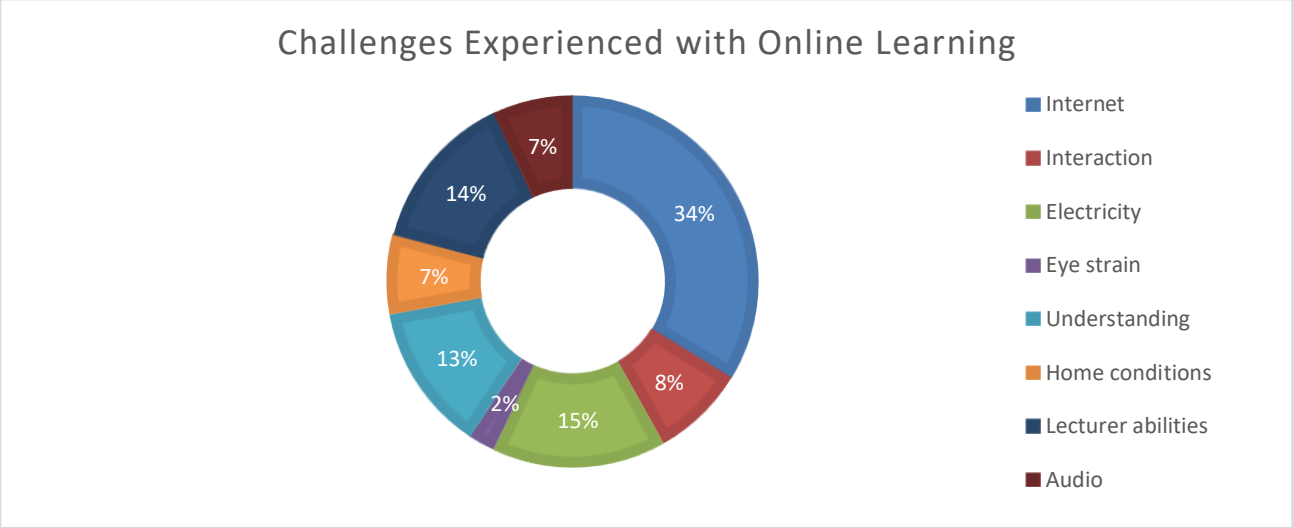


Figure 31: Students' challenges with online learning

As can be seen from the above chart, almost half of the challenges expressed referred to either connectivity problems or problems with electricity or power outages. Eye strain was cited in 2% of the cases. (This is a problem that has not generally been reported on in the literature.) As shown in the chart, 7% of students spoke of their home environment as being inappropriate for learning referring to noise levels and other home disturbances. A high number of learners referred to lecturers'/teachers' online teaching abilities 14% and problems of interaction with peers and teachers (7%).

The following are examples of the comments made by students as represented by the categories in the above chart.

The problems listed below largely pertain to the digital divide and an extensive list is included to highlight the various dimensions.

- The internet connection has a quota for rapid download/upload. After the quota is exhausted, the bandwidth diminishes drastically. This definitely affected online classes and internet browsing.
- Connectivity issues during online classes.
- Sometimes the electricity or internet connectivity issue may arise either from my side and something from the lecturer's side. If it is from my side, I will miss the lecturer's explanation until the internet is not reconnected, and if it is from the lecturer's side, then the video resolution and sound may not be as clear.
- Expensive Internet Costs.
- Power cuts and device limitations In some places we get power cuts for between 5 to 9 hours which affect learning. "It is not a common occurrence, but it does happen enough time to be a drag.
- poor people have to data package fees to have access to internet at home.
- old PCs that are not properly maintained are a problem.
- The problem that "rural areas do not have too much Internet connection.
- Internet connectivity issues/ power outages can greatly affect the learning experience especially in areas with poor connectivity.

- The internet connection has a quota for rapid download/upload. After the quota is exhausted, the bandwidth diminishes drastically. This definitely affected online classes and internet browsing.
- Disturbances at home creating a noisy atmosphere which is not conducive for learning. Had some distractions such as scrolling on the social medias during online lectures.
- On a specific day I kept having power cuts at my place, which interrupted my ongoing lecture.
- it was sometimes difficult to focus online as I was easily distracted at home.
- Connectivity issue or power failure.
- Loss of internet connection due to electricity cut.
- During the pandemic, my slow device caused me to miss some online classes.
- Due to low connectivity and group calls voices/questions could not be asked properly during conference calls. The lack of face-to-face interaction is a big drawback as lots of students feel shy whereas some may feel intimidated by others who participate more freely.

Other problems referred to physical challenges or stress experienced with online learning:

- Eye strain.
- It was stressful for me to take calls. My teacher uses to shout a lot on the phone call or during class meeting.
- Difficult to understand some learning topics without face-to-face interaction with teachers
- It is difficult to take notes.
- It is difficult to hear and ask questions.
- Difficulty in adapting and to stay focus during the online classes.
- Theoretical lectures, the lecturer may clearly explain the lectures but... without visual represent, after some period of time like 30 min, I feel I can't concentrate.
- Some teachers did not contact us.
- Since it is an integral part of institutions. Well, remote learning is not for everyone. There is no physical contact with classmates and staff. It does not cater for social interaction and as well as for networking. Moreover, it does not offer realistic feedback. Sometimes, it is tough to understand their verbal interaction due to poor quality of audio.

21. IMPROVING ONLINE TEACHING AND LEARNING

The questionnaire included an open-ended question for all respondents requesting them to reflect on and to make proposals for what could improve online teaching and learning. These responses were coded by theme and the following chart presents the main categories of recommended improvements with 18% of responses referring to the need for improved connectivity. Affordability (9%) and improved devices (11%) and better software (11%) were frequently recommended as areas for improvement. The recording of lectures (11%) corroborates the literature which shows that students frequently request recorded lectures and frequently requested hybrid and blended methods as being modes of choice.

As shown in the chart below, the proposal for recorded lessons would mean that a-synchronous learning was possible and that students could learn at times most convenient (and also at times when the Telecoms provided off-peak (night owl) lower cost data. Furthermore, as indicated above among the advantages of online learning is that recorded lessons could be used for examination preparation.

Given that students highlighted poor teaching abilities of their educators and the lack of e-materials, the recommendation for deploying the skills of content developers would serve to address pedagogical problems that teachers might have in presenting lessons and for developing online materials.

An interesting contribution from the point of students was for “a mobile app which will allow to keep up to date with learning stuffs such as assignment, new notes posted by teacher and also with university important post and issues”.

The following chart depicts the main categories for improving online teaching and learning as found in the questionnaire:

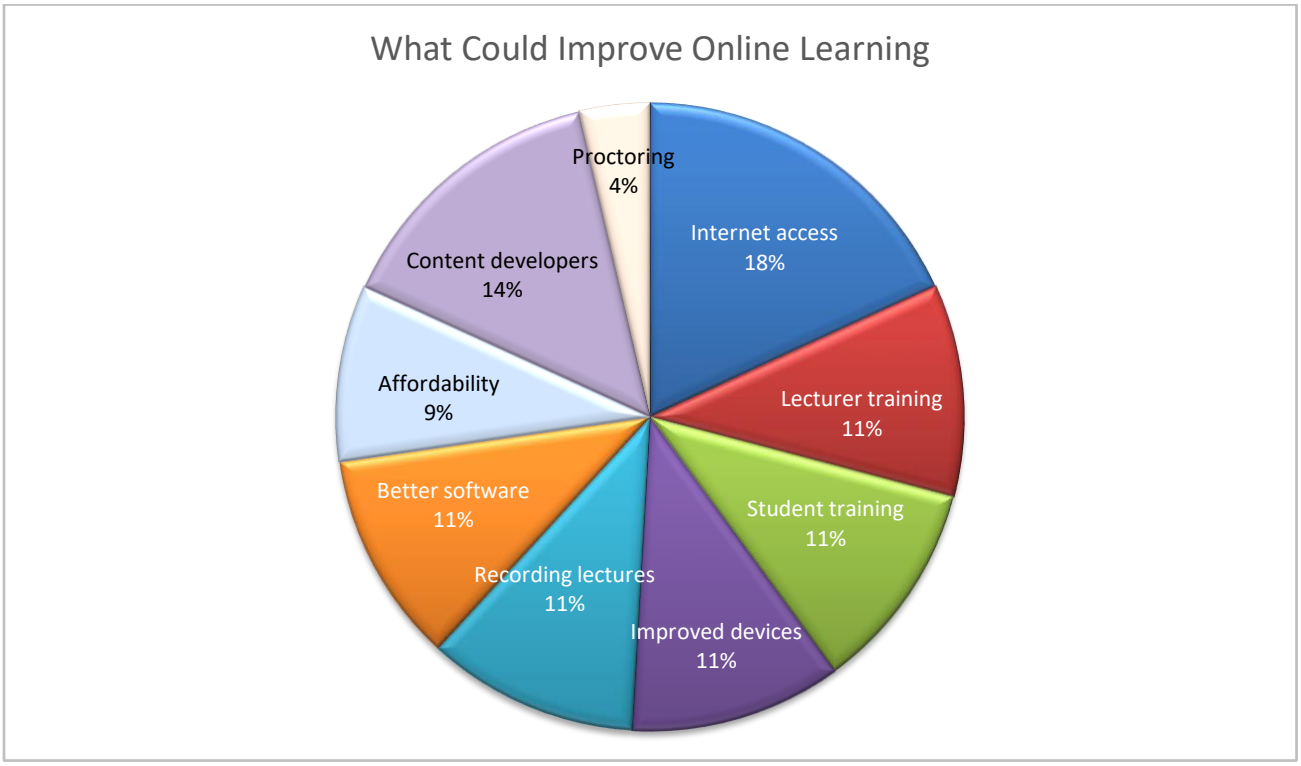


Figure 32: Students’ proposals for improving online learning

Problems associated with the digital divide:

The extensive list of proposed improvements largely referred to problems associated with the digital divide. They included:

- Free office tools and/or student discounts on various learning sites.
- Better training and formation of staff and investment in student plans for free access in software in various useful computer software applications.
- Providing fast unlimited bandwidth at an affordable prices.
- More sophisticated software for online classes which can accommodate more students Implementing a powerful learning management system with numerous online learning features that are actively utilised (e.g. discussion forums, gamify activities, multiple choice questions).

- Use better and newer technological knowledge and hardware.
- A better internet connection will improve the experience. And also, proper training to teachers.
- Accessibility to affordable IT equipment and subsidised internet costs.
- Better tools for remote education, better connectivity.
- Provide staff with better equipment as well as to students.

Pedagogical improvements:

- Providing support to learners, students and content developers.
- Proctoring system for online exams.
- There could be some sort of FAQ related to recorded online lectures and make learning become more interactive while also keeping track of the progress.
- Improvements in learning software. Video-conferencing classroom sizes should be kept low to facilitate communication.
- Pre-recorded materials so student can learn at their pace.
- Some teacher left their camera off. I guess turning camera on might be a big step to be able to see the human reactions and all.
- Online educational games or trivia can help a lot.
- E-learning materials and better connectivity.
- Better internet connectivity and devices.
- A platform that will allow the teacher to monitor all the students therefore, preventing any cheating from occurring.
- Get instant feedback.

ICT in education requires massive investment to get good quality. Continuous training must be given to academics and students. If need be, hire more people rather than increasing the workload of existing ones.

Tertiary sector improvements:

More training to use ICT in the context of education. better access to internet restructuring of educational programs to include more use of ICT:

- access to better and faster internet connection for both students and lecturers.
- more training in terms of pedagogical approach for online teaching would be beneficial.
- communications software where teachers and learners can interact.
- file sharing platforms – in the long term, more advanced software.
- to fully conduct exams online with the assurance that students are not able to cheat.
- more funding to buy new tools or upgrade existing.
- good infrastructure to support these technologies available access to internet from home for all students.
- the provision of a laptop for each student.
- to set up a robust infrastructure and make available the human resources.
- good home internet connectivity.

Schooling improvements:

- Implementation of more training for primary school students.

- Immediate needs: train staff. Provide courses for teachers.
- Medium term needs: to provide necessary materials to conduct classes.
- Long term needs: to foster for new technologies and employ it its daily use.
- We are already incorporating it in our methodology.
- Implementation of more training for primary school learners.

TVET improvements:

There new system needs to ensure opportunities to conduct hands-on online, through the use of holo lenses et and funding to procure these.

ICT for special needs:

To easily navigate and access platforms:

- Special gadgets for use.
- A degree in any ICT related course.
- A basic knowledge of computer.
- Animation slides.
- Using ICT for teaching may open access to more students having special needs.
- ICT is especially beneficial to them, especially those who cannot move around freely.
- Access to technologies like AR/VR to support their learning. Closed Captioning for live online classes.
- Assistive devices.

Curriculum changes required:

- No major curriculum changes needed as most programs already include components of ICT use teaching
- Already in place. The C-Delta programme has been integrated in our curricula.
- A dynamic curriculum change where student's forum can be created to express their views.
- To encourage slow learners and disabled learners to express their learning issues.
- Our curriculum has been designed in a way that makes provisions for both online and face to face teaching and also it is mandatory for all our students to follow at least one ICT module
- Information on whether we need to pay for licenses for software for students across the country. Can licenses be donated?

Changes to be made to improve assessments:

- Students' performance cannot be assessed in one day. Innovative way of evaluating students should be promoted.
- I think educators all sitting down and talking to each other could help improve all spheres of learning.
- The support of the appropriate organisations could also help.
- Proctoring should be used for high stake assessments.

22. THE STRENGTHS, WEAKNESSES OPPORTUNITIES AND CHALLENGES (SWOC) OF ICT USAGE

The interviews required to indicate what they considered to be the strengths, weaknesses, opportunities and challenges for the education sector. The SWOC in this section can be seen as complementary to those suggested in Part 1 of this study. The practical SWOC given by respondents are captured as follows:

22.1. SWOC analysis

Strengths	Challenges
• A motivated workforce and continuous improvement of internet facilities • The country has a good education level with high literacy rates and even the digital divide is not a major issue • Innovation in the ICT sector • Positive attitude towards change • All parts of the country have access to the internet • Solid ICT knowledge base • A platform based for students • The growth of the sector • We have WiFi connection available, and students get access to WiFi in their classrooms • We have a high penetration of mobile phones and Internet connectivity among the population. • The young population is very accustomed to technology • The Ministry concerned has been investing in good connectivity as well as trained human resources. • Loan facilities are made available for the purchase of personal laptops for students • Free education, university in IT sector • Multilingual, high internet penetration, Governmental Support and continuous	• Rapid bandwidth and proper tools • Infrastructure Connectivity • Not all learners have a connecting device. • As such, there is no obstacle at the level of universities for using ICT. • Internet connectivity • Hackers • Lack of IT experts to manage • Budgets • Poor students do not have connection • Students cannot understand well • Lack of training from pedagogical aspects of using ICT in teaching • It is difficult to conduct examinations without fraud • Connection can be a problem at times • Lack on internet access and poverty • Expensive hardware • Lack of computer materials • Cost, Resistance • Electricity and knowledge • To restrict the use of other websites • To make Mauritius more modern country

training, good ICT infrastructure (Fibre, 4G and 5G, etc) • High level of computer literacy • There are many computer labs in our education infrastructures	
Weaknesses	**Opportunities**
• ICT tools are expensive • Lack of commitment • Learners will spend too much time and will not focus on their studies as they should • Lack of willingness among students and learners to adapt • Learning management systems require investment and adequate staff to ensure monitoring. • Poor students do not have equitable access to the Internet • Lack of training for educators to use ICT as part of their teaching • Inaccessibility to ICT equipment and internet connectivity • Lack of training and motivation, incentives • Teacher readiness • Lack of good devices • Poor guidelines and availability	• Courses can be accessed anywhere and anytime • Users will get to know more about ICT and be more exposed • ICT is taught as from the primary education and in the years to come we will have a population who will be ICT Literate. • To attract more students. • Job creation, digitalization and new technologies • Industry partner collaboration • Encourage students to self-learn • Political will and the emphasises on the use of ICT in education • A more holistic approach • Need to invest in more advanced learning and teaching software • Government emphasises on the use of ICT in education

23. NEEDS FOR ICT IN EDUCATION

With a view to areas for funding and development, government officials and educators were asked to rank the following ICT needs on a 3-point scale. As can be expected, the following chart shows their ranking – which suggests the greatest needs being more computers, internet connectivity and technical support. Support for the development of educators' ICT skills, changes to policy, and online assessments and curricula were considered moderate to high needs. The development of ICT policy and the development of student ICT competencies were regarded as relatively less important.

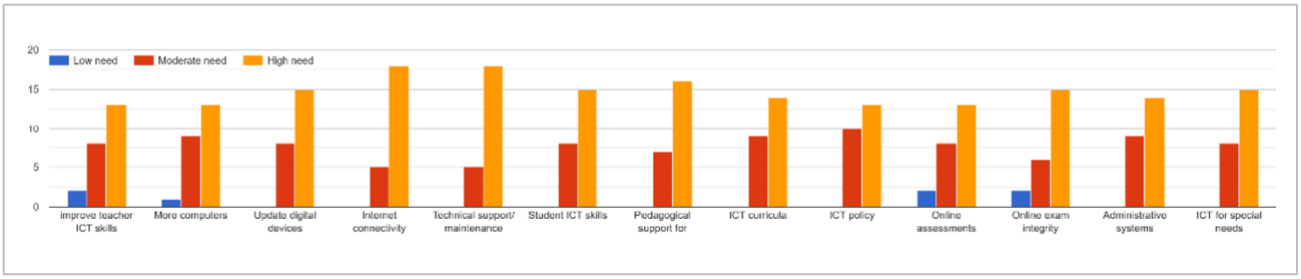


Figure 33: Needs identified officials and educators

24. RECOMMENDATIONS

The two sections of this report need to be read as a composite study noting that the findings of a primary research corroborate those of the desk review. Flowing from the two parts of this report, the following recommendations are made in order to support national digital learning initiatives.

A focus on infrastructure in relation to the digital divide:

It is concluded that despite Mauritius's advantageous position with its existing system of education bolstered by a strong digital infrastructure, the education system nevertheless faced challenges during the pandemic at a time when it needed to rely on the use of ICT. The findings suggest that the electricity power cuts impacted e-learning particularly for vulnerable learners and thereby exacerbating the digital divide. This coupled with the lack of ICT resources hampers the enormous progress the country has made towards equity and equitable learning opportunities.

Reaching vulnerable learners:

While Mauritius has the advantage of a strong national educational policy and ICT policies, the country can establish a new basis for education through providing ODL solutions to expand the accessibility of their educational systems to various vulnerable groups of learners, including learners with disabilities, children and youth that drop out of school. The country's solutions could have wider applicability for the region and beyond.

Connectivity:

Mauritius has the advantage of high-speed internet connectivity however the means to afford this is a challenge for lower socio-economic households. As this study found, additional resources will be required as the country recovers from COVID-19, in the context of fiscal consolidation in order to ensure resilience and future-proof the sector. Moreover, as this study shows, the various respondents referred to the need for upgraded or better spec laptops more specially to address the digital divide.

Capacity development of the workforce and students:

Although ranked as a moderate need, and despite learners and educators having acquired improved digital skills over the past two years, ongoing training is essential. The upgrading of systems, digital platforms, and learning management systems all require bespoke and updated training. While the study found that educators had improved digital skills some two years into the pandemic, these findings draw attention to the importance of conducting a subsectoral needs analyses to benchmark

and to redefine learning interventions for preservice and inservice educators in order to better target interventions.

Special educational needs:

The findings referred extensively to the need for improving opportunities for learning for learners with disabilities by utilising specific assistive technologies. Training opportunities should be provided to SEN teachers, especially in terms of ICT competencies and high–tech assistive solutions.

TVET:

The consolidation of technology and TVET is an important step forward. The use of ICT for the management and delivery of TVET will enable a responsive, demand driven TVET system. Moreover, the use of e-materials, OERs and MOOCs, could enable the sector to take advantage of international best practices for ensuring globally competitive skills.

Harmonising interventions:

Given that Mauritius has several development and international partners keen to support its economic development, including its efforts to establish itself as a regional ICT and cyber hub. It should harmonise and align its diverse digital initiatives for accelerated impact. The partners are referred to in Part 1 of this study, with additional proposals from respondents engaged in the primary research.

Expanding impact:

The digital sector not only provides a pool of jobs for skilled young people, but its positive externalities also influence many other sectors where they improve productivity, contributing indirectly to job creation. The country's advanced digital abilities in education could furthermore provide a benchmark, as well as provide digital know-how, for other countries in the region.

25. CONCLUSION

Access to education has always been high on the Mauritian government's agenda. As this study shows that the country has achieved and sustained universal access through its introduction of free primary and secondary education in 1976; and the introduction of free tertiary education for citizens since 2019. This expansion has relied on the use of distance and online learning with a large segment of the country's higher education being offered by distance education. The ICT Strategy for the Education Sector in 2018 spans education subsectors with 4 ICT areas of focus: 1) infrastructure and connectivity; 2) enhanced teaching/learning and pedagogical content development; 3) education management; and 4) capacity-building and professional development. These four focus areas constitute the main recommendations emanating from the primary and secondary research conducted for this study as areas that are in concert with the commitment to access, equity and quality.

This study recommends investments for further enhancement of learning across the educational subsectors in the areas identified, so as to further contribute to national development.

SELECTED BIBLIOGRAPHY/REREFENCES

AUC/OECD, Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs.

eLearning Africa Report (2019), GTZ/German Cooperation.

International Journal of Learning, Teaching and Educational Research Special Issue, Vol. 13, No. 4, pp. 14-19, October 2015

MIE, Strategic Plan 2018-2022, Empowering Professionals for Quality Education, Reduit, 2018.

Mauritius Economic Development Board (2022), https://www.edbmauritius.org/ict.

Ministry of Education, Tertiary Education, Science and Technology (MoTEST) (2021), Annual Report 2020-21,

Ministry of Education, Culture and Human Resources (2009), Education and Human Resources Strategy Plan 2008-2020, Phoenix, Mauritius.

Ministry of Technology, Communication & Innovation (MTCI) (2018a), Digital Mauritius 2030, Republic of Mauritius.

Ministry of Technology, Communication & Innovation (MTCI) (2018b), Digital Government Transformation Strategy 2018-2022, Republic of Mauritius.

Ministry of Technology, Communication & Innovation. Digital Mauritius 2030 strategy. Republic of Mauritius. DigitalMauritius2030.pdf (govmu.org)

Ministry of Technology, Communication & Innovation (MTCI) (2007), National ICT Policy 2007-11, Republic of Mauritius.

Mohamedbhai G (2021), Addressing the challenges of the skills gap, University World News, https://www.universityworldnews.com/post.php?story=20210707095325999

National Computer Board. Mauritius ICT Indicators Portal, http://indicators.ncb.mu/English/Indicator%20Definitions/Pages/ICT-Economic.aspx

National Productivity and Competitiveness Council (2021), Strategic Plan 2021-2025, Building a resilient tomorrow, Mauritius.

Prime Minister's Office (PMO) (2020), The Government Gazette of Mauritius Extraordinary, Gazette of Mauritius No. 57 of 16 May 2020, Act No1 of 2020; Act No2 of 2020, Government Printing Company. Government

Statistics Mauritius (2020), https://statsmauritius.govmu.org/Documents/Statistics/ESI/2020/EI1543/Edu_Yr20.pdf

UNESCO (2022), https://iite.unesco.org/news/openemis-capacity-building-in-mauritius/

UNESCO (2021), Report by the Director of UNESCO IITE on activities of the Institute, Governing Board, accessed at https://iite.unesco.org/wp-content/uploads/2021/06/Directors-Report-at-the-20th-GB-meeting.pdf

UNESCO, 2021, Analytical report, COVID-19 and inclusive open and distance learning solutions: A rapid assessment of the development and implementation of inclusive open and distance learning solutions for students with disabilities served by inclusive, special schools and resource centres in Rwanda and Mauritius, UNESCO, Paris.

Université des Mascareignes (2022), https://udm.ac.mu/research-field/ict-and-education/

World Bank, 2022, Mauritius – Systematic Country Diagnostic (SCD) Update January 2022.

ANNEXES

ANNEX A: ANNOTATED COUNTRY DEMOGRAPHICS

The following table provides background data pertaining to the national demographics obtained from www.theglobaleconomy.com.

Table A.1: National demographics

Demographics	Measure	Latest value	Reference
Population size, in millions	million	1.27	2020
Percent urban population	percent	40.76	2020
Population density, people per square km	people per square km	624	2020
Population ages 65 and above, percent of total	percent	12.52	2020
Population ages 0-14, percent of total	percent	16.78	2020
Female population, percent of total	percent	50.66	2020
Rural population, percent of total population	percent	59.24	2020
Dependent people as percent of the working age	percent	41.45	2020
Refugee population	refugees	20	2020
Migrant population, percent of total population	percent	2	2015
Population growth, percent	percent	0.00	2020

The low population rates have implications for the provision of education at the lower grades initially. With approximately 17 percent of the population below the age of 14 years, suggests an expansion in senior schooling, TVET and HE areas where distance learning could make a significant contribution. The proportion of children below the age of 14 years relative to the total population group is shown in the following figure.

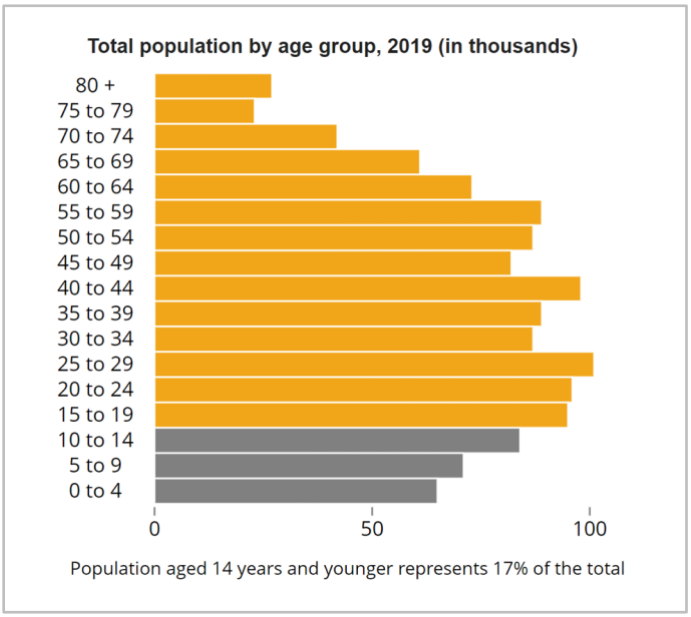


Figure A.1: Population breakdown by age cohort

This chart suggests the need to increase learning offerings for upper secondary learning as well as for the post-school sector. Both are subsectors where distance learning can play an important role. Moreover, the large 25- 29 age cohort would be a target for in-service professional development, thus suggesting an increase in focus on distance learning post post-school opportunities.

The table below reflects the advanced level of mobile ICT penetration in the country and a high proportion of internet users in the population.

Table A.2: Infrastructure

Infrastructure and transport characteristics	Measure	Latest value	Reference
Internet users, percent of population	percent	64.88	2020
Broadband internet subscribers, in thousands	thousand subscribers	323	2020
Fixed broadband internet subscribers per 100 people	percent	25.41	2020
Mobile phone subscribers, in millions	million subscribers	1.91	2020
Mobile phone subscribers, per 100 people	subscribers per 100 people	150.41	2020
Mobile network coverage, percent of the population	percent	99.00	2016
International Internet bandwidth per Internet user, kb/s	kilobits per second	32.99	2016

ANNEX B: EDUCATION STATISTICS

Mauritius has a negative population growth which will impact on the numbers of learners in pre-primary schooling with relatively low numbers of children enrolled up to upper secondary levels of schooling.

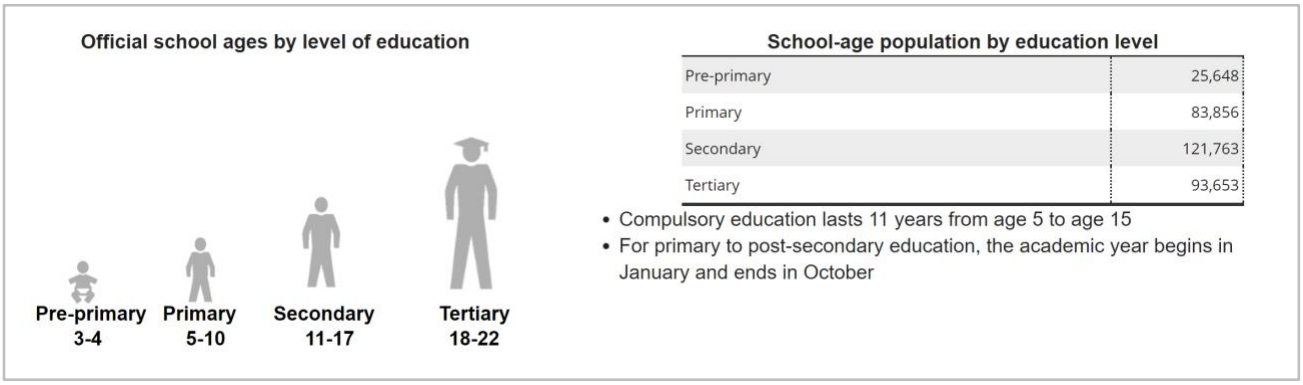
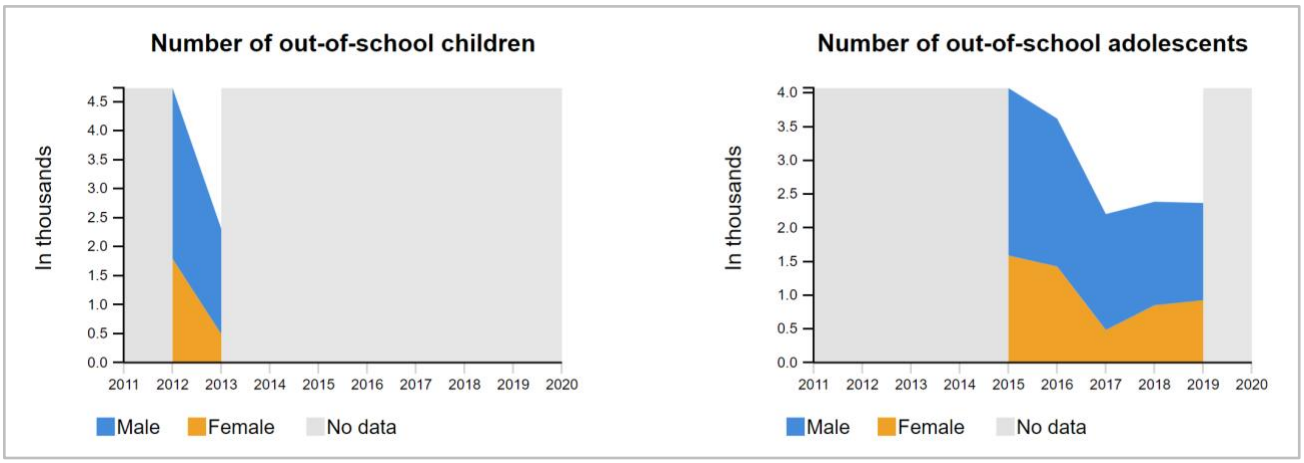


Figure B.1: Education population by sector (Source UIS)

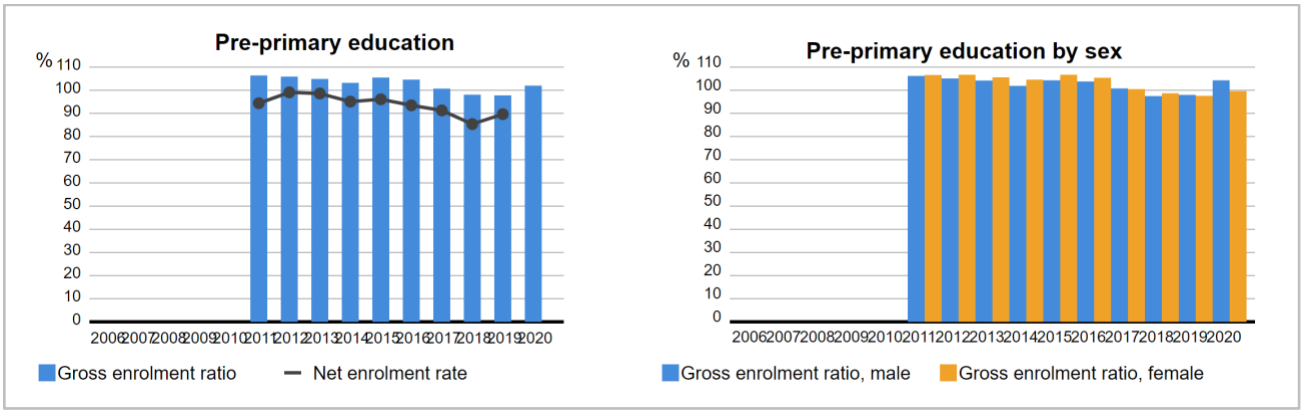
ANNEX C: POPULATION DEMOGRAPHICS

Distance education which is firmly in place in Mauritius could target those youth who are out of school with a view to providing basic education, TVET and entrepreneurial skills.



	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Out-of-school children										
Total	1,338	4,732	2,305	1,229	1,063	1,426	1,008	1,156	1,209	...
Female	...	1,789	491	...	...	...	...	...	...	...
Male	...	2,943	1,814	...	...	...	...	...	...	...
Out-of-school adolescents										
Total	...	...	...	...	4,070	3,618	2,202	2,386	2,368	...
Female	...	...	...	...	1,587	1,425	484	851	924	...
Male	...	...	...	...	2,483	2,193	1,718	1,535	1,444	...

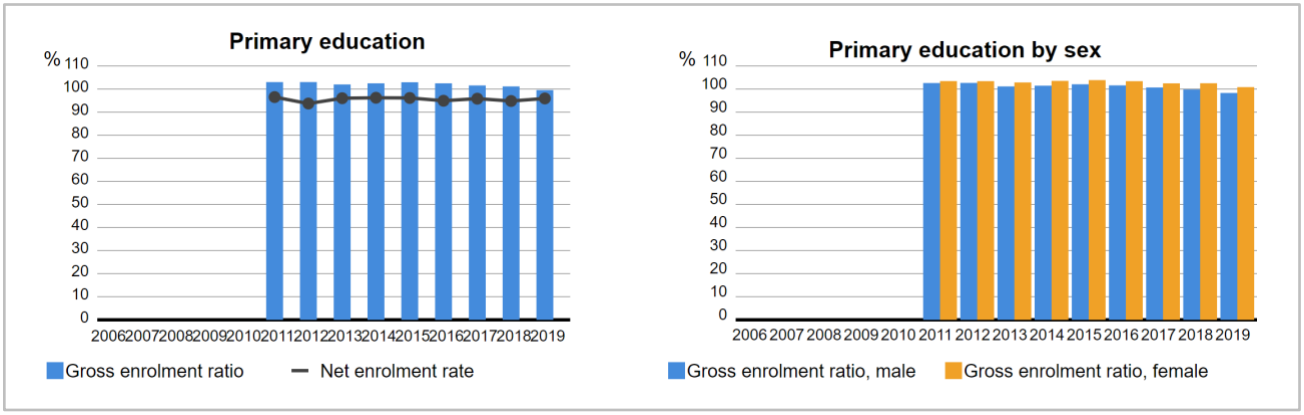
Figure C.1: Out of school children and adults (Source UIS)



PRE-PRIMARY EDUCATION	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross enrolment ratio (%)										
Total	106.4	105.9	104.9	103.2	105.5	104.6	100.7	98.1	97.8	102
Female	106.6	106.7	105.6	104.6	106.7	105.4	100.5	98.7	97.6	99.6
Male	106.2	105.1	104.2	101.9	104.3	103.8	100.8	97.5	98	104.3
Net enrolment rate (%)										
Total	94.4	99.1	98.6	95.1	96.1	93.5	91.3	85.4	89.7	...
Female	94.4	100	99.2	96.1	97.2	94	91.2	86.2	89.6	...
Male	94.3	98.3	98.1	94.1	95	93	91.5	84.5	89.8	...

Figure C.2: Pre-primary participation rates by sex

Mauritius's progress with universal primary education, particularly for girls is reflected in the gross enrolment rates in particular the inclusion of girls.

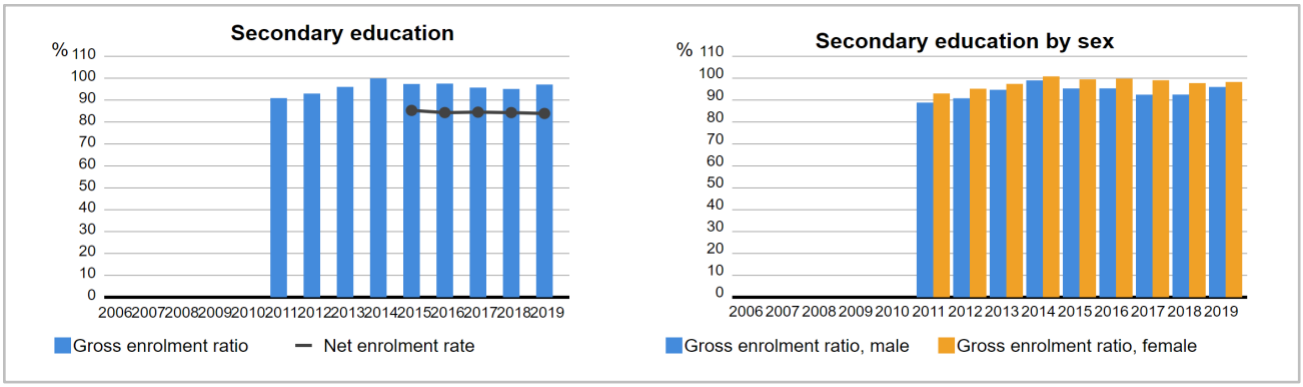


PRIMARY EDUCATION	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross enrolment ratio (%)										
Total	102.99	103	101.96	102.45	102.92	102.45	101.53	101.11	99.52	...
Female	103.42	103.39	102.83	103.51	103.84	103.38	102.44	102.49	100.81	...
Male	102.58	102.63	101.11	101.43	102.04	101.56	100.65	99.78	98.28	...
Net enrolment rate (%)										
Total	96.5	93.7	96	96.2	96.1	94.9	95.8	94.8	95.9	...
Female	...	94.6	97.2	...	...	...	...	...	...	...
Male	...	92.7	94.9	...	...	...	...	...	...	...

Figure C.3: Primary participation rates by

School life expectancy ISCED 1-8 (years)	15.06	14.42	15.72	(2017)
Percentage of repeaters in primary (%)	0	0	0	(2019)
Survival to the last grade of primary (%)	94.61	94.9	94.33	(2018)
Gross intake ratio into the last grade of primary (%)	96.4	95.4	97.4	(2020)
Effective transition rate from primary to lower secondary general education	99.7	100	99.4	(2018)

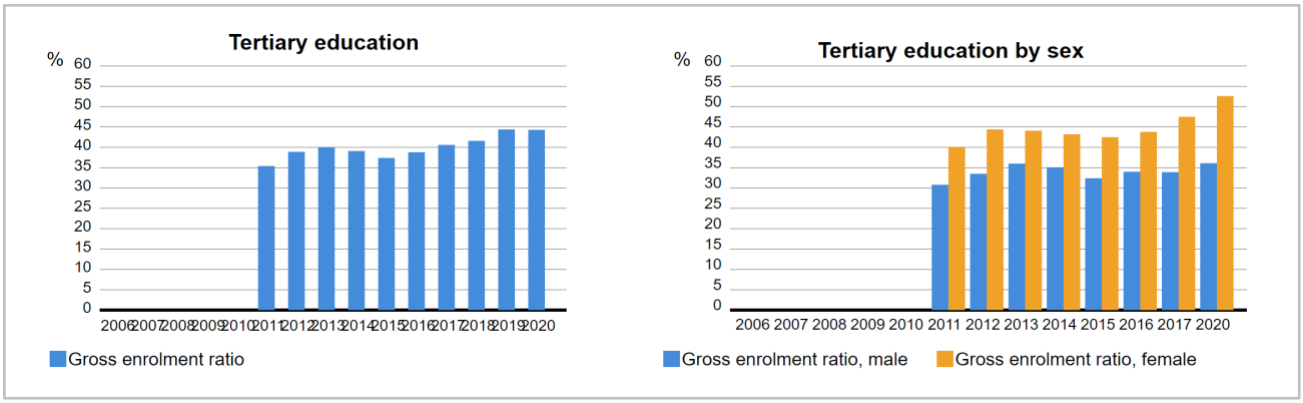
Figure C.4: Transition rates from primary to secondary schooling



SECONDARY EDUCATION	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross enrolment ratio (%)										
Total	90.92	92.99	96.04	99.9	97.37	97.54	95.72	95.1	97.12	...
Female	93.03	95.2	97.41	100.83	99.48	99.81	99.08	97.77	98.29	...
Male	88.87	90.83	94.71	99.01	95.32	95.35	92.49	92.53	96	...
Net enrolment rate (%)										
Total	...	...	...	...	85.3	84.3	84.5	84.3	83.9	...
Female	...	...	...	...	87.8	86.7	87.7	87.1	86.6	...
Male	...	...	...	...	83	82	81.5	81.7	81.3	...

Figure C.5: Secondary education rates by gender

While the transition from primary school to secondary school shows marginally lower rates, the number of females remains higher than males. And, as shown in the following chart, the number of females in higher education exceeds the number of males. This trend differs from most countries in Africa.

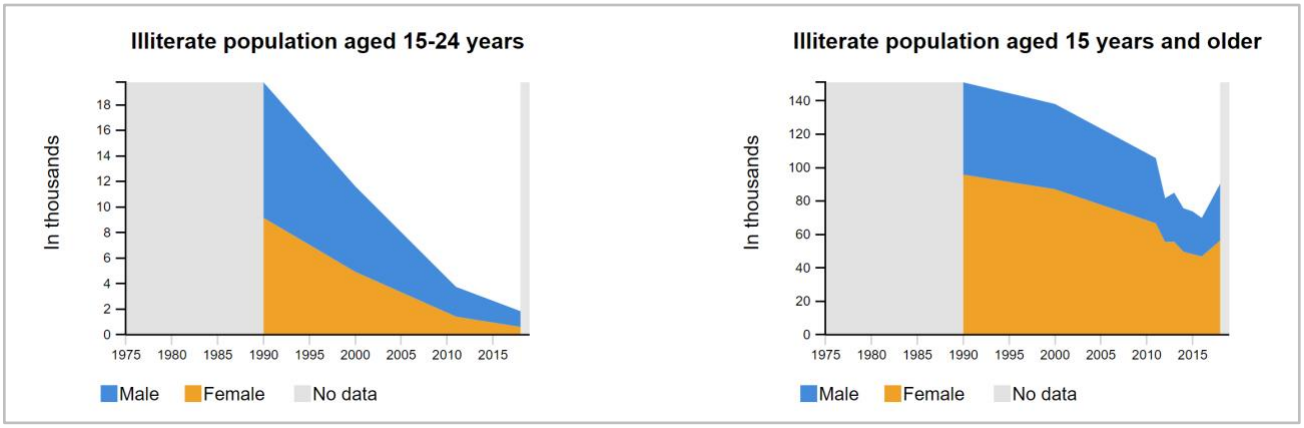


TERTIARY EDUCATION	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Gross enrolment ratio (%)										
Total	35.4	38.9	40	39.1	37.4	38.8	40.6	41.6	44.4	44.3
Female	40.1	44.4	44.1	43.2	42.5	43.8	47.5	...	...	52.6
Male	30.8	33.5	36	35.1	32.4	34	33.9	...	...	36.1

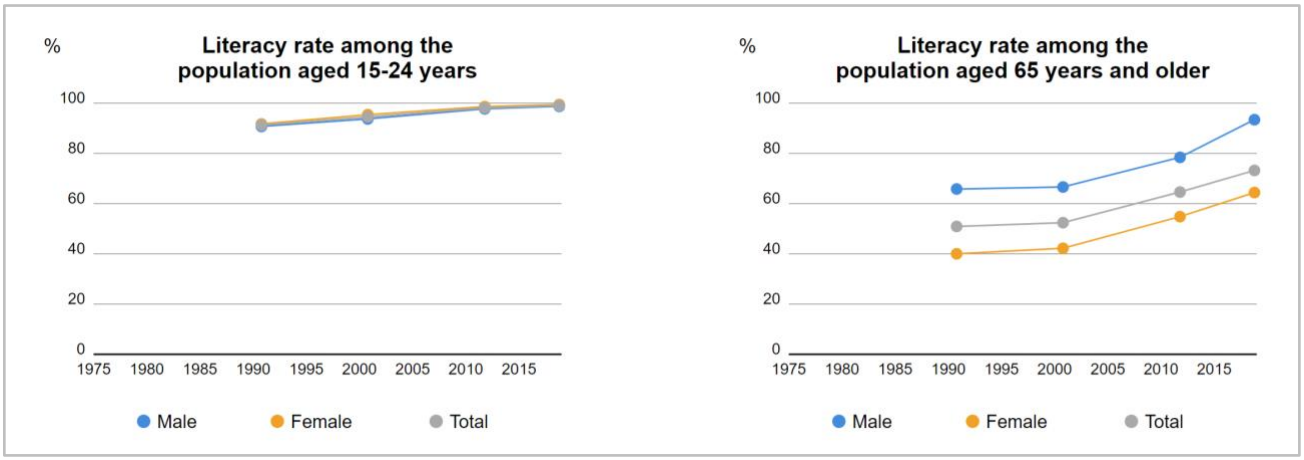
Figure C.6: Tertiary education rates by gender

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Government expenditure on education										
as % of GDP	3.3	3.4	3.6	4.9	4.9	5	5	4.8	4.7	4.6
as % of total government expenditure	13.8	15	14.8	20.9	19.5	20	20.4	19.3	18.7	16.1
Government expenditure per student (in PPP$)										
Primary education	1622.8	1692.7	2047.4	2465.7	2407.2	2707.9	3257.1	3334	3595.5	...
Initial government funding per secondary student PPP$	2668.7	3079.3	3429.1	5311.2	5898.9	6024.4	6616	6708.2	6919.4	...
Initial government funding per tertiary student PPP$	1541.2	1423.3	1567.2	2000.1	2137.3	2025.8	1982.4	...	...	2391.2

Figure C.7: Government spending on education



	TOTAL	MALE	FEMALE	
Illiterate population				
15-24 years	1,850	1,233	617	(2018)
15 years and older	90,364	33,966	56,398	(2018)

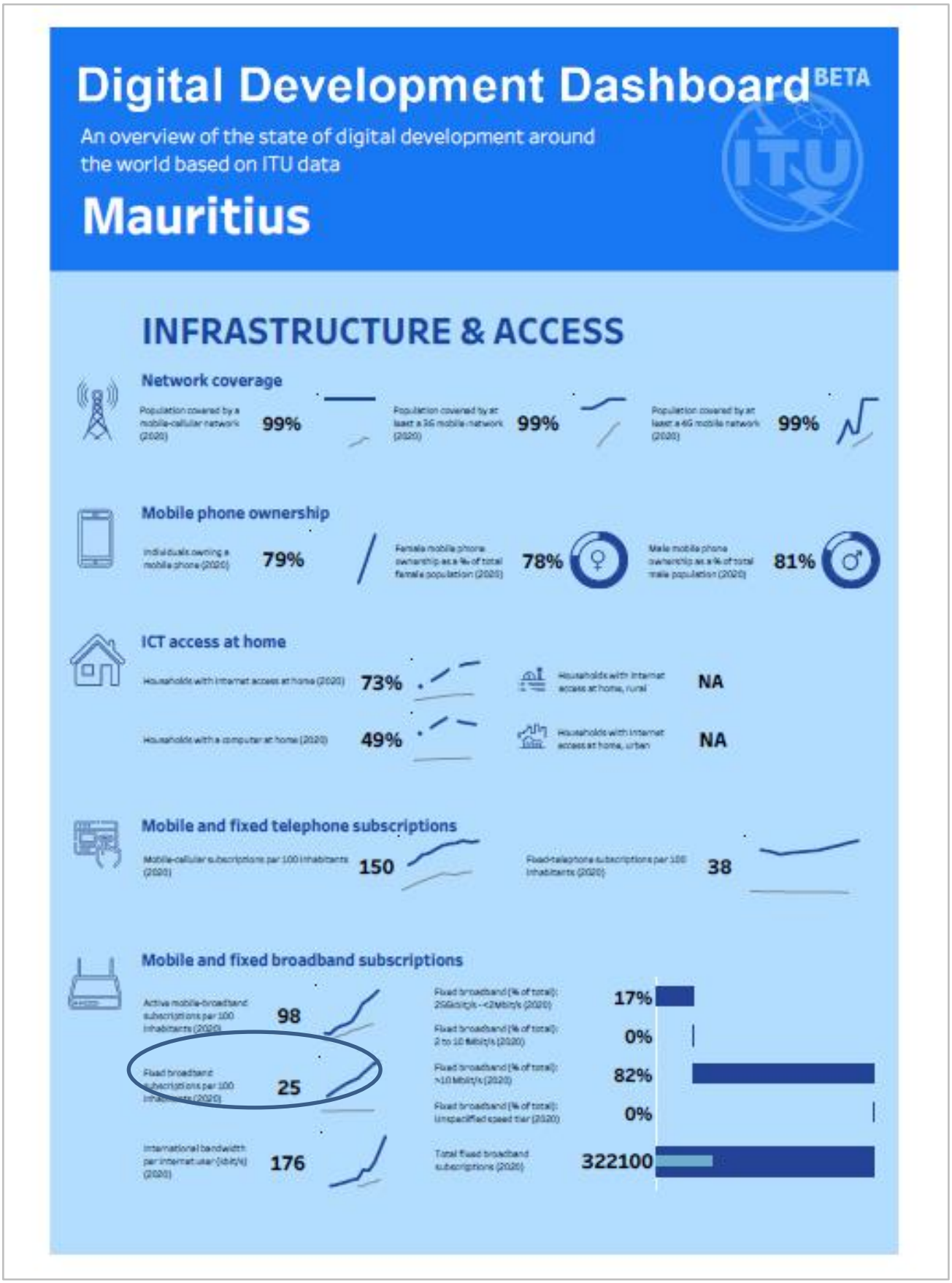


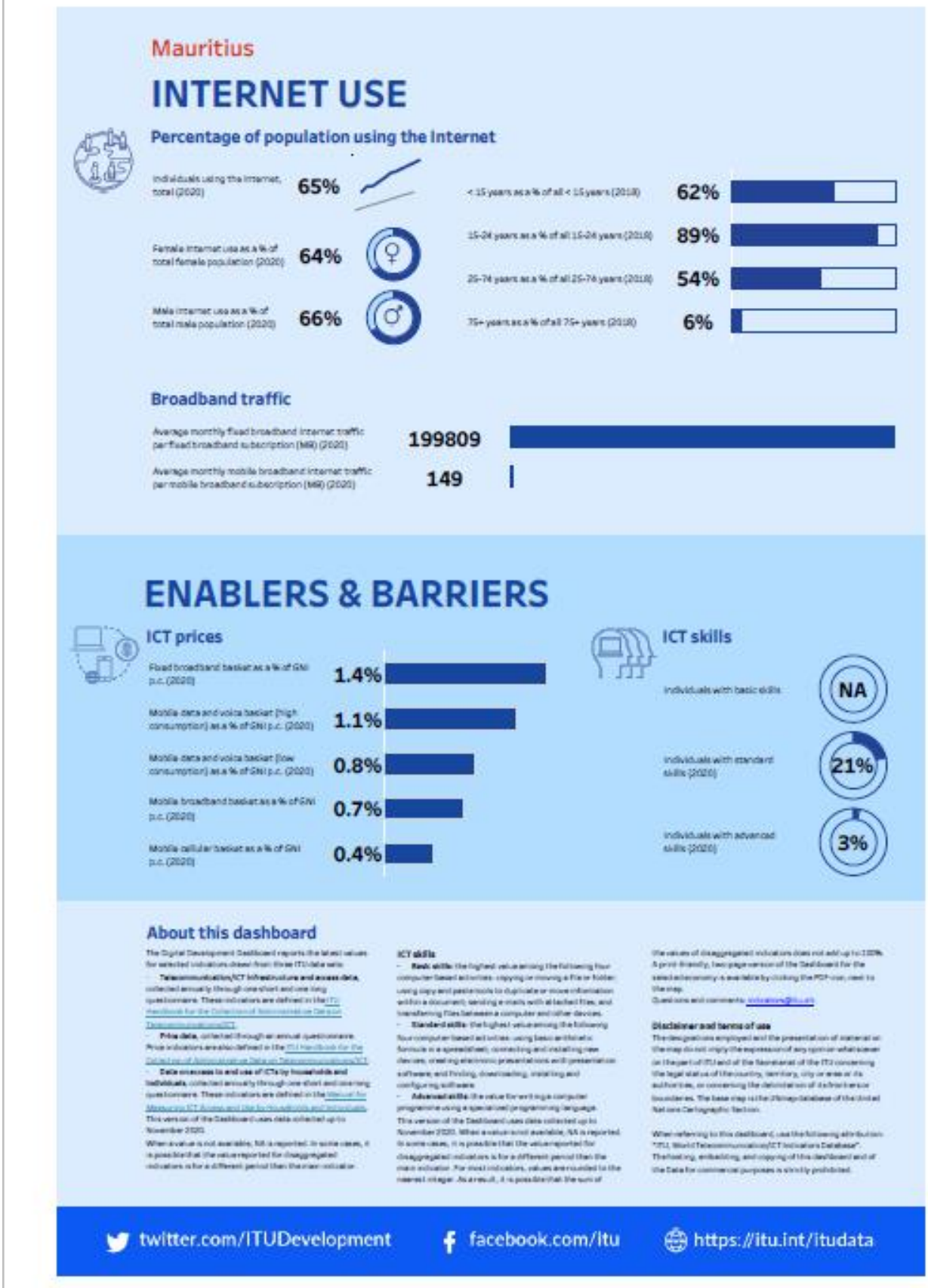
	TOTAL	MALE	FEMALE	
Literacy rate (%)				
15-24 years	99	98.7	99.4	(2018)
15 years and older	91.3	93.4	89.4	(2018)
65 years and older	73.2	93.4	64.4	(2018)

Figure C.8: Literacy/Illiteracy rates

While the literacy rates are consistently high, those citizens above the age of 15 who have low literacy levels or who exited the school system before completion could be the target for distance learning.

ANNEX D: THE PENETRATION OF ICT IN MAURITIUS – ITU DASHBOARD




Mauritius
INTERNET USE
Percentage of population using the Internet
Individuals using the Internet, total (2020)
65%
Female Internet use as a % of total female population (2020)
64%
Male Internet use as a % of total male population (2020)
66%
< 15 years as a % of all < 15 years (2018)
62%
15-24 years as a % of all 15-24 years (2018)
89%
25-74 years as a % of all 25-74 years (2018)
54%
75+ years as a % of all 75+ years (2018)
6%
Broadband traffic
Average monthly fixed broadband Internet traffic per fixed broadband subscription (MB) (2020)
199809
Average monthly mobile broadband Internet traffic per mobile broadband subscription (MB) (2020)
149
ENABLERS & BARRIERS
ICT prices
Fixed broadband basket as a % of GNI p.c. (2020)
1.4%
Mobile data and voice basket (high consumption) as a % of GNI p.c. (2020)
1.1%
Mobile data and voice basket (low consumption) as a % of GNI p.c. (2020)
0.8%
Mobile broadband basket as a % of GNI p.c. (2020)
0.7%
Mobile cellular basket as a % of GNI p.c. (2020)
0.4%
ICT skills
Individuals with basic skills
NA
Individuals with standard skills (2020)
21%
Individuals with advanced skills (2020)
3%
About this dashboard
twitter.com/ITUDevelopment
facebook.com/itu
https://itu.int/itudata

Ushirika wa Maendeleo ya Elimu Barani Afrika
الرابطة لأجل تطوير التربية في إفريقيا
Association for the Development of Education in Africa
Association pour le développement de l'éducation en Afrique
Associação para o Desenvolvimento da Educação em África

Association for the Development of Education in Africa (ADEA)
African Development Bank Group (AfDB)
Immeuble CCIA Plateau, Avenue Jean-Paul II, 01 BP 1387
Abidjan 01, Côte d'Ivoire
Tel: (+225) 27 20 26 39 64
Email: adea@afdb.org - Website: www.adeanet.org

ADEA **@ADEAnet** **ADEA** **ADEA Channel** **ADEA Photos**