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COVID-19 IMPACTS ON DIGITAL EDUCATION IN MAURITIUS: A DIGITAL READINESS ANALYSIS

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Abstract: Institutional, national, and international education community are all, without any exception, facing challenging situations to mitigate the impacts of COVID-19 pandemic on the education systems. Mauritius has taken several important initiatives towards remote learning and distance education in general, to maintain continuity of teaching and learning during COVID-19 related school closures. One such policy initiative is the amendment of the Education Act Bill, to make provision for staffs of educational institutions to produce and conduct distance education and online learning programmes, including broadcast lessons, during temporary closure of educational institutions. However, in line with the bottom-up approach, such policy initiative and its implementation should be informed by baseline empirical data representing the voices of the key stakeholders. This Mauritian study, underpinned by a mixed epistemological stance, is an integral part of the Stockholm University recent Global Online Survey on 'COVID-19 Impacts on Education and Needs for distance education and digital solutions. It analyses the voices of stakeholders, namely students, teachers, managers and policy makers, to (i) situate the country's current digital readiness based on four performance indicators namely accessibility, affordability, readiness /preparedness and effectiveness, (ii) provide empirical baseline data to inform and assist policy makers in developing both during and after COVID digital educational actions, solutions and policies, and (iii) provide a list of recommendations that will assist the educational community in their choice of the most effective and contextualized distance education and digital solutions to reduce or mitigate Digital divide in Mauritius.

Keywords: digital divide, digital solutions, stakeholder voices, COVID-19, online learning

Introduction

The COVID-19 pandemic has and continues to be a great source of tension and disruption to the education systems of many countries around the world including the education system of Mauritius. In fact, since the first three COVID-19 cases were reported on 18th March 2020, the Mauritian government opted for a complete lockdown, which included closures of all educational institutions from primary to tertiary levels, to halt the spread of the disease on the island and especially amongst students. After the first COVID-19 related school closures for more than three months from 20th March to 1st July 2020, educational institutions were reopened as Mauritius was declared COVID-safe with no local cases. However, the resurgence of several COVID-19 local cases in March 2021, marking the second wave of

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the disease in the country, led to a second lockdown from 10th March to 30th April 2021. Though educational institutions reopened on the 1st May 2021 after 50 additional days of closures, staggered timetable was used where students attended schools only two or three days per week to maintain social distancing at classrooms level. However, in spite of all sanitary precautions taken at school level, educational institutions had to close again on the 10th of November 2021 due to increasing COVID-19 death cases and the proliferation of the lethal delta coronavirus variant in the country.

The closures of educational institutions and use of staggered timetable have undoubtedly affected the school calendar and disrupted the usual teaching and learning like nothing else could. Acknowledging this rupture and amid this terrible disruption, the Mauritian government decided to adopt the new normal by shifting from the traditional face-to-face to online education to maintain the continuity of teaching and learning (Mauritian Government gazette, 2020). Consequently, the Education Act was amended to make provision for staffs of educational institutions to produce and conduct distance education and online learning programmes, including broadcast lessons (Mauritian Government gazette, 2020), in line with the recommendations of the Digital Education for All (DEFA), Reaching Out ALL (ROA) and the Sustainable Development Goals 4 (SDG4). Though considered laudable by many, some believe that these digital and remote educational initiatives will widen the gap of digital divide if not properly planned and monitored, furthering social injustice and inequity in the country. Favouring the bottom-up and consultative approach of policy making, this study captures the voices of different stakeholders, including students, teachers, managers/administrators of educational institutions and policy makers, to situate the current digital readiness of the country that will inform policy makers and educational specialists on the way forward towards digital education underpinned by the concepts of digital unite, contextualized digital solutions and quality digital education for all.

Importance of establishing the digital readiness of country's education system

Digital readiness of an education system is defined as the inclination and willingness of the system to switch to and adopt digital technology which create new innovative opportunities so that their goals are successfully achieved (Zalite and Zvirbule, 2020). Education systems, developed on the basis of digital readiness, impart the country's human capital with knowledge and 21st century skills (Damian and Georgescu, 2014, and Horrigan, 2016) that transforms the lay public into skilled and informed citizens capable of facing current and future challenges. Many researchers have even highlighted a significant correlation between the efficiency of the education system of a country with its digital readiness. In fact, analysis of the UNESCO's (United Nations Educational, Scientific and Cultural Organization), OECD's (Organisation for Economic Co-operation and Development) publications and technical documents revealed countries which are highly ranked in international and regional e-learning assessments such as the 'index of readiness for digital lifelong learning', such as China, Singapore, Japan, Canada and Sweden amongst others, have high digital education readiness with well-supported

national ICT infrastructures supporting digital teaching and learning. In contrast, many countries of the world lack the basic digital facilities, and adequate internet penetration which altogether impact heavily on their digital readiness and students' achievement, leading to digital divide.

Moreover, the COVID-19 pandemic with the associated school closures has impacted the teaching and learning in many vulnerable countries around the world and widen the gap of digital divide. According to the World Bank report on Education for Global development (2020), some 1.5 billion students across more than 170 countries have seen their schools closing down during the COVID-19 associated sanitary curfews and confinements to halt the spread of the disease among people and especially children. While countries with high digital readiness have been able to maintain the continuity of teaching and learning by shifting from face-to-face to fully online mode using a variety of educational technology solutions to keep communication and learning spaces as open and stimulating as possible, many other countries have experienced a complete halt in teaching and learning. The paradox is that while the digital readiness seems to be the best way to minimize huge learning losses during conditions of crisis, it also represents a driver of digital divide, equity gaps and social injustice in the world.

As different countries have their own educational specificities and contexts, it is imperative that each country analyze its current digital education readiness, representing key baseline data that inform policy makers and educational specialists on the way forward towards the development of policies and their effective implementation as well as the improvement, monitoring and evaluations plans shaping digital education of the country, in line with the concepts of digital unite and digital education for all.

International Efforts to improve the digital readiness of countries around the globe.

International bodies militating for the improvement of quality education in the world such as the UNESCO, OECD, Room to Read, Education Development Trust, Pearson, World Learning Inc., Education Development Center, among others are all focusing on the improvement of digital readiness of different countries of the world to reduce the digital divide gap between the northern and southern countries and improve digital education in line with the recommendations of the DEFA, ROA, and SDGs, especially the SDG4 which ensures inclusive and equitable quality education and promote lifelong learning opportunities for all. The first dimension of the efforts is to ensure that all students have internet connectivity, allowing them to access online learning materials, educational content and digital teaching and learning platforms such as Zoom meetings, Microsoft Teams, and Google classrooms. The second dimension is to provide fast internet connectivity to all students which is important to support quality online teaching and learning. In fact, though many countries have high internet penetration, speed of connectivity is too slow to support digital education. The third dimension is to decrease the digital use gap which represents the lack of direction, engagement, and motivation of using digital educational platform by the vulnerable groups which include students from poorer socio-economic backgrounds, students of low academic abilities and students not at ease with ICT tools. The

fourth dimension is to reduce the school digital gap, which is the capacities and capabilities of each school to provide individualized or level-based or needs-based digital learning experiences to students. For example, some schools have developed functional digital systems based on innovative digital solutions to provide each student with adapted digital learning experiences, tasks, and feedback so that quality teaching and learning is maintained.

Based on such recommendations, several practices of digital learning have emerged where technologies, pedagogies and guiding values are incorporated (Aparicio, Bacao, & Oliveira, 2016) leading to different forms of online learning. For instance, one form of online learning, such as MOOCs (Massive Open Online Courses) focuses on making premium educational content globally accessible (De Corte, Engwall, & Teichler, 2016), whereas a second form seeks to implement scalable learning-management systems that maximize individual flexibility while supporting optional forms of cooperation (Dalsgaard & Paulsen, 2009; Paulsen, 2008), and a third form which includes those developed within the transactional tradition (Garrison & Archer, 2000), and emphasizes collaborative learning, targeting both the social and cognitive development of participants (Blayone et al., 2017; Garrison, 2017; Swan, 2010; VanOostveen, DiGiuseppe, Barber, Blayone, & Childs, 2016). By integrating the individual and the social dimensions of learning, and foregrounding active participation, open expression, democratic deliberation and collective inquiry, this orientation appears especially well-aligned with the provision of quality digital education. However, to realize meaningful and quality digital education in a particular country, the country's degree of digital readiness should be assessed.

In fact, it is important to understand that though the above-mentioned international bodies have developed policy documents and recommendations to guide all countries of the world, the degree of implementation, monitoring and evaluation is not the same, as each country has its own sets of specificities and have different inputs or starting loads. This explained why the 'one size fits all' approach has been failing in several countries. It is therefore imperative to understand and develop a clear picture of the digital readiness of each country, based on the voices of the different stakeholders, to act as baseline data informing policy makers and educational specialists on the way forward towards quality digital education.

Pre-COVID digital education status in Mauritius

The pre-covid status of digital education in Mauritius can be precisely expounded on the basis of the report 'Digital education in Mauritius: A Ministry perspectives' by Auckbur (2012). The report highlighted that despite government and the Ministry's (Ministry of Education) commitment and initiatives taken for digital education in Mauritius, teaching and learning is still (i) dependent on full-time class attendance, (ii) based on traditional print-based and white/black board delivery, (ii) traditional with little use of ICT in delivery and access to information. In fact, some of the initiatives taken by the Ministry for digital education are (i) the provision for increasing the use of digital platform,

tools and contents in Primary Schools, (ii) public investment programme to equip all primary schools with computer rooms and secondary schools with computer labs, (iii) expanding the culture of e-Education by providing trainings at all levels in schools, (iv) supporting para-statal bodies, such as MIE (Mauritius Institute of Education), MGI (Mahatma Gandhi Institute) and MES (Mauritius Examination Syndicate) in expanding the sector, (v) improving performance with extended capacity-building programmes and recruitment of support staff, such as ICT Support officers in all primary schools and ICT technicians in Zones, (vii) the development of 'Sankore project' for digitization of classrooms at primary level, and (viii) tablet PC project to provide students with tablets with academic content. Though the country has been investing heavily to provide the basics for digital education in Mauritius, the target of transforming the system for digital education has not been reached due to several challenges such as the need for continuous training to update stakeholders in new technologies and digital content, heavy capital investment, high maintenance costs, obsolescence of equipment, need for legislation in OERs (Online Educational Resources), and most importantly resistance to change and lack of motivation to use ICT tools at classroom levels.

COVID-19 pandemic as a driver for digital education in Mauritius

In addition to the economic downturn, the Covid-19 has actually confined students and teachers to their respective homes halting the usual teaching and learning like nothing else could. In fact, as a measure to halt the spread of the disease in the island and especially amongst students, the Mauritian government had to resort to measures such as limited access to educational institutions, schools' closures and use of staggered timetable where students attend schools only two or three days per week to maintain social distancing in the classrooms. This led to important changes in school calendar with the 2020 academic year lasting 18 months instead of the regular 10 months. Atchia (2021) highlighted that the extension of the academic year has severely impacted on students' psychological balance, motivational level, stress index, academic outputs, and admission to universities for further studies. The pandemic has actually impacted and disrupted all levels of the education system from pre-primary to tertiary where all stakeholders including policy makers, educational specialists, administrative of educational institutions, academics, parents, students and the community at large are all struggling to make sense of and adapt to what is increasingly becoming our "new normal".

Though it is legitimate that in such incertitude our minds are still swaying back and forth longing for a return to "normality" and refusing to acknowledge the rupture, the latter exists. And amid this terrible despair, the pandemic situation has offered us a chance to reflect and rethink our education system along these justifiable questions: Do we wait for a return to normality, or do we adapt and adopt a 'new normal'? Do we wait for the eradication of the disease, or do we plan alternative ways to mitigate the impacts of school closures? Do we resume to the traditional face-to-face interaction as a post-COVID strategy, or do we go for enhanced digital education, contextualized digital solutions, and digital unite?

The Mauritian government, through the Ministry of Education (MoE), has actually opted to adapt to the new normal by adopting relevant contextualized digital and remote education to maintain the continuity of teaching and learning (Mauritian Government gazette, 2020).

To shape this new normal in the education sector and ensure a shift from traditional to remote and digital education, the Mauritian Government amended the 1957 Education Act in line with the COVID-19 (Miscellaneous Provisions) ACT 2020. The amendment makes provision for staffs of educational institutions to conduct online distance education and produce 'Digital Educational resources (ODERs)' such as video lessons to be broadcasted on the National TV. To concretely implement these policies, the Ministry of Education (i) issued circulars to educational institutions in all layers of the Mauritian education system including pre-primary, primary, secondary and tertiary institutions to engage in remote and online teaching and learning, (ii) mandated the Mauritius Institute of Education (tertiary education institute specialised in teacher training, curriculum development and educational research), the Open University of Mauritius (private university with much experience in broadcasted programmes) and the Mahatma Gandhi Institute (specialised in Asian languages) to produce video lessons to be broadcasted on the national TV (Mauritius Broadcasting Corporation) as a mean to cater for students who do not have internet connectivity, (iii) approved to give 2572 tablets to children under the Social Register of Mauritius (SRM) for poor households, (iv) allocated one channel of the National TV to broadcast video lessons for all subjects taken at grade 1 to 9 levels, with different timings respectively for each grade, (v) training of teachers/educators to use online teaching and learning platforms such as Microsoft Teams to engage grade 10-13 students, (vi) designed a digital space for all parents and teachers to have safe interaction and communication so that queries of parents and pupils having difficulties are cleared, (vii) maintained the Cambridge International Examinations (CIE) School Certificate (SC) and Higher School Certificate (HSC) despite the second wave of the pandemic, but promoted students of grades 1-5, 7,8, 10 and 12 to the next grade, to avoid further disruptions and grade stagnation, amongst others.

In addition to ensuring the shift towards remote and online teaching and learning at pre-primary, primary, secondary education levels through the above-mentioned policy and implementation initiatives, the MoE also facilitated the shift at tertiary level. In fact, 23 out of 41 institutions reported that they had ongoing lecturers during the lockdown periods using different online platforms ranging from Zoom meetings, Microsoft Teams, Google classroom among others. Most of the tertiary institutions also adopted online examination systems, assignments, and open-book examinations to prevent further extension of semesters especially for the final year students to avoid any career and socio-economic implications.

However, all these initiatives have been taken in a top to bottom approach without neither considering the current digital readiness of the country nor the implications that the initiatives may have on the

digital divide in the country, due to the unexpected struck of the COVID-19 pandemic. This study therefore captures the voices of different stakeholders to situate the current digital readiness of the country. The data generated in the study are key as it represents important baseline data that inform policy makers and educational specialist of the way forward in the planning and implementation of digital education in Mauritius.

Research questions

The research question guiding this study are: (i) What is the current status of digital education, in Mauritius, based on key performance indicators namely accessibility, affordability, stakeholders' readiness and effectiveness, (ii) What are the possible actions that may be implemented to improve digital education in Mauritius?

Theoretical Framework

Analysis of the literature revealed that assessment and profiling of digital readiness of education systems for online teaching and learning is an international research domain, where numerous digital readiness models (Alaaraj & Ibrahim, 2014; Darab & Montazer, 2011), instruments (Dray, Lowenthal, Miszkiewicz, Ruiz-Primo, & Marczynski, 2011; Hung, 2016; Hung, Chou, & Chen, 2010; Lin, Lin, Yeh, Wang, & Jansen, 2015), and empirical studies, have been set in a variety of national contexts (Aldhafeeri & Khan, 2016; Chipembele, Chipembele, Bwalya, & Bwalya, 2016; Gay, 2016; Parkes, Stein, & Reading, 2015; van Rooij & Zirkle, 2016). Researchers generally adopt either a macro-level perspective, addressing the readiness of organizations, countries, and regions (Beetham & Sharpe, 2007; Bui, Sankaran, & Sebastian, 2003), or a micro-level perspective, focused primarily on classroom, teachers, and students (Dray et al., 2011; Parkes et al., 2015; Gay, 2016; Hung, 2016).

As far as the macro-level perspectives of assessing country's digital readiness of the education system is concerned, different underpinning frameworks have been used as per context requirements. For instance, the Technology Acceptance model (Davis, 1989) used to measure the adoption of new technology for digital transformation focusses on users' perceived usefulness, attitudes towards use, and perceived ease of use whereas the 'digital Media readiness framework of the World Economic Forum (Nasution, Rusnandi, Qodariah, Arnita and Windasari, 2011) assess digital readiness of education system in terms of capacity and environment using indicators such as digital infrastructure, accessibility, affordability and skills capacities in addition to legal, and educational environments.

This study adopts the macro-level perspectives where the voices of different stakeholders, namely teachers, managers/administrators of educational institutions, students, and policy makers are captured to understand the country's current digital readiness, through the use of performance indicators such as accessibility, affordability, readiness and effectiveness, underpinned by the e-readiness assessment model (2016), the technology readiness index (Yarbrough and Smith, 2007), the digital media readiness

framework (Nasution et al., 2011) and the e-learning readiness model (Kilani and Awad, 2017). Though underpinned by these frameworks and models, this study generates a contextualized model of country's digital readiness, focusing on a specific set of performance indicators.

Methodology

Backed by a mixed epistemological and ontological stance, this study forms part of a larger international study which captures the voices of different stakeholders namely teachers, managers, students, and policy makers from 104 countries of different regions of the world, including Mauritius. The larger study 'COVID-19 Impacts on Education and Needs for distance Education and digital solutions', housed under the 'Stockholm University, Sweden', comprise the development and implementation of an online survey questionnaire which captures the voices of different stakeholders on key performance indicators developed jointly by the focal persons of the participating countries. The global online survey features as one among the many other research initiatives to shed lights on the need for relevant and most appropriate educational policies, strategies, and modalities to better address the impacts of COVID-19 on education and the need for contextualized distance education and digital solutions.

In fact, educational actions reaching down the everyday learning-teaching contexts and conditions locally, nationally, and globally cannot be treated in the total absence and isolation of the direct voices and concerns from those actual beneficiaries, partners, and targeted audience of our educational sector, from primary/basic up to the higher/university levels. The global online survey serves this very purpose in collecting the most updated and relevant empirical information and data on country's current digital readiness and on the impact of COVID-19 on education to inform international and national policy makers on the way forward towards contextualized digital education.

Sample

The sampling procedure was developed on the basis involving focal persons, representative of their respective countries, to coordinate the dissemination and implementation of the global online survey questionnaire. The focal persons were selected educational professionals and researchers forming part of the 'community of practice' developed under the aegis of the 'Department of Computer and Systems Sciences and the Department of Education' at Stockholm University, Sweden. Altogether 104 countries responded positively, including 31 African, 20 Asian, 31 European and 22 countries from other parts of the world. Participants of the global survey are representatives of the different levels of their country's education system ranging from schools to tertiary levels. They were recruited on a volunteer basis taking into consideration the COVID-19 pandemic prevailing situation. A total of 12,676 participants including 680 Mauritian successfully completed the online survey questionnaire, which included both Likert-scale Multiple choice and open-ended questions to capture both qualitative and quantitative data. After piloting with some 500 persons and translated into 10 different languages (English, Chinese, Slovak, Czech, Swedish, Thai, Portuguese, French, Gulgarian and Arabic), the

instrument was amended accordingly. For instance, the negatively worded items were reversed by transforming and recoding into the same variables.

Data Analysis

The quantitative data were analysed using SPSS and AMOS for the descriptive analysis and development of the SEM, whereas the qualititative data was analysed using the MAXQDA 11 software to code and identify the overarching ideas and key statements.

As long as the quantitative data preparation and analyses were concerned, the data once inputted in SPSS were (i) verified using descriptive statistics analysis to identify input errors and then cleaned, (ii) checked for accuracy and reliability of the items using the reliability estimates, (iii) tested to ensure that data were in line with the assumptions for structural equation modelling, such as normality, multicollinearity, autocorrelation, and homoscedasticity, (iv) analysed using descriptive analysis, crosstabulations, correlation, and (v) analysed using factor analysis to eventually generate and test a simple Structural Equation Model which depicts the correlations between the independent variables(accessibility, affordability, readiness and effectiveness) and the dependent variable (Country's digital readiness).

In fact, the SEM was used because it integrates several different multivariate techniques into one model fitting framework, and it is an integration eventually of measure theory, factor (latent variable) analysis, path analysis, regression, and simultaneous equations among others. It is particularly suitable when it involves complex, multi-faceted constructs that are measured with errors as it makes provision for the correction of the said errors.

Findings and discussions

The findings and discussions are organized in terms of the 'participants characteristics', 'participants voices based on the performance indicators', the 'SEM depicting the country's digital readiness' and finally the 'recommendations' for improving digital education in Mauritius.

Participants Characteristics

Plate 1 shows the characteristics of the 680 Mauritian participants who participated in the global survey in terms of location, gender, educational levels, age and voices.

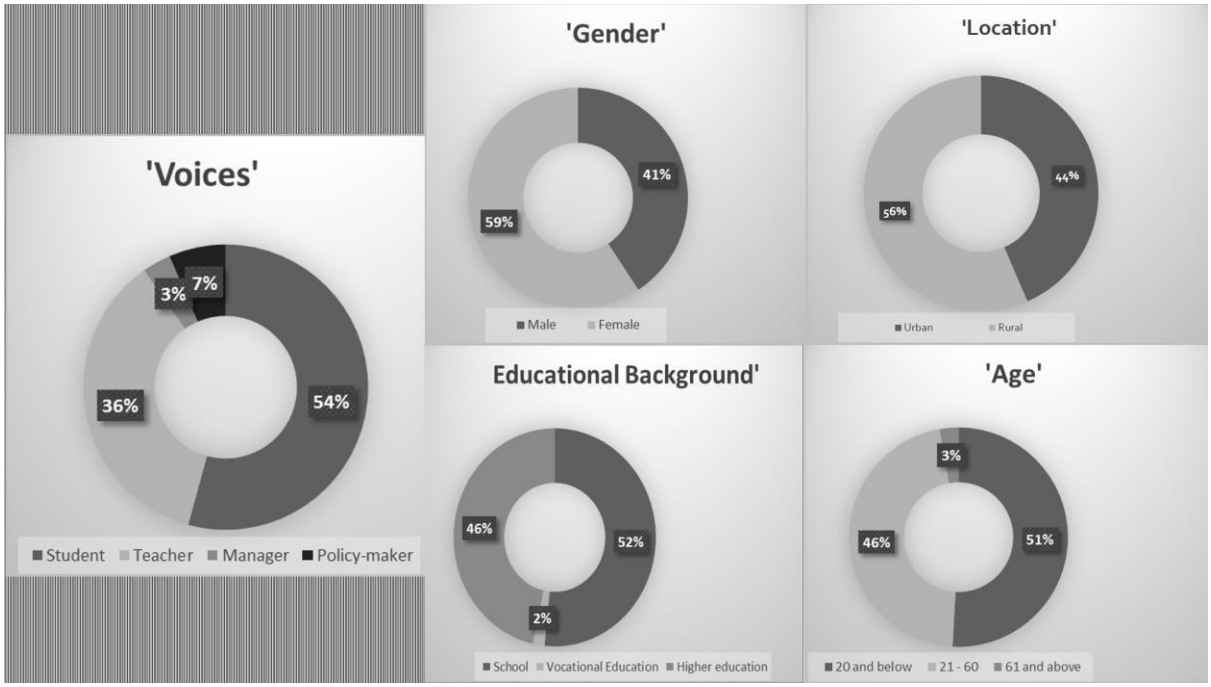

Plate 1: Participants' characteristics

Plate 1 shows that the characteristics of the sample corroborate closely with the demographic characteristics of the Mauritian population in terms of gender, location, age, and educational background. In fact, the Mauritian population comprises of slightly more women (51%) than men (49%), a higher percentage of people living in the rural areas (59%) compared to urban areas (41%), a larger proportion of the current education-related population aged 20 and below, followed by 21-60 and fewer above 60 years old. In addition, most of the current education-related population in Mauritius has a post-secondary qualification, followed by those having up to secondary level and only few having vocational qualification. The sample is also representative of the ratio of the different key stakeholders of the Mauritian education system comprising students, teachers, managers and administrators, and policy makers. The corroboration of the sample characteristics with the current population characteristics is key to ensure the reliability and validity of the voices.

Participants' voices based on the performance indicators'

Plate 2 presents the analysis of the voice of the Mauritian sample on the country's accessibility, affordability, readiness or preparedness, and effectiveness of digital education is Mauritius.

Accessibility

Though more than 40% of the sample believe that we have enough skills for Digital Education (DE), less than 20% believe that we have enough online learning content, support, and an efficient online

system. These findings were also supported by the following statements captured in the qualitative analysis.

"Among the loads of online materials available on the net, the best quality contents are not free or are of limited access."

"Though online materials for teaching and learning of concepts are at a finger touch on the net, there is no proper online systems to centralise the contents to cater for the needs of teachers and students"

"…the interesting and high-level online contents such as virtual laboratories, digital books and educational software are far from free. These costs a lot and is thus accessible only for the students of high economic status but not accessible to me"

"Though the students of this generation are considered as the digikids with high online skills, this is not true for everyone and surely not for those from the lower socio-economic status who do not even have a proper internet connectivity"

"Some have more access, more support and more online materials than the others. This is the reality of being poor"

"Though a lot has been done by the Mauritian government to improve access to online materials, we are still far from other countries in terms of DE and access to online learning"

"As a student, I faced a lot of difficulties during online sessions and needed support. This I don't like it was readily available and paradoxically we keep hearing about digital quality education for all. I often reflect on this, and I now think that these are slogans for the rich"

In fact, the current high school or university cohort is often referred as the 'digital natives' or the 'net generation' cyberkids' who, it is claimed, have appreciably different learning styles and more of an affinity for digital learning than previous generations of students (Pesce, 2009; Prensky, 2004; Toledo, 2007). However, having skills is not the end of the process especially when accessibility to online materials is compromised for many. In fact, researchers like Bennett, Maton & Kervin (2008), Kennedy, Judd, Churchward, Gray & Krause, (2008), Margaryan & Littlejohn (2008), and Oliver & Goerke, 2007) have highlighted that not all students have access to the technological devices that young people are supposedly universally using and those with access are not necessarily using them for educational purposes. According to Owens (2004) it is not the so-called digital natives making the most use of ICTs, rather it is professional adults, and the highest usage of the internet is among 35-44 years old. Thus, to improve the digital education in Mauritius and prepare the workforce of the future based on the values of inclusivity and equity, all students should be given access and support based on their receptive needs. The spawning of Digikids into the future workforce with knowledge, skills, attitudes, and values can only be shaped by providing the proper online systems, support and access to people based on needs requirements.

Affordability

Plate 2: Participants' voices on the accessibility, affordability, readiness/preparedness and effectiveness of Mauritius in digital education

Though more than 75% of the participants believe that the use of online or remote teaching and learning significantly saves time, less than 60% believe that digital education is cheaper compared to traditional education, internet quality in Mauritius is good enough for DE, and that internet costs are affordable in Mauritius. These data are supported by the following key statements captured in the analysis of the qualitative data.

"Online and remote learning significantly cuts on the cost of transport to and from schools and tuition"

"As Mauritius is a small island with a heavy vehicle load, movements from home to school and vice versa, especially in peak times, consume a lot of teachers' and students' time. However, with online teaching in the comfort of our houses, we have more time and are less tired. We therefore make better use of the afforded time for quality learning'

"Though I agree that the cost of basic internet connectivity is affordable, good quality connection is still very expensive in Mauritius compared to other countries. Though my parents can afford the cost of high internet connectivity, many of my classmates cannot afford a proper connection"

"Some families cannot afford IT materials and proper internet connectivity needed for online teaching and are thus have no other options that viewing video lessons being broadcasted on the TV, without the active interaction with the teachers. These students are being left behind"

"Some families have multiple wards simultaneously doing online classes. Many cannot afford individual rooms or space and individual ICT equipment (e.g laptop or PC) for each ward. DE is really not affordable for such families"

"Internet connectivity becomes very low when we have multiple users, which is common for many Mauritian families"

"Not all teachers can afford good internet connectivity. A connection allowance could have been provided to ensure quality teaching"

There is an increasing demand of online learning in the world (Arthur-Nyarko and Kariuki, 2019) including Mauritius, especially in this COVID-19 pandemic situation (Atchia and Rumjaun, 2021). However, many researchers believe that online and remote learning is still not affordable in many countries. For instance, Beamish, Armistead, Watkinson, & Armfield (2002), Ono (2005), Cutler, Hendricks & Guyer (2003), Henderson (2005), Gillingham and Molinari (2012), and Cheah & Chun (2013) supported that learners' financial position and socio-economic status are positively correlated with affordability of ICT equipment and their use in online teaching and learning. They expounded that student who can afford higher levels of access to digital devices such as computer, smartphones, tablets, and the Internet would respond positively to eLearning delivery and the opposite is equally probable. This is further supported by Zhao and Frank (2003) and Al-alak & Alnawas (2011) who stated that the lack of Internet and ICT equipment from home are the main barrier to the use of technology in the teaching and learning process.

Readiness/Preparedness

Less than 26% of the participants believe that teachers, students, and the country are currently prepared for distance education and online teaching and learning. Participants expounded their views with the following statements derived from the qualitative data collected through the questionnaire.

"As an officer mandated to scrutinize the engagement of teachers in providing quality online teaching experiences to students, my take is that some teachers are genuinely doing a professional and excellent job. However, many others are not well-prepared and have adopted a fire-fighting approach awaiting the end of the pandemic to shift back to traditional face-to-face teaching"

"Google classrooms, Zoom meetings, Microsoft TEAMS and WhatsApp are most commonly online platforms being used by teachers in Mauritius. In fact, some teachers are well versed with the online educational technology and online platforms providing students with enjoyable and fruitful learning experiences. Few science teachers are even using virtual laboratories such as Praxilabs, Labster and NCBioNetwork Microscopy to compensate for the lack of the physical practical work"

"Though most of the educators have the ability to use online platforms, many need to improve on online pedagogy"

"Though the government has invested a lot in setting computer labs in primary and secondary in Mauritius, not much has been done in the field of Online teaching and learning. Equipping schools with ICT equipment is important but is surely not the digital solutions needed to adopt online teaching"

"Distance or online teaching and learning happened as an emergency to maintain the continuity of teaching and learning during the COVID-19 related school closures. The country was not prepared for this."

"Contingency programme has been set overnight, where schools, teachers, and students were neither prepared nor ready to adopt an overnight shift from the traditional face-to-face to online teaching and learning."

"From my interaction with the main TVET public institutions, practically all training are done using the face-to-face mode. Hence, it was difficult to shift to online learning for many reasons, such as, teachers were not trained, logistics were not there, teaching materials are not available, the courses are practical-based."

"The Government has amended the 1957 Education act to ensure online teaching and learning and remote learning take place in the country during school closures, more policies are needed to plan De and online teaching and learning"

Readiness/Preparedness to shift from face-to-face to online teaching and learning entails prior preparation at government, institutional, community, teachers, and students' levels, else the shift is doomed to failure. In fact, Martin Weller (2020) rightly pointed out that without the necessary support or development required, in such a small timeframe, teaching online with little or no experience is likely to be frustrating and full of potential errors, which makes teachers and students feel vulnerable. Koh et al. (2010), Herrington et al. (2010), Fook et al. (2011), Edris (2020), Rapanta et al. (2020) not only highlighted the needs of prior preparation at country, institutions and individuals levels, but also stated that the success of shifting to online learning is dependent on (i) the setting-up of an e-learning orientation course that explained how to use Learning Management System (LMS) and outlined the best practices for learning online, (ii) train teachers on the different functionalities and pedagogical opportunities of an e-learning platform before they embark on online teaching, (iii) train teachers on the use of alternative pedagogies such as authentic e-learning and project-based learning, and (iv) prepare online-based pedagogical content knowledge (PCK).

Moreover, Bates (2020), Weller (2020), Czerniewicz (2020), Kanwar & Daniel (2020), Bonk & Wiley (2020), and Luthra &Mackenzie (2020), in line with Gilly Salmon's five-phase model (Salmon, 2013), have highlighted the need of supporting novices in online teaching and learning in terms of (1) access and motivation; (2) development of online socialisation; (3) information exchange; (4) knowledge construction; and (5) development of understanding. Actually, the literature fully support the need of

countries, teachers' and students' preparedness, as highlighted in this study, for the successful shift from the traditional face-to-face to online mode.

Effectiveness

Less than 35% of the participants believe that the current online teaching and learning in Mauritius is effective in sustaining or improving students' engagement through learning tasks, students' learning, examinations, communications between students and teachers, and teacher-students' interactions. These quantitative data is supported by the following statements highlighted by the participants.

"Many teachers need to improve on online pedagogy so that online lessons become more engaging and less boring"

"Most of the teachers have adopted a teacher-centered lecture approach for online teaching. Even those teachers who generally engaged students in constructivist tasks during face-to-face sessions have adopted the traditional lecture approach for online teaching."

"Some teachers and students are not at ease with online teaching and learning. There is a need for training. For some teachers, sending notes by WhatsApp and mail is considered as online teaching"

"While some teachers are very dedicated and took the lead by self-studying and training themselves on the use of innovative online pedagogy to provide quality online experiences to students, others remained in their comfort zone with traditional lecture"

"In line with the concept of differential instruction and pedagogy, there is a need to cater for students' specific needs instead of mass online lecturing. Online education should be considered as an emergency shift at the detriment of quality teaching and learning. Online teaching and learning should be as effective or even more effective than face-to-face mode. This is surely not happening in most cases in Mauritius"

"As far as examination is concerned, online mode has been a real fiasco in Mauritius at all levels from primary to tertiary. In most cases, examinations have either been cancelled. In fact, most grades from grade 1 to 13 have been cancelled, instead of shifting to contextualised 'Online Learning Assessment system'"

"There is a real need to develop a contextualised online assessment mechanism in the education system"

These findings are backed by several researchers such as Ramkissoon, Belle & Bhurosy (2020), Sannegadu, Seethiah, Dookhony, Gunesh & Jagessur (2018), Kattoua, Al-lozi & Alrowwad (2016), Tarhini, Hone & Liu (2014), Al-Adwan et al. (2013), Shroff et al. (2011) and Cgaran & Pavri (2004) who showed that if not properly planned and stakeholders not properly trained, online teaching and learning cannot be effective. Qadir (2020) explained that effectiveness of online education depends on setting the proper mechanism that ensures that quality, inclusiveness and equity imperatives of online

teaching and learning are improved and at no point compromised. However, the findings of this study show that online teaching in Mauritius is more of a contingency plan to maintain continuity of teaching and learning during school closures rather than a well-planned system based on the mentioned imperatives, as highlighted by the participants. The outcomes of this study actually align with the findings of Sannegadu et al. (2018) who showed that the adoption of innovative mode of e-learning is still limited in Mauritius due to the lack of learners' self-efficacy and teachers' attitudes and intentions of teachers to the use of online system.

As an extension of the graphs presented in plate 2, plate 3 details of the voices of the different stakeholders on the items and performance indicators accessibility, affordability, readiness/ preparedness and effectiveness of online education in Mauritius.

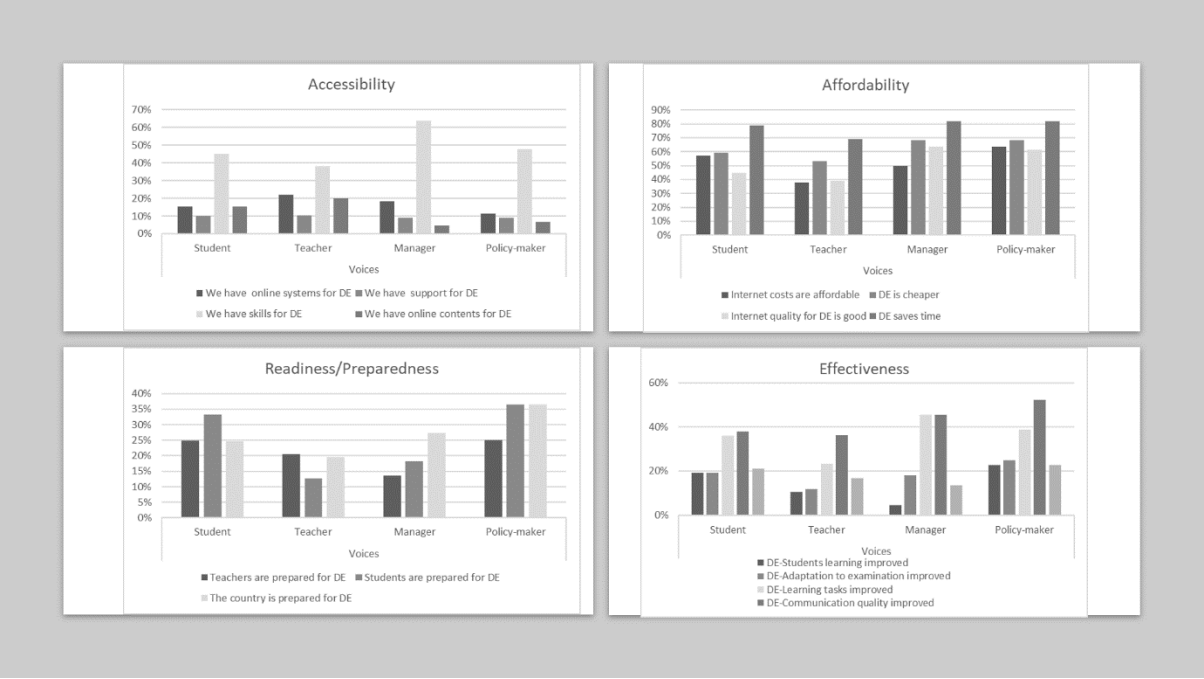

Plate 3: Voices of stakeholders on accessibility, affordability, readiness/preparedness and effective of online education in Mauritius.

The graphs in plate 3 focus on the contrasts between the views of one stakeholder as compared to others on each item of the questionnaire. The following is a list of discrepancies where significant differences (at 5% level) have been noted between the different groups of participants, that is students, teachers, managers, and policy makers. Appraisal of these divergences in opinions are key as it allows stakeholders to reflect on their current roles to plan the way forward towards the improvement of DE in Mauritius.

- As far as accessibility is concerned, though 64% of managers or administrators agree that we have enough skills for distance and online education in Mauritius, only 38% of teachers share the same views.

- As far as affordability is concerned, despite 60% of managers and policy-makers highlighted that internet quality is good for distance and online education in Mauritius, most of teachers (61%) and students (55%) who are at implementation level do not share the same views.
- As far as readiness or preparedness is concerned, there is significant differences between the views of teachers and managers with 13% and 18% compared to students (33%) and policy makers (36%) on students' preparedness for distance and online education.
- Though 36% of policy makers believe that the country is prepared for distance and online education, a significantly lesser percentage (less than 25%) of teachers and students share the same views.
- As far as effectiveness is concerned, there is a much lower percentage of managers (5%) who believe that online and distance education improve students' learning compared to the other stakeholders (more than 10%).

Analysis of these data reveals that the views of the stakeholders differ significantly on some aspects of distance and online education. The divergences noted between those at policy making and administration levels compared to teachers and students at implementation levels depict that there is a communication deficit, which evidence the top-down approach of policy making in the country, where the voices of all stakeholders are not taken onboard. Researchers, such as Charles Goodhart (1984), Corbett and Wilson (1990), Sarason (1990), Fullan (1994), Head (2008), Hogan, Sellar, & Lingard (2015), Seriawan (2020) and Rumjaun, Atchia and Weiss (2021) have all highlighted the need of using baseline data representing voices of stakeholders in policy making to improve education.

SEM depicting the country's digital readiness

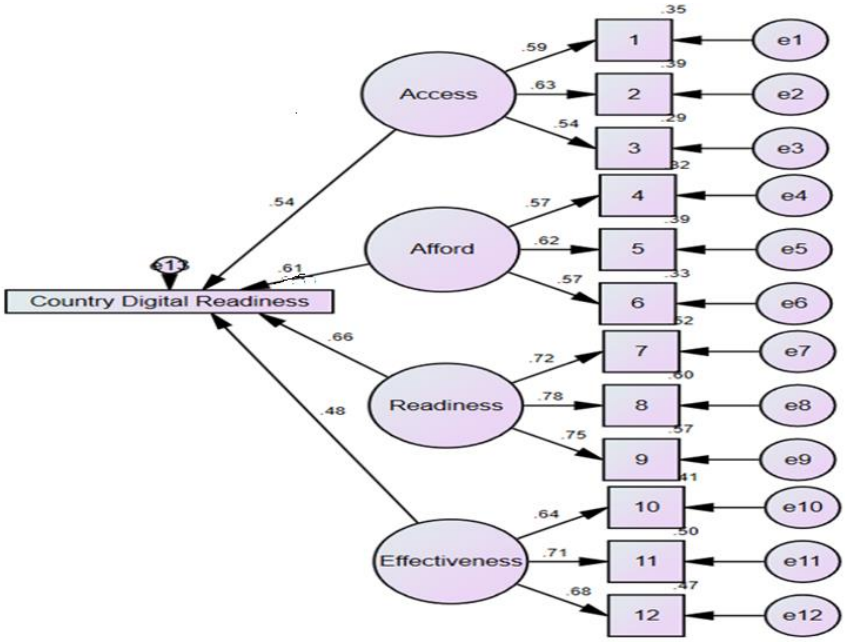

Figure 1: Structural Equation Model (SEM) depicting the digital readiness of Mauritius

Figure 1 is the Structural Equation Model generated using the Amos software to showcase the discrete and cumulative impacts of the independent variables, namely accessibility, affordability, readiness/preparedness, and effectiveness on the dependent variable (country's digital readiness). In fact, based on the relevant literature, each independent variable was represented by three items (observed endogenous variables) with the highest factor loadings.

The fit indices show the goodness of fit of the SEM where the test yielded a good Chi-square value with a significant P-value of Chi-square (p=0.000). Moreover, the value of the CFI, GFI and NFI are 0.970, 0.951 and 0.959 respectively and thus more than the minimum required value of 0.95. In addition, the AGFI value is 0.905 which fits within the acceptable range of $0.90 \leq AGFI \leq 0.95$. The value for RMSEA is .044 where the acceptable value should be less than 0.05. We may therefore conclude that the proposed structural model exhibits a good fit. In this model, where the one-way arrows show the causal relations between the endogenous independent variables and the dependent variable, preparedness (readiness), affordability and accessibility have the highest causal effect of 0.66, 0.61 and 0.54 on country's digital readiness as compared to 0.48 for effectiveness. However, all the 4 performance indicators equal to or above 0.48 have a p-value of 0.000 for the regression weights and thus significant. This SEM does not only show the correlations between the performance indicators on the dependent variable, but also shows through the highest loading where the Mauritian Government need to focus its priorities and policies to bring improvement of distance and online education based on the voices of stakeholders.

In fact, the data depicted in this section potentially inform all stakeholders of the strengths and limitations of the current digital and online education system in Mauritius. These findings represent key baseline data that inform policy makers and educational specialists of the way forward to improve digital education in Mauritius.

Recommendations to improve distance and online education in Mauritius

The effect of the COVID-19 pandemic on the education system has been double-faceted where on one side it has shaken the very foundation of the education system around the world leaving us in a vacuum of uncertainty, and on the other side it has ignited the need to reflect on our current education system to prepare our new normal.

The following recommendations have been strongly advocated by the participants (students, teachers, administrators, and policy makers) as the way forward towards digital education while reducing digital divide and inequality so that new normal is underpinned by fairness, equity, and social justice.

- The setting up of an appropriate system by the concerned ministry to identify and create a profile database of all vulnerable students' victim of access divide, use divide and quality-of-use divide.

- Democratisation of technology by the government which refers to the process by which access to technology become accessible to more and eventually to all people of the country.
- Access to big data, fast internet connectivity, mobile penetration, technological tools/equipment, and expertise, both business and technical, should be made accessible to each and everyone.
- Government should create a special fund used to provide students of the vulnerable groups with free technological access, equipment, and training based on a need analysis.
- Provide equitable distribution of technological support to students based on their needs.
- The authorities should ease the bureaucratic procedure to provide the necessary technological support needed by the students of the vulnerable groups.
- The concerned ministry should provide shareable private space on public cloud, creating a safe and secure cyberspace.
- Development and provision of all policies and actions plans, pertaining to the improvement of digital education in the country should be data driven. The government needs to set the necessary mechanisms based on the bottom-up approach where baseline data representing the voices of all stakeholders become the drivers of policies.
- Distance and online teaching and learning cannot happen as an emergency as contingency programme, put in place overnight during school closures, is not efficient. There is a need to have pro-active well-planned improvement, monitoring and evaluation plans to implement the shift from traditional face-to-face to online or blended teaching and learning, underpinned by contextualized data analysis and literature"
- Prepare contextualized plans for students of the extended programme and TVET who may become the victims of digital divide"
- Training of teachers for online education should be the priority. Teachers should be trained in using (i) innovative and creative online pedagogy based on students-centered constructivist approach, (i) online platforms, (iii) appropriate motivation and online students' engagement strategies and techniques, and(iv) preparation of online-based resources.
- Teachers should be given free internet connectivity and ICT equipment and should be made accountable.
- Science teachers should be trained on the use of virtual labs, virtual reality, augmented reality in the teaching of sciences, that is, chemistry, biology and physics"
- Teachers' improvement in online Teaching and Learning should be monitored, evaluated, and most importantly supported through needs-driven continuous professional development plans.

- Provide massive continuous (not one-off) digital education programme for teachers and students so that both parties become well versed with the use of online and remote teaching and learning.
- Creation of a community of practice involving representative of all stakeholders of the Mauritian education system to facilitate communication and to adopt shared decision makings.
- Initiate mechanisms at the level of the Quality Assurance and Inspection Division to identify teachers' limitations in using online teaching and learning to organize or provide the necessary support.
- Develop national and institutional online examination and assessment system.
- Provision of high quality Continuous Professional Development to teachers and other developers involved in video production
- Setting up of a group of specialised Subject Matter Specialists (SMEs) and technology experts to supervise the production of high-quality videos.
- Setting up of a feedback mechanism that would feed field intelligence from the students into policy development.
- Set up of a mechanism to detect the personal circumstances and level of preparedness of all stakeholders to embark on distance education. Research in this field should be maximized to improve DE in Mauritius. Funding should be made available through MRC (Mauritius Research Council) HEC (Higher Education Commission) to support such research.

Conclusion

The COVID-19 pandemic has undoubtedly disrupted the health care system, economy, society, and education system of Mauritius beyond all anticipations. However, drawing from Arundhati Roy's (Suleman, Mohamed and Ahmmed, 2020) concept of the "pandemic as a portal", COVID-19 has been a driver of reflection, re-imagination, and reconceptualization of education in Mauritius. Though the digital initiatives taken by the government to maintain teaching and learning despite school closures has been an emergency crisis response, there is a need to now scaffold from these enterprises to prepare the way forward where the focus is on digital unite, education and technology democratization, fairness, equity, and social justice. The data and recommendations from this empirically based paper are key in informing the government and policy makers on the way forward towards a digital education for the people and by the people.

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