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Editorial

In April 2020, author Arundhati Roy described the Covid-19 pandemic as a portal or a doorway to the future. She wrote, “Historically, pandemics have forced humans to break with the past and imagine their world anew”. In this instance, the viral spill-over from animals to humans causing severe human disease sent us a powerful message. If we continue to encroach on natural ecosystems and destroy diversity of habitats, these systems can breakdown causing devastating consequences. Do we continue with business as usual, promoting living in overcrowded cities and frequent long-distance travel? Is there a different way to see the world and to live in it, and to live well together, in harmony between people and with the natural world?

The digital transformation or the new normal for education systems began not only with Covid-19 forcing education systems to go fully online, but with how education is experienced by students, some of whom were taking to the streets, boycotting school, in waves of protest marches to chant or to demand that they have a right to a liveable future and to fulfilling jobs. They are making us question, what it means to be human, how to lead a meaningful life, how to live ethically. They are demanding us to consider the well-being for all life, and to protect the planet for future generations.

Traditional models of education may be insufficient to meet the changing needs of society and the economy. Lifelong learning, retraining and upskilling throughout the lifespan may become the new model of education; as what is learned today may be irrelevant within a decade, in the digitally and environmentally transforming world.

Afnan Nizam and Fathimath Saeed’s case study of online teaching and learning in a secondary school in Male’, Maldives during the corona virus pandemic demonstrated that teachers need extensive training to do self-regulated online learning, and to have the language proficiency to do so, if they are to fully utilise the benefits of digital education for themselves and for their students. Furthermore, children who are at risk of not achieving their full potential need to be a central focus in investments for home improvements for learning. Barriers to learning at school level were low internet speed and affordability, lack of skills and knowledge to develop self-regulated and collaborative learning, and unawareness of how to create or find relevant content.

Mariyam Azlifa and Fathimath Saeed in exploring the process of digitalisation of Maldivian schools, highlight that the relationship between equity, equality, and access to digital education is very context-specific and multi-layered, requiring intervention, knowledge sharing, collaboration and investment at all levels. Students learning across disciplinary boundaries on real life problems need to be aware of socio-cultural and economic implications of technological

change, while utilising digital tools to mobilise, network, collaborate and to share knowledge.

Societal and environmental problems that transcend national boarders such as climate change, environmental destruction, gender and racial inequality and discrimination, poverty, war, forced migration, rogue governments and corporations, forced land acquisition and exploitation, zero-hour work contracts and sweatshop work conditions termed “wicked problems” or “ grand challenges” require international research and collaboration. Human rights are a theme which cuts across all of these issues.

To bring about deep change through working together to make different kinds of investments, to change habits of over-consumerism, and exploitation; industry, government, educators and society need to plan together, to enable young people to use their creativity and energy to create a fairer and more inclusive world for all life and for the planet. This requires a focus on not only human rights but the rights of nature to survive and thrive. Ahmed Shahid’s paper on globalisation and human rights obligations identify the need for a much wider role by the governments and international organisations to ensure human rights are met through development of regulatory frameworks and implementation.

Mohammed Muazzaz and Velu Vengadeshwaran provide us with a practical design idea to evaluate the learning outcomes for all students to check if students are meeting the expected standards of programmes of study. This design tool is an example of what can be achieved through collaboration, to find concrete, practical ideas and context-specific solutions to achieve our vision of high quality education for all.

We wish to promote IJSRI as a valuable platform to share knowledge and present ideas that can positively influence policy level decision making for a sustainable future. We are always willing to work with authors, and encourage everyone to contact us at any point during their research and writing process.

Dr. Mohamed Adil
Dr. Sheema Saeed
Dr. Ahmed Shahid
(IJSRI Editorial Team)

Teachers' perspectives on the impact of online education on students' learning

Afnan Nizam[1] and Fathimath Saeed[2]

Abstract

The recent, sudden school closures due to the Covid-19 pandemic forced school teachers to quickly transfer their face-to-face teaching to online teaching platforms and to support all of their students remotely, revolutionizing the concept of K-12 learning using digital online technology. Physically being present in a classroom environment, five days a week, may not be the only option to acquire formal school education, in the future, as was modelled by Maldivian schools during the pandemic, using a blended approach to learning, whenever each island community was not in full lockdown.

The purpose of this qualitative study was to identify the factors that contributed to a successful online learning environment and to identify teachers' perspectives about online education and its impact on secondary students' performance. Data for this study was collected by using semi-structured interviews with twelve teachers in a public secondary school in Male'. The interviews were conducted through an online platform due to the ongoing Covid-19 pandemic. This paper describes how these teachers created online learning environments and the strategies they used to support students' learning. The findings of this study demonstrated that some teachers had used self-regulated online learning themselves, to develop their competency for online teaching and to learn how to use educational technology effectively. However, individual teacher competencies did not lead to effective collaborative learning among teachers or to team teaching within the school. Many teachers did not conduct online collaborative learning among their students. The home digital environment and living conditions for many children need to improve for them to engage and to achieve through online learning. A recurring theme was the high cost of internet connectivity and unaffordability by parents and schools, preventing collaborative learning.

Keywords: online education; children's learning; teachers' practice; Covid-19 pandemic

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Introduction

Situated in the South Asian Region, the Maldives is a small country with 1196 coral islands. Despite the wide geographical dispersion of the islands, the use of digital technology in the educational sector of Maldives is limited. More specifically, most of the people who live in other islands, other than the capital city use digital technology for learning sparingly, due to slow internet speed, and exorbitant costs of accessing the internet (Adam, 2016). In Maldivian schools, teachers use digital technology mostly for administrative work such as in the preparation of student reports and to search for teaching resources (Hoque et al., 2012). However, often this is also difficult due to slow internet speed, lack of technical support available to teachers and due to lack of competent staff and equipment to repair and maintain broken or damaged computer systems (Riyaz et al., 2012).

One of the main targets of incorporating information technology in the field of education is to improve students' academic achievement (Nguyen, 2017). It is necessary to evaluate the effectiveness of online learning in secondary schools and the challenges the educators face when assessing students online. Often it is believed that online education is a means for improving the educational outcomes and providing access to all at a lower cost (Christensen & Horn, 2008).

This is an exploratory case study done to determine the perception of Maldivian secondary teachers towards the impact of online education on secondary students' learning. Schools in Maldives had been based only on traditional methods of learning, which require students to attend to school for classes every day. Due to the outbreak of Novel Corona Virus (COVID-19) and sudden school closures, teachers had to adapt fast to use online platforms for teaching their students. For most of the teachers, this was the very first time they would have used synchronised online teaching in their classrooms. As a developing country, with very few digital resources available, the teachers had to adapt to the new change in every possible way.

Unlike the public education sector of the Maldives, the private schools in Male' started synchronous online classes since the first day of school closure in March 2020, and their students were receiving formal education. These schools conducted interactive lessons and shared materials through platforms such as Google Meet, Zoom and Google Classroom. It took time for the Ministry of Education to negotiate with telecommunication companies in the Maldives to provide a free internet package for all of the students and teachers so that

all of the schools could switch to online teaching. Support was also provided by the United Nations International Children's Emergency Fund (UNICEF) to the Ministry of Education, to conduct Google for Education Training program for educators to facilitate online learning in Maldivian schools, during the pandemic (UNICEF, 2021).

Literature Review

This study utilized Walberg's (1982) educational productivity theory to analyse students' achievement. Furthermore, to identify contributing factors of a successful online educational environment, community of inquiry framework in online learning (Garrison, Anderson & Archer, 1999) and online collaborative learning theory (Harasim, 2012) was used.

Walberg's educational productivity theory stated that students' psychological attributes and the psychological environment around them impact the behavioural, cognitive and learning outcomes. This theory points out nine factors that influence educational outcomes of students. These nine factors are categorized into three groups. The first group of factors consists of aptitude variables that include ability and motivation of students. The second group of factors in the educational productivity theory are instructional practices that affect students' learning. The third group of factors includes the psychological-environmental factors, which include home and class or school environment, peer group and exposure to mass media (Buruinsma & Jansen, 2007; Mazana, Montero & Casmir, 2019).

The community of inquiry framework is a process model of learning in online and blended environments, in which the social construction of knowledge is made non-trivial by the separation of course participants in time and space (Swan, Chen & Sommers, 2020). This concept was used by the early pragmatists, and is defined as any group of individuals that have a commitment to address a shared problem, interest or issue through a method that is similar to a scientific investigation (Shields, 1999).

Online collaborative learning theory focuses on the accommodations of the internet to deliver educational environments that foster collaboration and knowledge building. Harasim (2012) described this theory as a new theory of learning that has a focus on collaborative learning, knowledge building and use of the internet as a source to redesign formal and informal education. Knowledge is constructed in three phases through discourse in a group, idea generating, idea organizing and intellectual convergence (Harasim, 2012). Picciano (2017)

stated that this theory has been derived from social constructivism as learners are encouraged to collaboratively solve problems through discussion in which the educator has the role of facilitating. He also stated that this type of learning is suitable for smaller instructional environments.

Online education can be defined as learning experienced in synchronous or asynchronous environments by using various devices with access to the internet. In these environments, the learners can be anywhere to learn and interact with the teacher and other students (Singh & Thurman, 2019). Furthermore, online learning can be defined as a tool that can make the teaching and learning process more innovative, learner-centred, and flexible (Dhawan, 2020).

Online Pedagogical approach

Student engagement and motivation

A vast array of studies has been conducted to study student motivation in traditional classroom settings, but very few are found in online learning research. There are several factors that affect learners' motivation in general, such as the characteristic of the learners and their prior knowledge about the content. Furthermore, the motivating factors that are unique to online education could be experience and confidence in using the digital technology, and previous online learning experiences (Lim & Kim, 2003).

Martin (2020) stated in his paper that one area of motivation that is particularly relevant to online education is self-regulation. A study conducted by Sahranavard, Miri and Salehiniya (2018) showed that students who have better cognitive self-regulation have better educational performance and they have a great motivation towards learning. Martin (2020) stated that in an online environment, students can easily be distracted, therefore, there needs to be high-quality instruction and content to keep the student engaged in learning. He also suggested that setting more frequent due dates for small tasks gives the opportunity for learners to receive more feedback from teachers, which will increase students' motivation towards learning.

Instructional Strategies

Schools are experiencing difficulties in transferring effective teaching strategies in the traditional classrooms to an online environment and the online mode of instruction is not as simple as replicating the atmosphere that is found in

traditional classrooms (Fisher, 2003). One of the main issues in an online learning environment and in a traditional classroom setting is that teachers tend to have their focus on delivering the contents of the subject, rather than giving the opportunity for students to apply the learned content to real-life situations (Laurillard, 1993).

Hennessy, Ruthven and Brindley (2005) stated that teachers need sufficient ICT skills to implement the technology, and they need to have the confidence to use it in a classroom setting. Furthermore, they also mentioned that teachers require a vision into the pedagogical role of ICT for them to use it expressively in their instructional practice. In order for students to succeed in the online learning environment, they must be conscious about their comfort level with ICT, and the level of motivation to take on a self-directed learning experience (Cereijo, 2006). A strong understanding of this will help students to better handle the challenges posed by the online learning environment, which includes adopting their own strategies for learning and developing their own study schedule (Cereijo, 2006). Inadequate computer literacy among learners may cause novice computer users to suffer from computer anxiety, which prevents them from concentrating on learning activities (Lee, 2000).

In the community of inquiry model, the social presence is considered as the aptitude of the members to project themselves socially and emotionally in an online classroom environment and their consistent ability to perceive other participants in that class as real (Swan & Shih, 2005). Social presence is important in order to maintain a high degree of online social interaction (Kreijins, et al., 2014). This is also associated with the learning outcomes and the degree of satisfaction of the group members (Garrison & Arbaugh, 2007). It also affects the participation and social interaction of the learners, which is essential for successful collaboration and knowledge construction (Kreijins, et al., 2014).

The teaching presence can be defined as the design, facilitation and direction of the cognitive and social processes for the purpose of recognizing personally meaningful and educationally worthwhile learning outcomes (Garrison, Anderson & Archer, 1999). In a virtual learning environment, the interaction can be insufficient to ensure effective online learning. These types of interactions need to be supplied with clearly defined parameters and be focused towards a specific direction, thus the teaching presence is required. Although interaction and discourse play a key role in higher-order learning, without proper guidance, learners will engage in 'serial monologues' (Pawan et al., 2003). The educators need to give specific instructions in their assignments for threaded

discussions, charging the learners to resolve a particular problem and pressing the individuals to integrate their ideas (Meyer, 2003).

Online collaborative activities have the potential to keep learners engaged; and to establish a sense of community in an online learning environment, allowing them to experience and practice virtual teamwork skills (Faja, 2013). In an online environment, educators cannot assume that each member of the group makes an equal contribution to a task that is assigned to the group (Wang, 2010). Hence, the teachers should give marks to the students depending on their individual contributions (Swan, Shen & Hiltz, 2006). Compared to face-to-face teams, collaboration in virtual teams may be more challenging (Faja, 2013).

Collaborative activities in an online classroom can take different forms. It can be a discussion among the whole class or small group activities within smaller groups in separate online rooms (Macdonald, 2003). Online collaborative learning theory emphasizes peer discourse as the key to learning. In this theory, learning is defined as intellectual convergence, which is accomplished through three progressive stages of group discourse: idea-generating, idea-organising and intellectual convergence (Harasim, 2012).

Researches have considered how online discussions can be planned for learners' success (Corfman & Beck, 2019). Gao, Zhang and Franklin (2013) stated that there are four ways that online educators plan asynchronous online discussions: constrained environments. visualised environments, anchored environments and combined environments. They stated that in a constrained environment, the educator gives students starters or frames; in visualised environments, educators provide the students with software or digital tools that allow the learners to turn their discussions into concept maps; in an anchored environment, teachers give learners texts to interpret and ask learners to turn in their annotated texts for discussions; and in a combined environment, educators instruct students to participate in two or more types of discussions.

Teachers' perceptions

For successful online teaching, the instructors of online education need to have a positive attitude towards the technology (Selim, 2005). The attitudes of teachers towards using online education tools are associated with the perceptions of the implementation process (Cunningham & Bradley, 2006). The study conducted by Crews (2015) revealed that teachers do believe in online

education, but some practise it while other teachers do not practise it. He stated that teachers need the training to overcome the challenges that prevent them from instructing students in an online learning environment.

Learning conditions

In Walberg's theory, the third group of factors involves the learning conditions or the environment. Fraser et al. (1987) stated that the variables for the third group include home environment, classroom or school environment, peer group and mass media. Online education takes place on a different platform compared to the traditional classroom environments. In well-maintained online learning environments, all of the learning environments are taken into account (Williams & Fardon, 2005).

The online learning environment also changes the nature of interaction between the educator and the students. In an online environment, the students are expected to take greater control of their learning approaches (Xu & Mahenthiran, 2016). In online mode of education, the educators need to develop the resources in a way that will match the learning needs of the students, if it does not do so; the materials are considered to be useless as it doesn't contribute to students' learning, same as in regular face-to-face teaching (Ofsted, 2009).

Socio-economic status

The participation of students in a class can be characterized by various factors, which can affect their performance. The socio-economic background variable consists of factors such as the family situation of the student, the living environment, lifestyle and prior education of the caregivers (Koole et al., 2018). Learners from higher socio-economic backgrounds often perform better than other students since they often have more available resources including adult support (Ali et al., 2013).

Dawan (2020) suggested that during the Covid-19 pandemic, digital inequity came into sharp focus, as not all educators or all students have the access to digital devices and to the internet or access to sufficient internet connectivity even when the devices were available. Furthermore, he stated that the unavailability of proper digital tools and lack of or slow internet connection can cause a lot of problems such as students losing opportunities for learning and losing interest in engaging in online learning. Oswal and Meloncon (2014)

mentioned that cultural restrictions are an area that online educators should be mindful of as educational technology continues to represent the dominant culture and thus can be irrelevant to the students who are not familiar with the dominant culture.

Inadequate internet access is the main concern in implementing blended learning (Jurado et al., 2010). If the educators in a school do not have the access to adequate technological resources and a fast internet connection, it will not be feasible to implement educational technologies (Johnson et al., 2016). Limited access from homes or slow internet connections in rural areas can lead to students falling behind in their academic performance (Hampton et al., 2019). Lynch (2017) stated that there are several different ways in which a lack of internet access can influence the academic performance of a student. The reason for this is because without proper internet access, students will not be able to interact with their teachers or their classmates or they will be not able to do more research or get online homework help (Lynch, 2017).

Methodology

In this qualitative research, we used an interpretivist approach as our focus was to identify Maldivian secondary teachers' perspectives on the impact of online education on students learning. Purposive sampling was used, and twelve secondary teachers who taught in Key Stage Three and Key Stage Four in one public school of Male' were selected for the study. The data for this research was acquired through semi-structured interviews using a Voice over I software called 'WhatsApp'. 'WhatsApp Calling' was used because it provides the opportunity to speak privately; and end-to-end messages and calls are end-to-end encrypted. The data was collected after teaching session hours. The audios of the interviews were recorded and transcribed for the process of data analysis.

Pilot testing of the interview questions and interview process was done by pilot interviewing three teachers from the same school who did not participate in the actual study. The questionnaire was revised and improved based on feedback from the teachers (Lancaster, Dodd & Williamson, 2004).

After transcribing the interviews, each participant was given a pseudonym. Next, a series of codes were given to the statements made by the participants. These codes were selected by referring to the literature review and by referring to factors that contribute to a successful online educational environment. Then the codes of all participants were colour coded and cross-checked. This led

to identification of subcategories which consisted of similar codes collected together. Finally, from these subcategories, themes were selected.

Results and Discussion

The purpose of this study was to find out teachers' perspectives on the impacts of online education on students' learning. The thematic analysis was focused on the two main components that contribute to a successful online learning environment: the online pedagogical approach and the learning conditions.

Online Pedagogical Approach

The teachers perceived that students were less motivated in participating in online classes in comparison to traditional classes.

> *"Most of the students don't engage, and don't want to engage in the class. When asked, they say they don't want online classes, and that it is boring." (Participant L)*

This could be due to both teachers' and students' previous unfamiliarity with ICT and online learning experiences (Lim & Kim, 2003). Some of the participants stated that they were unable to provide effective feedback to students in the online learning environment and they also stated that they were not familiar with the online tools and approaches to provide feedback, thus this increased their workload.

> *"It consumes a lot of time: marking and giving feedback in online classes. It is more time consuming in online classes. It was like a 24/7 job when it came to online classes. The workload was increased in online classes." (Participant G)*

One reason that the students' engagement in online classes was less could be due to the unfamiliarity by teachers in using online tools and to give on-time feedback to students. The teachers who were more familiar with online tools seemed to be able to engage students in learning and to provide timely feedback.

> *"I found that actually more tools were available to monitor their work and also to provide feedback when we use different online tools, that was one thing, there were tools available to give more personalized feedback*

I found when we did online teaching." (Participant D)

One area of motivation that is significant in online education is self-regulation (Martin, 2020). Similar to the study conducted by Sahranavard, Miri and Salehiniya (2018), the findings of this study also showed that students who have self-regulation skills have better academic performance. Furthermore, it was evident that, in the classes in which more frequent due dates for small tasks were given; the students' engagement was more, as it gave the opportunity for learners to get more feedback from other learners, as mentioned by Martin (2020).

This study showed that most of the teachers in the particular school do not conduct online collaborative activities as they have less knowledge in online collaborative pedagogical approaches and some of them were unfamiliar with collaborative teaching online.

"Actually, for my subject I don't give any group work, I don't normally give any type of group work for my subject." (Participant H)

Inconsistent with Faja (2013)'s idea, it is evident from this study that the students are more engaged with learning when they have online learning activities. However, some participants mentioned that learners found online group activities to be more challenging in comparison to face to face groups due to the difficulty in communication, thus these findings coincide with the findings of the study conducted by Koh and Hill (2009). Connecting to Harasim (2012)'s online collaborative learning theory, the teachers who had planned the activities well were able to follow the three progressive stages of group discourse: idea generating, idea organising and intellectual convergence.

"Collaborative learning in an online classroom can take the form of discussion among the whole class, or team activities between small groups, can include group projects like small group discussions, and brainstorming." (Participant I)

For example, a language teacher mentioned that before directly going into writing work, the teacher planned an online collaborative activity in which students were provided with pictures and cues for them to think more about the topic and then they had to share the ideas with their peers. The ideas were organised in the form of graphic organisers and those were presented to the whole class later, thus this helped the students to learn or gain knowledge through online collaboration.

Most of the teachers in this study were not very familiar with ICT tools and online educational technologies. They did not have any prior skills or experiences of online teaching; thus, it was a huge challenge to conduct classes.

> *"I don't think google training was much effective because we were actually given a small duration to complete it so we were at a rush, so we didn't learn most of the things, I didn't learn that much." (Participant A)*

Similar to the study conducted by Yang (2020), teachers' perceptions revealed that all of the teachers expressed willingness to support online teaching.

> *"If we get more training and more lessons for the teachers, I think this will be much more beneficial. But for now, I don't think this is very effective. But we need training, we were not given training and suddenly we started this, so that is why I think we teachers are also struggling to work like this. (Participant A)*

Most of the teachers conveyed that the challenges they face are due to the sudden shift to online classes and they did not have any time for preparation or for training. Prior to this pandemic no online classes were conducted in secondary schools of Maldives, thus it was a new experience for students as well. They also didn't have any experiences with ICT educational tools.

Inadequate computer literacy among learners was also a hindrance to learning and a source of computer anxiety by some students, which prevents them from concentrating on learning activities (Lee, 2000). Some teachers mentioned that they took separate classes, to teach students on how to use some of the tools. They also stated that, this was a challenge as this resulted in less instructional time in classes.

Many participants highlighted the fact that they spent a lot of time preparing materials for online classes. Moreover, it was evident that due to the fact that they were unfamiliar with various online educational tools, some of them failed to incorporate interactive activities in their teaching. Most of the time, teachers opted for using only presentation slides as a teaching aid as it was the one with which they were most familiar.

Learning Conditions

Online classes were started for the first time in Maldivian schools during the

Covid-19 pandemic and many of the students had to face financial issues due to their parents' losing jobs. Furthermore, some students migrated from the capital city to different islands temporarily as they were not able to pay rent and these students attended online classes from their islands. In accordance with Dawan (2020), the participants of this research also mentioned that it is important to have digital equity and the unavailability of suitable digital tools and no suitable internet connection can result in a lot of problems such as students losing opportunities for learning.

> *"When online classes there may be more than one child at home. For both the children, the parents have to provide the expensive data packages, because of that some students are sacrificing some of the subjects" (Participant J)*

> *"Some students, at the end of the month, would not be joining the class, their parents will separately call me and tell that due to financial problems they can't take extra internet packages." (Participant A)*

One main challenge the teachers had to face was issues with the internet. They mentioned that the ten gigabytes of the data that was provided to the teachers per month were insufficient for successful teaching. All of the teachers mentioned that they had to pay for extra data packages as the data provided for them didn't last till the end of the month. Only 5 gigabytes of data were provided for each child, often this data was only enough for about 30 hours of Google Classroom access only.

Participants stated that students did face a lot of difficulty as in some households there was more than one student studying online in the same room with different devices. In addition to this, not having a comfortable home environment influenced students' performance as they were hesitant to turn on their camera or microphone as they didn't want others to see their home living environment or for others to hear the noises in their background.

Conclusion

In this study, we looked into how online education impacted students' learning in one of the public schools of Male', the capital city of Maldives. The findings showed that online education had impacted students' learning in an undesirable manner, mostly due to the unpreparedness of teachers for online teaching; lack of adequate teaching resources available and familiar to teachers; as well as lack of exposure to online learning by children. Ineffective pedagogical

approaches and unfamiliarity of both students and teachers in online teaching and learning techniques caused disengagement of students and for teachers to spend huge amounts of time preparing resources, whilst paying from their own pockets to cover internet costs.

Integrating digital technology into our teaching is an important matter as we need to help our students to develop the appropriate digital literacies by modelling them in teaching. Developing teacher capacity to use digital technology to design effective learning environments; to engage students in self-regulated and collaborative learning, well-matched to their learning needs, goals and interests; and to assess and provide timely and effective feedback, can be achieved using similar techniques in MOOC teacher training courses. Moreover, developing a tailor-made online educational tool that is well-suited with the National Curriculum of the Maldives and a digital platform where Maldivian teachers can share online teaching materials will be helpful for teachers. This will increase the teachers' knowledge about ICT tools and teachers will have the opportunities to share their ideas across the country, regardless of the geographical barrier. Additionally, improving internet speed and eliminating the financial burden of internet data packages will help students, teachers and parents to create a collaborative online learning environment.

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A Holistic Design Tool to Evaluate Learning Outcome Attainment Levels in Engineering Education Programmes

Mohammed Muazzaz[1] and Velu Vengadeshwaran[2]

Abstract

The International Engineering Alliance (IEA) plays a vital role in promoting the mobility of the engineering professionals through recognizing the locally accredited Engineering programmes in its signatory countries. This is achieved through various accords and agreements within the signatory countries to ensure internationally recognized standards are met. The Washington Accord, Sydney Accord and Dublin Accord provide the necessary guidelines to implement the required competencies for Professional Engineering, Engineering Technologist and Engineering Technicians standards respectively through effective outcome-based education. The Engineering Programmes offered at Villa College Maldives are designed to fully adhere to the Washington Accord standards in order to ensure the attainment of the graduate attributes.

This paper outlines a dedicated outcomes-based education (OBE) tool which was designed to correlate the module learning outcomes to the programme learning outcomes. It was developed to ensure that all of the assessments implemented in the programme appropriately measure the attainment of the Complex Engineering Problems, Knowledge Profiles and the Engineering Activities as per the IEA accord standards. This paper provides the technical details of the design, different types of reports generated and the techniques adopted in the proposed OBE Tool for the measurement of the attainment of the learning outcomes of the course, programme and learning outcomes achievement of the students.

Keywords: engineering teaching; engineering graduate attributes; outcomes-based course design and assessment; outcomes-based education tool

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Introduction

Engineering plays a vital role in the economic development of a country, meeting the technological advancements needs and services to the society. Engineers are expected to find creative, innovative, and technologically advanced solutions to resolve complex engineering problems. This requires a comprehensive amount of both theoretical and applied engineering knowledge, practical hands-on skills, socio-cultural, management and financial awareness and abilities. In general, engineering graduates are expected to possess the specialization-based engineering knowledge, problem analytical skills, design and development knowledge to find solutions for complex engineering problems, well-versed in modern tools, with adequate knowledge on sustainability and environment, work ethics, and lifelong learning habits required of a professional engineer.

Engineering education as such is classified into three categories or tracks based on level of qualification such as Diploma (for Technicians), Engineering Technologist Degree (for Technologists) and the Professional Engineering Degree (for Engineers). The International Engineering Alliance (IEA) is a global organization that drafts and approves the graduate attributes and the professional competencies for the Engineering Profession that have to be fulfilled by the Universities offering Engineering Education qualifications (International Engineering Alliance, 2021). The IEA consists of members from twenty-nine countries with forty-one jurisdictions across seven international agreements. In order to maintain the international standards benchmark for the engineering education at various levels of competencies and for the mutual recognition of engineering qualifications, the members of IEA sign various agreements such as Washington Accord, Sydney Accord and Dublin Accord corresponding to Engineer, Engineering Technologist and Engineering Technician respectively.

The Washington Accord (WA) provides the required graduate attributes and professional competencies for the Professional Engineering Track, whereas the Sydney Accord (SA) is for the Engineering Technologist Track and the Dublin Accord (DA) is for the Engineering Technician Track. The latest version of IEA graduate attributes and professional competencies was released in September 2021 (International Engineering Alliance, 2021).

The accreditation regulatory bodies of engineering qualifications adopt outcome-based education as the strategy to measure attainment of the Graduate Attributes and Profession Competencies (GAPC). The signatories of

the accords recognize each other's graduates of the accredited engineering qualifications. This facilitates the mobility of graduates for further studies and employment across the signatory countries.

Graduate attributes are clearly defined statements on the expected qualities of professionalism appropriately arranged to the competency levels for the various grades of engineering such as Engineer, Engineering Technologist and Engineering Technician. The Engineering Programme at bachelor's degree level is required to produce graduates able to apply knowledge of mathematics, science, computing and engineering fundamentals and an engineering specialization as specified in WK1-WK4 respectively to develop solution to complex engineering problems.

It is imperative for the accrediting authorities of the signatories to ensure that all of the engineering qualifications are effectively being implemented based on outcome-based education (OBE) in order to ensure that the graduates of these programmes possess the desired graduate attributes and professional competencies (Tshai, K. Y et al., 2014). Outcome based education is a proven academic strategy for effective teaching and learning, dynamic assessments and continuous quality improvement (CQI) activities.

The Graduate Attributes and Professional Competencies of the International Engineering Alliance (IEA) is adopted as the international standard for accrediting engineering education by the professional bodies across various signatory countries. It is developed based on outcome-based education with distinctive competencies together with their educational underpinnings which include common range and contextual definitions. It highlights the Range of Problem Solving, Range of Engineering Activities and the Knowledge Profiles.

The attributes of range of problem solving are depth of knowledge required, range of conflicting requirements, depth of analysis required; familiarity of issues; extent of applicable codes; extent of stakeholder involvement; and conflicting requirement, interdependence, consequences and judgement. The attributes of range of engineering activities are preamble; range of resources; level of interactions, innovation, consequences to society; & the environment and familiarity. The attributes of the knowledge profile are understanding of natural sciences; conceptually-based Mathematics; engineering fundamentals; specialist knowledge; engineering design; engineering practice; role of engineering in society; and research literature.

The implementation of the outcome based education is through the establishment of systematic correlation between the programme learning outcomes to the courses offered under the programme in order to ensure that all of the graduate attributes are attained by each and every student by graduation. For accreditation of engineering programmes, evidence is required to prove that the graduating students possess the required theoretical knowledge and practical abilities.

The objective of this paper is to present a tool designed and developed based on the IEA Standard for utilization in the Engineering programmes offered at Villa College, Maldives. The paper presents a technique to directly measure programme learning outcomes using an outcome-based education tool. The outputs of the OBE Tool generate the percentage attainment of each Programme Learning Outcome (PLO) every semester and the progressive growth of overall attainment through spider charts.

Outcomes based Attainment in Engineering Education

The accreditation standards for engineering education programmes outline the outcomes of the engineering curriculum that has to be attained in order to ensure the institution of higher learning meets the minimum standard stipulated in the IEA Accords. The engineering programme's learning outcomes have to be in line with the graduate attributes and the professional competencies (GAPC) statements and the vision and mission of the Institution of Higher Learning (IHL). The OBE strategy adopted by the IHL should ensure that the graduates of the engineering programme possess all of the desired graduate attributes and professional competencies on graduation.

In this paper, we have chosen to adopt Washington Accord (WA) attributes and competencies mainly because the Engineering Programmes offered at Villa College Maldives are professional engineering track programmes. Once the Villa College engineering programmes are accredited by the signatory institutions, the Villa College Engineering Graduates will be assessed on the Washington Accord standards and demonstrate equivalence of competence. This will allow them to pursue higher studies and to work abroad.

OBE Tool Design Strategy

The block diagram of the design strategy for the outcomes-based education proposed by K.Y. Tshai et al (2014) was used to design the OBE Tool for the

programme and is highlighted in the Figure 1.

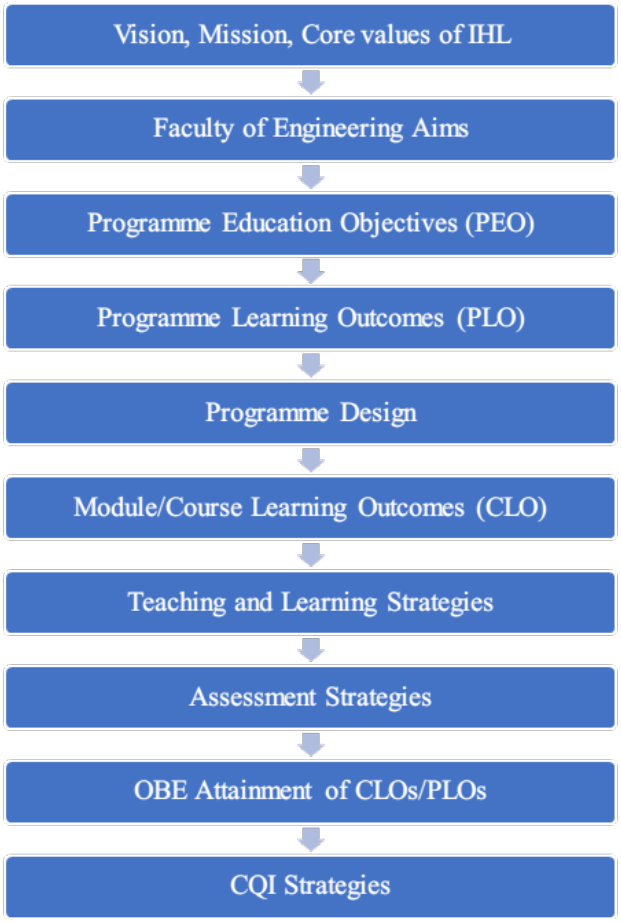


Figure 1: Block diagram of OBE Design Strategy

The Graduate Attributes and the Professional Competencies (GAPC)

The knowledge and attitude profiles of the Washington Accord are classified into eight categories from WK1 toWK8. The characteristics of complex engineering problems are classified into seven categories WP1-WP7. The range of complex engineering activities or projects is classified into five categories EA1-EA5. The Graduate Attributes and the Professional Competencies (GAPC) stipulated in the IEA standard version 2013 is listed in Table 1 (International Engineering Alliance, 2021).

Table 1: The Graduate Attributes and the Professional Competencies (GAPC)

No	Differentiating Characteristic	Engineering Graduate
1	Engineering Knowledge:	WA1: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to the solution of complex engineering problems.
2	Problem Analysis Complexity of analysis	WA2: Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (WK1 to WK4)
3	Design/ development of solutions: Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified	WA3: Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (WK5)
4	Investigation: Breadth and depth of investigation and experimentation	WA4: Conduct investigations of complex problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
5	Modern Tool Usage: Level of understanding of the appropriateness of the tool	WA5: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations. (WK6)
6	The Engineer and Society: Level of knowledge and responsibility	WA6: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (WK7)

7	Environment and Sustainability: Type of solutions	WA7: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (WK7)
8	Ethics: Understanding and level of practice	WA8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (WK7)
9	Individual and Team work: Role in and diversity of team	WA9: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10	Communication: Level of communication according to type of activities performed	WA10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project Management and Finance: Level of management required for differing types of activity	WA11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Lifelong learning: Preparation for and depth of continuing learning.	WA12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Knowledge Profiles, Complex Engineering Problems and Complex Engineering Activities

The IEA GAPC documents also provide the details of various categories of the knowledge Profiles, Complex Engineering Problems and the Complex Engineering Activities to be addressed as shown in Table 2 (International Engineering Alliance, 2021).

Table 2: Knowledge Profile, Complex Engineering Problems and Engineering Activities of Washington Accord

Knowledge Profile	Complex Engineering Problems	Complex Activities
WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline	WP1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of WK3, WK4, WK5, WK6 or WK8 which allows a fundamentals-based, first principles analytical approach	EA1: Involve the use of diverse resources (and for this purpose resources includes people, money, equipment, materials, information and technologies)
WK2: Conceptually-based mathematics, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline	WP2: Involve wide-ranging or conflicting technical, engineering and other issues	EA2: Require resolution of significant problems arising from interactions between wide ranging or conflicting technical, engineering or other issues,
WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline	WP3: Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models	EA3: Involve creative use of engineering principles and research-based knowledge in novel ways.
WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.	WP4: Involve infrequently encountered issues	EA4: Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation
WK5: Knowledge that supports engineering design in a practice area	WP5: Are outside problems encompassed by standards and codes of practice for professional engineering	EA5: Can extend beyond previous experiences by applying principles-based approaches

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline	WP6: Involve diverse groups of stakeholders with widely varying needs	
WK7: Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability	WP 7: Are high level problems including many component parts or sub-problems	
WK8: Engagement with selected knowledge in the research literature of the discipline		

Engineering Programmes at Villa College Maldives

The Engineering programmes offered at Villa College adhere to the specifications stipulated in the WA GAPC; and follow an outcomes-based programme design, teaching and assessment method. This ensures that each student achieves the attributes and competencies expected of a professional engineering training programme. The Faculty of Engineering and Information Technology offers three Bachelor Degrees of Engineering programmes of four years duration, namely Bachelor of Mechanical Engineering (Honours), Bachelor of Mechatronics Engineering (Honours) and Bachelor of Electrical and Electronics Engineering (Honours).

Programme Learning Outcomes (PLOs)

The Programme learning outcomes (PLOs) of the Villa College Engineering Programme adopts the graduate attributes and professional competencies verbatim from the WA standards. The Programme Learning Outcomes of the Bachelor of Mechanical Engineering (Honours) is shown in Table 3 (International Engineering Alliance, 2021).

Table 3: Programme Learning Outcomes of Mechanical Engineering Programme

PROGRAMME LEARNING OUTCOMES (PLOs) OF BACHELOR OF MECHANICAL ENGINEERING (HONS)
PLO1: Engineering Knowledge- Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to the solution of complex engineering problems;
PLO2: Problem Analysis- Identify, formulate, conduct research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4);
PLO3: Design/Development of Solutions- Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (WK5);
PLO4: Investigation – Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
PLO5: Modern Tool Usage- Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations (WK6);
PLO6: The Engineer and Society- Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems (WK7);
PLO7: Environment and Sustainability- Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts. (WK7);
PLO8: Ethics- Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7);
PLO9: Individual and Teamwork- Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings;
PLO10: Communication- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;

PLO11: Project Management and Finance- Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments;
PLO12: Lifelong Learning- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Design & Mapping of Modules to PLOs

The modules of each programme were carefully identified in different sectors of knowledge profiles corresponding to the respective engineering discipline based on the feedback from various stakeholders. Detailed benchmarking was done with reputed international universities in United Kingdom, Australia, Canada, Malaysia, and India to ensure that the modules are appropriate to the engineering programme discipline. The modules were then mapped and correlated to the corresponding PLOs to ensure that the modules provide the necessary knowledge, analytical and practical skills and the needed experiences to achieve the programme learning outcomes on graduation.

Module/Course Learning Outcomes (MLOs/CLOs)

Adequate benchmarking was done in the design and development of the programme modules. The course learning outcomes were designed at appropriate complexity and speciality level using the Blooms Taxonomy hierarchies. Appropriate formative and summative assessments were used to measure the course learning outcomes to ensure the students had the required theoretical knowledge, practical skills, attitudes and awareness of safety and sustainability expected.

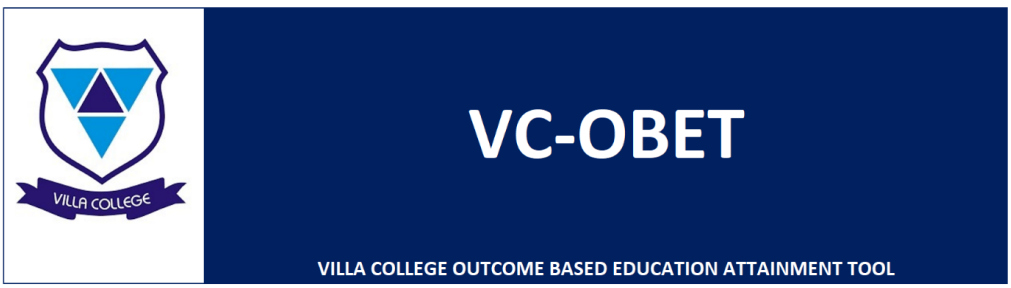


Figure: Villa College OBE Tool

The Villa College OBE Tool (VC-OBET) was subsequently developed to track the programme's implementation of outcome-based education. The tool was primarily designed to track the attainment of students' GAPCs, with the added ability to ensure that modules are fully addressing the PLOs listed in Table 3. The tool was developed in Microsoft Excel and includes detailed instructions on how it is to be used on the first sheet.

CLO Number	Course Learning Outcomes	PLO Map
CLO 1	Comprehend and apply the fundamentals of workplace safety standards	PLO 6
CLO 2	Select and apply appropriate Causation Models to investigate safety incidents	PLO 4
CLO 3	Comprehend and apply the fundamentals of workplace safety and health risk management	PLO 11
CLO 4	Comprehend and apply the fundamentals of conceptual Engineering ethics and resolve problems throu	PLO 8
CLO 5	Comprehend and practice the key aspects of "trust and reliability" and be responsible for "Risk and Lia	PLO 8

Figure 2: PLO - CLO mapping table

The module's Course Learning Outcomes (CLOs) are to be initially mapped to Programme Learning Outcomes (PLOs) in a table as shown in Figure 2. One PLO can be selected for each CLO via a drop-down menu. While a CLO may address more than one PLO, a limit to mapping to one PLO was made to prevent overcomplication of the tool.

Mark Distribution By Assessment Type						
Final Total (Percentage Marks)						100
Module Learning Outcomes	Test	Assignment	Quiz	Practical	Final Exam	Total
Total Assessment Marks	25	50	25	30	100	
CLO 1	5	7			6	18
CLO 2	10	8			12	30
CLO 3	10	6			12	28
CLO 4		4			10	14
CLO 5					10	10
Total Weightage By Assessment Type	25	25	0	0	50	

Figure 3: Mark Distribution table

The percentage marks for each CLO are then entered, split into the assessments that they are graded in. The total mark for each assessment is also to be filled

in. Figure 3 shows an example in which the test (i.e., mid-semester exam) is out of 25 marks, and contributes to 25% of the module. 5% of the module is based on CLO 1 from the test, and 10% each for CLO2 and CLO3 from the test. Note that when the assessment marks differ from the percentage contribution of the assessment on the module, the CLOs are to be entered by percentage contribution of the module. A check is made to ensure the summed percentage contribution to the module equals 100, which is highlighted in green when true and in red if the value differs.

Input of Student List

Student List		
Name	StudentID	Status
Ahmed Ali	S2100027	Active
Ahmed Hussain	S2100028	Inactive
Ali Arif	S2101037	Active

Figure 4: Student list example (note: names and IDs are anonymised)

The student list, with the data shown in Figure 4 is then added to the tool. The full format of the table is identical to the student list available via Villa College's Student Management System (SMS) enabling the list to be copied and pasted in quickly for different purposes within the college.

Student Marks

The last step in which manual entry of data is required is entering in student marks. Each set of assessment marks obtained by the student are to be keyed-in correspondingly to the CLO allocations for the particular assessment.

Student Name	Student Number	Test CLO 1	Test CLO 2	Test CLO 3	Assignment CLO 1	Assignment CLO 2	Assignment CLO 3	Assignment CLO 4	Final Exam CLO 1
		5	10	10	14	16	12	8	12
Ahmed Ali	S2100027								
Ahmed Hussain	S2100028								
Ali Arif	S2101037								

Figure 5: Marks Entry Table Example

A table for marks entry (Figure 5) is populated with the student list as well as the assessments based on the information added in the previous steps. The assessment marks are split by CLOs for each assessment. The 2nd row of the headers displays the total marks, automatically split, and calculated for each

CLO/assessment combination. These calculated values allow the marks from the assessments to be directly inputted, reducing the likelihood of calculation errors. Inactive students are highlighted to further ease the marking process.

This table could also be used to automatically calculate the marks allocation for each assessment's total marks when writing question papers. Conversely, historical marks from before using this system are recommended to be added by evenly distributing marks for each assessment between the respective CLOs,

Module Analytics

Once student marks are entered, total assessment marks are generated to allow detailed analysis of marks attained by each student, and by each cohort.

Student Name	Student Number	Grade	Total	Test	Assignment	Final Exam	Test CLO 1	Test CLO 2	Test CLO 3	Assignment CLO 1
							5	10	10	14
Ahmed Ali	S2100028	HD	96.3%	100.0%	93.3%	96.0%	100.0%	100.0%	100.0%	93.3%
Ahmed Hussain	S2100807	DN	78.0%	80.0%	88.0%	72.0%	80.0%	80.0%	80.0%	88.0%
Ali Arif	S2100027	CR	74.3%	96.7%	76.7%	62.0%	96.7%	96.7%	96.7%	76.7%

Figure 6: Student Results Table

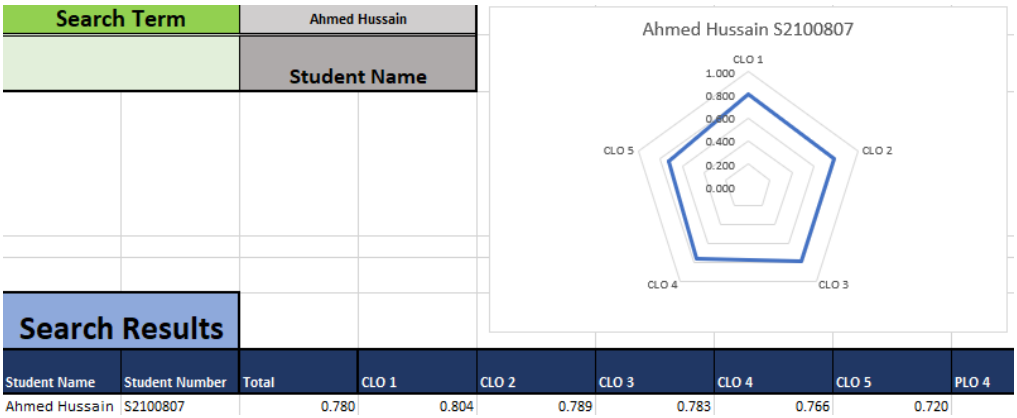
Figure 6 shows the results summary for all of the students which are automatically generated. Percentage marks for each assessment is estimated, along with the grade and total percentage. The percentage marks for each CLO can also be checked for each assessment.

Student Name	Student Number	Total	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	PLO 4	PLO 6
			18	30	28	14	10	30	18
Ahmed Ali	S2100028	96.3%	96.1%	96.6%	96.9%	95.2%	96.0%	96.6%	96.1%
Ahmed Hussain	S2100807	78.0%	80.4%	78.9%	78.3%	76.6%	72.0%	78.9%	80.4%
Ali Arif	S2100027	74.3%	77.3%	77.5%	77.5%	66.2%	62.0%	77.5%	77.3%

Figure 7: CLO and PLO Breakdown

Figure 7 shows percentage attainment for students split only into CLOs and PLOs. This can help to identify if students are struggling with attaining specific learning outcomes, which may not be immediately noticeable if marks are only split by assessment. The weighted marks for each CLO and PLO are displayed on the second header row.

Equivalent tables with weighted marks are also available for each assessment.



Search Term	Ahmed Hussain
	Student Name

Ahmed Hussain S2100807

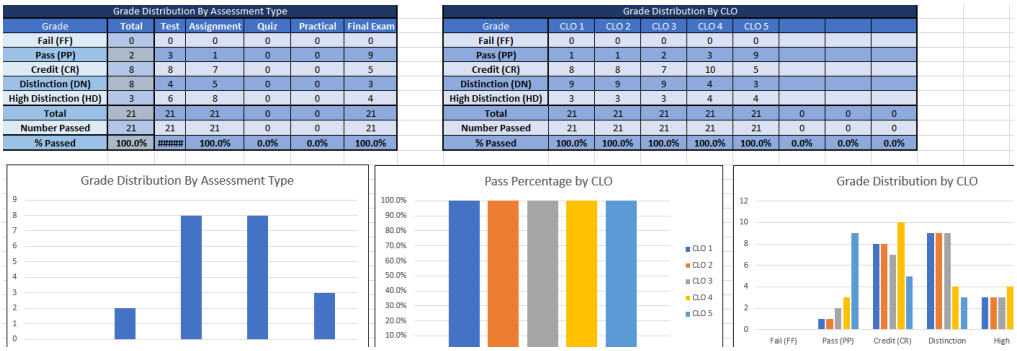
CLO 1 1.000 0.800 0.600 0.400 0.200 0.000 CLO 2 CLO 3 CLO 4 CLO 5

Search Results

Student Name	Student Number	Total	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	PLO 4
Ahmed Hussain	S2100807	0.780	0.804	0.789	0.783	0.766	0.720	

Figure 8: Results Search Example

A search function has been added to find specific students based on either name or student ID as shown in Figure 8. On selecting the student, the respective per unit CLO attainment will be displayed with the aid of a spider chart as shown in Figure 8.



Grade Distribution By Assessment Type

Grade	Total	Test	Assignment	Quiz	Practical	Final Exam
Fail (FF)	0	0	0	0	0	0
Pass (PP)	2	3	1	0	0	9
Credit (CR)	8	8	7	0	0	5
Distinction (DN)	8	4	5	0	0	3
High Distinction (HD)	3	6	8	0	0	4
Total	21	21	21	0	0	21
Number Passed	21	21	21	0	0	21
% Passed	100.0%	#####	100.0%	0.0%	0.0%	100.0%

Grade Distribution By CLO

Grade	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5			
Fail (FF)	0	0	0	0	0			
Pass (PP)	1	1	2	3	9			
Credit (CR)	8	8	7	10	5			
Distinction (DN)	9	9	9	4	3			
High Distinction (HD)	3	3	3	4	4			
Total	21	21	21	21	21	0	0	0
Number Passed	21	21	21	21	21	0	0	0
% Passed	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%

Grade Distribution By Assessment Type

Pass Percentage by CLO

CLO 1 CLO 2 CLO 3 CLO 4 CLO 5

Grade Distribution by CLO

Fail (FF) Pass (PP) Credit (CR) Distinction High

Figure 9: Module Results Analytics

Lastly, overall module trends can be viewed on the analytics page. Pass rates, and grade distribution for each assessment, and each CLO are listed and displayed in graphs, as shown in Figure 9.

Programme Analytics

The tool has the additional feature to estimate the Programme level attainment for each student progressively semester wise. The tool collates the results of multiple modules to track the PLOs assessed over the course of the programme.

Module Code	Module Name	Credits	% Credits	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 10	PLO 11
COMP1007	Computer Programming	12	18.2%	1.2	3.6	5.4	1.2	0	0	0	0	0	0.6
ENGI1001	Electrical and Electronics Principles	12	18.2%	2.16	2.76	2.16	3.36	1.56	0	0	0	0	0
ENGI1002	Engineering Drawing and Graphics	12	18.2%	1.2	0	8.4	0	2.4	0	0	0	0	0
ENGI1003	Engineering Mathematics 1	10	15.2%	0	10	0	0	0	0	0	0	0	0
ENGI1004	Occupational Safety and Ethics	10	15.2%	0	0	0	3	0	1.8	0	2.4	0	2.8
ENGI1005	Environment and Sustainable Engineering	10	15.2%	2	0	0	0	0	0	2.5	1.5	2	2
Total		66		6.56	16.36	15.96	7.56	3.96	1.8	2.5	3.9	2	5.4

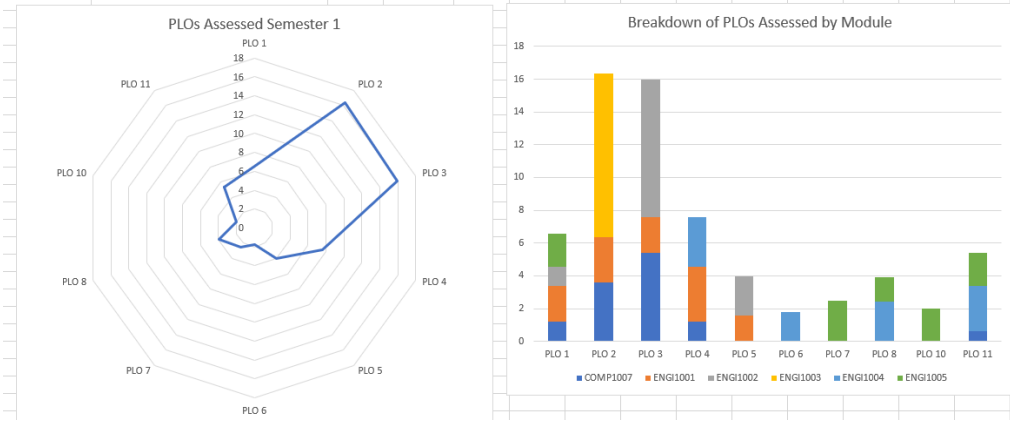


Figure 10: Collation of Module Information

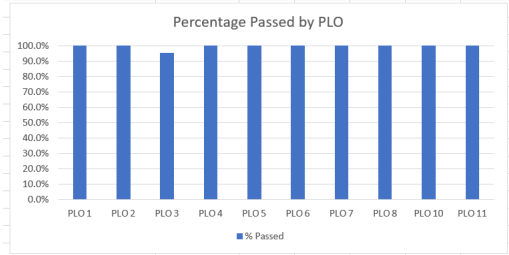
Figure 10 shows the distribution of credits by PLO by splitting the credits of each module based on the CLO/PLO mapping from section 3.1. Note how this shows that PLO 2 and 3 have the greatest priority in semester 1, with PLOs 9 and 12 not being addressed significantly. This tool allows such disparities to be reviewed, and help ensure that by the end of the programme, all PLOs have been addressed to a satisfactory standard.

Student Name	Student ID	Programme	PLO 1	PLO 2	PLO 3	PLO 4
Ahmed Ali	S2100027	83.8%	90.7%	79.8%	85.4%	90.4%
Ahmed Hussain	S2100028	81.4%	86.5%	80.5%	78.1%	84.0%
Ali Arif	S2101037	84.3%	92.7%	87.6%	83.1%	84.7%

Figure 11: Attained Percentage per PLO

Figure 11, similarly to Figure 7, displays percentage attainment of PLOs based on marks attained from all modules. The percentages are based on the marks input for each module as well as the information collated as shown in Figure 10.

Grade Distribution by PLO											
	Programme	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 10	PLO 11
Fail (FF)	0	0	0	1	0	0	0	0	0	0	0
Pass (PP)	0	0	0	3	0	0	1	0	1	0	0
Credit (CR)	4	0	2	0	0	1	8	3	10	1	6
Distinction (DN)	17	3	16	16	16	9	9	16	10	15	14
High Distinction (HD)	0	18	3	1	5	11	3	2	0	5	1
Total	21	21	21	21	21	21	21	21	21	21	21
Number Passed	21	21	21	20	21	21	21	21	21	21	21
% Passed	100.0%	100.0%	100.0%	95.2%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%



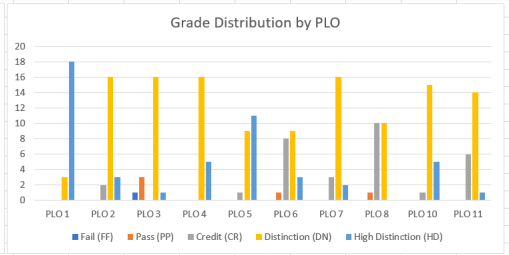
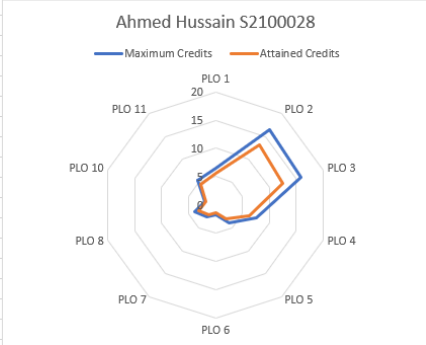


Figure 12: Programme Results Analytics

Search Term	Ahmed Hussain
	Student Name

#	Student Name	Student ID	Programme	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 10	PLO 11
Best	Maximum Credits		66	6.56	16.36	15.96	7.56	3.96	1.8	2.5	3.9	2	5.4
Match	Attained Credits		53.71082	5.67392	13.16692	12.4596	6.35148	3.129	1.4472	2.12	3.0783	1.8	4.4844
#	Student Name	Student ID	Programme	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 10	PLO 11
2	Ahmed Hussain	S2100028		81.4%	86.5%	80.5%	78.1%	84.0%	79.0%	80.4%	84.8%	78.9%	90.0%	83.0%



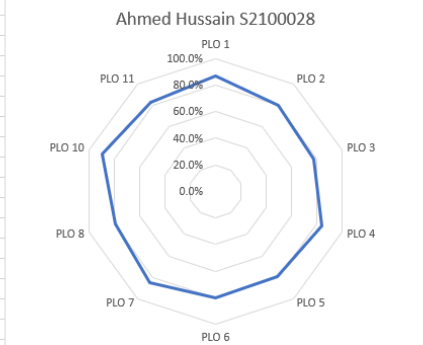


Figure 13: Programme Level Student Result Search

Figure 12 shows the programme level analytics, similar to Figure 9. Figure 13 shows the programme level counterpart to course level analytics shown in Figure 8. The latter allows for creation of radar graphs based on PLOs for use in showing the GAPCs attained by the students for use in individual student reports. Graphs with percentage results, as well as based on "credits attained" are generated. In this case "credits attained" refers to the percentage marks obtained on each PLO multiplied by the number of credits allocated.

We found that the proposed techniques of assessing the individual CLOs and

the corresponding PLOs for each module works well and the outputs generated by OBE Tool measures directly the attainment of the graduate attributes and professional competencies stipulated in the IEA standard for each graduating student. Spider charts are produced as evidence for the attainment of PLOs.

Conclusion

This paper demonstrates some of the potential benefits of using outcome based education and development of related tools to enable easier, more thorough tracking of both programme content, and student performance within programmes. VC-OBET tool has the capabilities to measure the attainment of learning outcomes at student level, module level and at programme level. The analytical output of the VC-OBET will be used in the Continual Quality Improvement (CQI) meeting to close the loop. This VC-OBET tool is designed to ensure that all of the graduates of the engineering programme possess the required graduate attributes and professional competencies as per the Washington Accord standards. On top of being able to ensure that the Villa College engineering programmes will meet standards set by international accreditation bodies for Engineering qualifications, it is the belief of the authors that the use of these tools can be further expanded to other higher education departments to implement outcomes based education programmes and to enhance the quality of the programmes offered.

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Globalisation and Human Rights Obligations: Interactions between the State, the Market, and International Cooperation in an Integrated World

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Abstract

Globalisation driven by developments in technology, openness, and interdependence in economic and social transactions, has drastically changed the power dynamics of the bilateral and complex relationships among states, markets, and individuals. These transformations have understandably attracted mixed reactions from human rights scholars, with many envisaging a rather negative outlook on the effect of globalization on the realisation of fundamental human rights in many parts of the world. This article reviews the common notion of globalisation as a threat to human dignity and the promotion of human rights, and using the *World 3.0* scenario of globalisation expounded by Ghemawat (2011), defending the position that a more integrated and globalised world offers superior opportunities for the protection and promotion of human rights. The article then identifies some areas in which economic, social, and cultural rights policy and advocacy efforts should evolve in this eventuality. It is proposed that a new form of global integration, enhanced regulation and governmental role can create a more robust environment for the realisation of human rights.

Keywords: *Globalisation; Human rights Integration; International cooperation; ESC rights realisation*

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1. Introduction

The *raison d'être* of the international human rights regime and its many institutional mechanisms – as defined by the International Bill of Rights and subsequent human rights treaties and protocols – is the protection of fundamental rights and freedoms of human beings everywhere, which are indispensable for dignified lives. Thus, the design of the international human rights regimes attaches the primary obligation on protection of human rights on the state – as duty bearers – in which the individual lives; however, there is also an extraterritorial obligation which spans all states, reflecting the global nature of human rights based on shared values such as fairness, justice and dignity for all.

Globalisation as a phenomenon has radically affected and transformed the way the global interactions take place, from the market forces, technology and the level of state control and sovereignty in policymaking. There is an across-the-board recognition that globalisation increases and further opens up new ways for interconnectivity and interdependency between and among states and people (Addicott et al., 2012). These changes have very significant impacts on the level and quality of human rights enjoyed by individuals and groups regardless of the national jurisdiction they live in. Thus, globalisation has become an increasingly visible and prominent variable affecting the overall enjoyment of human rights by the multitudes; this is particularly relevant in the context of Economic, Social and Cultural rights (ESC rights).

Human rights scholars have long recognised the inevitable influence of the globalised world-order on the realisation of human rights in general as well as on specific rights, with arguments supporting both sides of the debate (Dunoff, 1999; Evans, 2010; Kinley, 2009; Shafir & Brysk, 2006). However, very few of these analyses seriously examines globalisation as a force that breaks barriers and integrates disparate states within more universally-adept systems and mechanisms which can be harnessed for better protection and promotion of human rights for all individuals across the globe.

Global capitalism and its associated liberal rights, Evans (2011; p. 91) alludes, should be accepted as "an inherent characteristics of humankind, not a self-consciously made choice about our preferred pathway to the good life." No matter where we stand on the debate on globalisation, there is no doubt that the current path of globalisation requires rethinking, for the fact that its benefits are still not maximised and there is only limited scope for influencing its course (Appel, 2019; World Commission on the Social Dimension of Globalization,

2004). As philosopher Peter Singer has aptly stated whether "we accept or reject the claim that economic globalisation is a good thing, we can still ask if there are ways of making it work better, or at least less badly" (Singer, 2002; p. 103). This notion of taming globalisation for the greater good has far-reaching consequences to the realisation of human rights.

1.1 Aims and objectives

This article aims at exploring the interactions and points of convergence between these two global ideals: universal enjoyment of human rights and global integration of national policy boundaries. It is the objective of this article to identify the commonalities of essence between globalisation and human rights within the ESC rights framework and the emerging trends on the future trajectory of globalisation, with its possible impact on the realisation of ESC rights. It does not aim to take sides on the globalisation debate, but rather attempts to position ESC rights in a more globalised world, specifically within the paradigm of *World 3.0* as expounded by Ghemawat (2011), which offers such a perspective in the analysis which can hopefully catalyse a more creative approach to link these two important phenomena.

1.2 Methodology

This article adopts a critical commentary approach using a doctrinal lens and is designed to capture the scholarly discourse on globalisation, juxtaposed within the context of the international human rights norms. This methodology is useful in mapping and scoping, as well as developing deeper analysis and conceptual innovation (Grant & Booth, 2009). The methodology is grounded in a thorough evaluation and critiquing of existing ideas and conceptual models in the field, with the purpose of synthesising them towards a new conceptual model. Hence, this paper provides a comprehensive literature review and conceptual analysis of historical and contemporary debates on globalisation and the realisation of human rights. It then puts forward a conceptual narrative on the role of State in guaranteeing the realisation of human rights in a globalised and interconnected world.

2. Making sense of the current debate on globalisation, integration, and regulation

Whereas globalisation and its effects are felt in many aspects of modern life, its impact on the States' regulatory capacity, increasing influence of corporations and market forces, ethics and human rights implications of globalisation are particularly relevant for developing a better appreciation of the interaction between these concepts. Using Nobel Laureate Joseph Stiglitz's argument that, while those who vilify globalisation overlook its benefits, its proponents are even more unbalanced in providing a clear picture (Stiglitz, 2002), one can propose the need to be more accommodative in appreciating this interaction. A more nuanced approach to understand this complex interaction can help identify more points of convergence and commonality.

Any intersection of discourse concerning globalisation and human rights naturally creates not only fierce arguments and counter-arguments on the merits or drawbacks of these two themes, but also a fair bit of intellectual energy is apportioned on scrutinising how these ubiquitous forces interact and influence one another. While the pro-globalisation camp emphasises the progress brought about by globalisation and integration in the last several decades in terms of increased global aggregate wealth and poverty reduction, the anti-globalisation camp is of the view that globalisation has helped only a few and left behind a significant proportion of humanity, resulting in the greatest degree of inequality in history (Coyle, 2010). The form of globalisation that is prevalent in the world today is seen by many to be unfair, undesirable, and unsustainable (Prato & Adams, 2021), mainly because of the hegemonic dominance of the rich and powerful States and corporations, which undermines the sovereignty of weaker States (Reddy, 2012). All states in the end lose much of their ability to control capital forces, economic flows and to even shape their domestic public opinion as they are under pressure from above (supra-national institutions and MNCs).

At the core of globalisation is the convergence of many diverse States and societies to become increasingly alike (Pikalo, 2007), and the unprecedented integration of world economies and cultures under the rubric of globalisation has attracted vast amount of intellectual output. For the purpose of this article, globalisation is identified as and associated with the economic, political, social and cultural processes it encompasses (Ssenyonjo, 2009), with particular emphasis on economic interdependence of States, technological change, cultural homogenisation and global institutions (Feyter, 2007). Instead of the narrow definition of economic dimension of globalisation, often preferred

by anti-globalisation scholars (Twining, 2009), the adoption of a broad definition allows our discussion to address the aspects of interconnectedness in globalisation that have direct bearings on human rights, and also make it possible to build the *World 3.0* scenario to the exposition later in this article.

2.1 Challenges and opportunities in realising Economic, Social and Cultural Rights in a globalised world

ESC rights espoused in the International Covenant on Economic, Social and Cultural Rights (ICESCR) and other international and regional human rights instruments encompass a set of human rights that are fundamental for the realisation and protection of human dignity (United Nations, 1966). The basic rights identified in the ICESCR include: right to work (article 6); rights in work (article 7); trade union rights (article 8); right to social security (article 9); right to social protection (article 10); right to health (article 11); right to an adequate standard of living (article 12); right to education (article 13,14); and cultural rights (article 15).

All States part ies to ICESCR are required to 'take steps, individually and through international assistance and co-operation, especially economic and technical, to the maximum of available resources, with a view to "achieving progressively the full realisation of the rights" and "by all appropriate means"' (ICSRI, article 2(1)). This obligation necessitates the States parties to engage all appropriate means and resources at their disposition, including the requirement to direct domestic legislations and policy tools as well as international engagement with other States, towards the "progressive realization" of these rights. State responsibility and obligations with regard to ESC rights, like all other categories of human rights, consists of the obligation to *respect, protect* and *fulfil* these rights. While the approach of progressive realisation applies to all rights, the Committee on Economic, Social and Cultural Rights (ESCR Committee) has established that the Minimum Core Contents of these obligations attach an immediate obligation on the States, which are not subject to progressive realisation or the available resources.

Despite the near-universal ratification of ICESCR (as of 2022, a total of 164 States have ratified the covenant) and the emphasis on *universality, indivisibility,* and *interdependence* of all human rights, the realisation of ESC rights still remain far below that of Civil and Political rights (Robinson, 2004; Strydom, 2019). The low level of ESC rights realisation is often associated with the capacity of the State to fulfil these rights, especially citing the resource-intensive nature of these rights. It is also argued that in contrast with civil and political rights, ESC

rights realisation requires a substantial amount of resources and most States, particularly developing States, are resource-constrained, therefore unable to fully address the requirement to have these rights fulfilled (Chirwa & Amodu, 2021; Felner, 2009; Künnemann, 1995). ESC rights literature also advances arguments from the economic and programmatic nature of these rights as well as the presently dominant market-based international economic environment, which affects the State's ability to 'guarantee' these rights.

States confront a number of challenges in the progressive realisation of ESC rights, including the available policy space for the State to properly regulate the enjoyment of facilities and services that are required for the ESC rights realisation and the resources constraints all States face. These factors of market reality effectively confine the scope of States to exercise their policy imperatives to ensure the realisation of ESC rights. While the judicial recognition of ESC rights and their justiciability (Koch, 2003) in courts offer strong foundations for guaranteeing the protection of these rights, the practicality of the State responsibility to ensure the realisation of these rights remains difficult mainly due to the inherent nature of these rights. The new globalisation forces and the international economic order also ostensibly have the effect of shrinking policy space for States (Forster et al., 2020), resulting in cutbacks on the level of policy autonomy States traditionally possessed and exercised, particularly in areas of direct market engagement and intervention (Jackson, 2021).

While the obligation to *respect* and *protect* the ESC rights require State resources particularly in the form of setting up and administering the requisite legal and institutional frameworks necessary for the protection of these rights, the obligation to *fulfil* clearly requires substantially more commitment and investment of resources. However, the amount of resources that can be mobilised and allocated by the State to realise human rights depends on many factors such as the level of economic development, tax-base and revenue flow, level of investment and macroeconomic policies.

With the obvious constraints on resources experienced by all States, particularly developing States, there is an increasing recognition that resources other than that of monetary and financial nature can also be considered in the basket of resources that can be used for the realisation of human rights. These resources include technical resources, natural resources, human resources as well as knowledge and management resources (Robertson, 1994). The State can thus expand its capacity to fulfil ESC rights through better mobilisation of these resources.

No matter how resources at the disposition of the State are defined, they are continuously faced with the daunting reality of resource scarcity that affects the level of ESC rights realisation. Any amount of resources that the State has access to, also must be mobilised and allocated based on many conflicting and competing policy priorities and political objectives. When these challenges are observed through the lens of globalisation and how the State's policy space is affected by global integration, it can significantly expound the debate on the enjoyment of human rights in general, and ESC rights in specific.

ESC rights are inherently linked to the market and individualised consumption of goods and services within the market mechanism. For example, the right to work is enjoyed at an individual level through their engagement with the job market, either in the public or private sector within the country or abroad, hence the fulfilment of these rights at the individual level naturally has more bearing of market forces, such as supply and demand and the cyclical factors of the economy. Likewise, perhaps more evidently, the rights to housing, food, water, and clothing, etc. (which make up the aggregate right to an adequate standard of living) are crucially market-based, consumption-driven rights, the enjoyment or deprivation of which can in most cases be directly attributable to the market forces and the individuals' interactions within the market. Right to education and right to health are often much less market-provided, due mainly to their public sector provision in most countries. Nonetheless, even these rights are also highly subjected to the forces of the market, especially in countries where education and health services are increasingly being provided by private sector service-providers. A similar trend is likewise observed in the area of right to social protection and cultural rights.

2.2 Globalisation, markets, and ESC rights

The economic, social and political power and influence of corporations as a result of globalisation (Toebes & Černič, 2012), and how they shape up the world economy and socio-political order have significant impact on the realisation of human rights, particularly ESC rights (Govindjee & Taiwo, 2012). While the State is the primary duty-bearer under international human rights law, the role of the State in economic globalisation is often seen as minimal or simply as a facilitator, raising questions about the ability of the State to fulfil human rights obligations in these diametrical roles, particularly after relinquishing part of its authority over to the market (Feyter, 2007). Likewise, given the shifting balance of power between States and non-State actors, whether if the State is the most suitable and most appropriate agent to negotiate and protect individual's human rights is also debatable (Evans, 2010). Maintaining the primacy of the

State obligation to protect human rights, Joseph (2011) argues that States must preserve a certain 'policy space' in trade negotiations, and should view the benefits flowing from such arrangements as means that serve the fulfilment of human rights.

O'Connell (2011) identifies two distinct forms of globalisation; globalisation from above and globalisation from below and argues that, in order to construct a more human alternative, the globalisation from above should be rejected, because it is driven by the interests of dominant transnational capital holders. At the core of this argument is the perceived malevolence of the integrated market, which has helped sustain and exacerbate poverty, thereby negatively impacting the quality of life and undermining the human rights of countless (O'Connell, 2011). On the other hand, the globalisation from below, which is also referred to as 'subaltern' or 'counter-hegemonic' or 'alter' globalization (O'Connell, 2011), is identified to be the ideal form with the capacity to change the world for the better.

The negative connotations associated with globalisation are often the common basis of criticism, as these forces are perceived to be responsible for not only the 'disappearance' of the State, but also responsible for the economic exploitation that has created a world of disparity and suffering. The ability of the State to regulate and govern affairs of the economy and society is often seen to be hindered by the pressure of globalisation, limiting the State's ability to regulate the market, social services and also affect the amount of resources that are available for the State to invest in the area of ESC rights (Lang, 2009). Here, the contention is that the forces of globalisation has removed or significantly diminished the authority of the State to run policies at the domestic level. Others have expressed concern on the amount of economic, political, and social powers and influence outside the State, which have the potential to undermine the State's authority as 'the primary unit of political organisation and loyalty' (Govindjee & Taiwo, 2012), and reducing many human rights obligations to mere tradable services.

On the other hand, the alleged undermining of the State's ability to regulate the national economy in favour of private corporations and its destruction of the livelihood of poor and marginalised, are often dismissed by many who view that globalisation has strengthened the State rather than withering them away (Pikalo, 2007). It is often argued that global economy has a much bigger influence on the realisation of economic and social well-being, and there is an observable shift away from the State in the realisation of human rights (Evans, 2010).

Another common criticism is that globalisation gives priority to the interests of the market over the citizens, thereby negatively impacting the lives of people. It is argued that the conditions for the violation of human rights are structurally embedded in the current form of globalisation, hence breaking away from its hegemony and defeating its power are necessary to protect human rights (O'Connell, 2011). While generic globalisation – consisting of the electronic revolution, post-colonialism, transnational social space, and the new cosmopolitan movement – has opened up unprecedented opportunities for human rights, the historically-dominant capitalist form of globalisation undermines the opportunities for advancing human rights universally (Sklair, 2009). Sklair's main contention is that there is too much attention on capitalist globalisation, while the actual value of globalisation is more significant in the generic globalisation, which is seen positively by the vast majority of the world's population. In this framework, neo-liberal globalisation is seen as unduly dominated by the capitalist interests, which has created a system of extreme wealth and extreme poverty (O'Connell, 2011), and 'inconsistent with the protection of human rights not only in theory, but also in practice' (O'Connell, 2011). This perspective questions the practicality of protecting human rights in a world dominated by globalisation (Feyter, 2007).

The counter argument to these views hold that the problems identified here are not necessarily the characteristics of globalisation or the market economy which fuels it, and that poverty and under-development in many parts of the world have less to do with globalisation, but more about these countries' failure to globalise (Wolf, 2004). Likewise, the assumption that markets are value-free, thus morally ungrounded, overlooks the reality that these markets "embody the social norms and underlying values of the societies in which they operate" (Wolf, 2004; p. 217). Wolf argues that the market-based globalisation may be morally imperfect, because globalisation is a reflection of "the tastes and desires of people, who are also imperfect" (Wolf, 2004; p. 56). According to him, "the world needs more globalisation, not less" (Wolf, 2004; p. 320). He further contends that:

> *"The market economy satisfies the desires of the majority more than the tastes of a refined minority. It rewards the hustler more than the sage. But it is also the basis of freedom and democracy. It encourages valuable moral virtues. It makes people richer and more concerned about environmental damage, pain and injustice. It makes the welfare State possible" (p. 56).*

It has been argued that the debate on globalisation misses the mark if it fails to recognise that the world's poorest billion people live in States that have not globalised, while the top billion are citizens of the developed wealthy world, and the middle four billion are those whose standard of living is improving, as a consequence of globalisation (Collier, 2007). On this account, Paul Collier contends that, among other causes, bad governance, wars, and being landlocked are more relevant explanations for the poverty of the bottom billion, rather than identifying it with the effects of globalisation (Collier, 2007). Thus, a positive outlook on globalisation points to the phenomenon's ability to impel social change, greater democracy, economic redistribution and rule of law, thereby enhancing the protection of human rights (Howard-Hassmann, 2005).

Some critics of globalisation and its impact on the protection of human rights argue that "one cannot be committed to the protection of fundamental human rights and at the same time acquiescent in the dominant model of globalisation" (O'Connell, 2011; p. 507). This approach calls for the current form of globalisation to be challenged and overcome in order to protect and promote human rights. Even if globalisation poses challenges to the State in carrying out some of its human rights obligations, a State cannot retract its human rights obligations on the basis of diminished State authority due to globalisation (Feyter, 2007). Likewise, (Sklair, 2009; p. 89) contends that:

> *"The globalization of human rights is the logical and substantive link between genuine democracy and alternative post-capitalist globalization. If we can demonstrate that the achievement of a global system of human rights is not possible under the conditions of capitalist globalization (capitalism can only justify itself in the long run by its alleged superiority in providing better lives for all), then it follows that some other form of globalization will be required if human rights are to be realized for all peoples."*

When the project of human rights promotion is affected by the forces of globalisation, it is pertinent to create new legal rules, structures and standards of behaviour that are in line with these demands (Addicott et al., 2012). The *World 3.0* scenario developed by Professor Pankaj Ghamavat in his 2011 book "World 3.0: Global Prosperity and How to Achieve it" presented below addresses some of these concerns.

3. Transforming globalisation and regulation: enter World 3.0

The above analysis of globalisation literature suggests that despite the

enormous benefits to the world population in terms of better technology, connectivity and high level of prosperity, the current model of globalisation may not be the only, or even the best, model that there is for explaining how globalisation works. According to Ghemawat (2011), despite the current obsession about the level of globalisation which has resulted in a 'flat world' as depicted by Thomas Friedman, in actuality we are not as globalised as we think we are: the author argues the current level of globalisation is far below what is expected and desired and often the current level of globalisation is reported with a high level of exaggeration. For him, the current level of globalisation is incomplete and can best be described as *semi-globalisation* (The author divides the various eras of humanity into the worlds. World 0.0: when the humanity was still living as hunter/gatherers. World 1.0: the world with earlier civilisations and middle age. World 2.0 post-industrial revolution globalized world. World 3.0: the ideal world of complete integration). In order to advance the current *World 2.0* to *World 3.0*, market integration and market regulation should be treated as two dimensions of choice that need to be coordinated, and the individuals embracing *World 3.0* give accent to a form of *rooted* cosmopolitanism (Ghemawat, 2011). This perspective on globalisation puts emphasis on increasing the current level of market integration, but with corresponding limited, and targeted market regulation, which guarantees a path to greater prosperity.

The approach embraced in *World 3.0* is both attractive and realistic because it not only recognises and focuses on cross-border integration, but also takes into account divergence of geographic and other forms of distinctiveness across the States. This necessitates an increased attention to be paid to both borders and distances, but also at the same time, benefit from a higher level of integration across these borders. The core model of globalisation emanating from this approach is more realistic about human nature. According to Ghemawat (2011; p. 18):

> *"*World 3.0 *strives for more realism about what drives us, but without sacrificing morality. It recognizes self-interest is important, but also provides a basis, rooted in distance, for bringing awareness of, sympathy for, and altruism toward others into the picture, in order to consider how we might make some progress along those dimensions. By contrast,* World 0.0 *and* 1.0 *embody an 'us versus them' approach that ignores foreign welfare entirely."*

In addition to grounding globalisation in a realist and moral basis, the *World 3.0* model proposes consideration for market failures and minimising such

eventualities through better cross-border market integration and regulatory initiatives. The rooted cosmopolitan approach envisions the individuals to be more aware of the world around them, through better acquaintances, multiple contact and engagement over time, and a sense of altruism (Ghemawat, 2011).

3.1 Possibility of more integration and regulation of ESC rights in World 3.0

If the notion of globalisation is understood to reflect a more practical and viable system as depicted in *World 3.0* scenario, exploring how such a system could interact with and impact the human rights obligations of the State can be an intellectually fulfilling task. While it is reasonable to assume that openness to trade, finance and investment stimulates economic growth, thereby, increasing the aggregate wealth and welfare of the society, it is questionable whether such a scenario may offer any promise of better human rights protection, particularly ESC rights, through better empowerment of the individuals, more resources and policy space for the governments.

While the philosophical and legal foundational roots of human rights remain firmly grounded in the history of its development, many changes that are brought about by globalisation prompt us to construct new concepts and paradigms of human rights that better reflect the world reality and dynamics. For example, Evans (2010) raises the question whether it would be better (and possible) to develop a new form of transnational law with the international citizen as its subject, which could better protect and promote human rights, on the face of the new challenges faced by globalisation. The creation of a new legal structure that can work in the real world- new rules and legal standards of behaviour recognised and practiced amongst civilised States in the context of the community of nations.

In *World 3.0*, an important conceptual transformation that is likely to happen is the extension of the human rights obligations to include non-State actors. The State as the primary human rights duty-bearer will remain in this scenario. However, the role of other actors in the realisation of rights will be better incorporated into the human rights regime. This change would also be accompanied by further enhancement of the State's regulatory authority and capacity, allowing individual States to be better able to regulate and implement policies targeted towards the realisation of ESC rights. Thus, the contention of the State about taking a minimalist view of its human rights obligations in the face of neo-liberal globalisation (O'Connell, 2011) can be addressed by seeking activist, interventionist approaches by the States (Dunoff, 1999). Such an approach is likely to create not only more policy space for States, but also the

opportunity for wider democratic participation in policy decisions.

It is often argued that the market-based globalisation has increased the authority and influence of non-State actors and transnational corporations and other business enterprises way beyond the capacity of the State, allowing these entities to positively or negatively influence human welfare and the enjoyment of human rights (Ssenyonjo, 2009). Practices of these entities in diverse areas as employment practices, environmental policies, as well as their interactions with the host governments can directly and indirectly affect the overall enjoyment of human rights of individuals. Hence, the changing paradigm of *World 3.0* necessitates the involvement of non-government actors, such as transnational corporations in the future planning of human rights programmes (Evans, 2010). This new paradigm is already visible in the form of increased incorporation of human rights concepts into the governing ethos of corporations in the form of corporate social responsibility (CSR). Likewise, the institutional mechanisms such as the UN Global Compact and the United Nations Guiding Principles on Business and Human Rights (UNGP) point to the movement towards better recognition that human rights responsibilities can and should transcend beyond the State to incorporate non-State actors (United Nations, 2011). The *Ten Commandments of Globalisation*, suggested by Martin Wolf, emphasise the potency of the market to create and sustain human ingenuity and prosperity allowing them to seek their goals and desire in life, and outlines actions that are required from the States, individuals, the market and international community in order to build a global society built on these values of globalisation (Wolf, 2004). What remains now is to see how these global norms could help transform the human rights landscape.

4. Realising ESC rights in World 3.0: market, State, and international co-operation

The emphasis on shared values and social norms in both market and State interventions remains crucial in our understanding of human rights realization (Coyle, 2010). The experience of the last few centuries leaves no doubt that the 'market is the most powerful institution for raising living standards ever invented: indeed, there are no rivals. But markets need States, just as States need markets' (Wolf, 2004; p. xvii). Likewise, markets 'need an effective State to operate well, and a healthy State would in turn depend on a thriving market sector of the economy' (Coyle, 2010). Economic globalisation does not alter the State's human rights obligations and cannot fail to discharge these obligations on the basis of arguments from State's incapacity due to globalisation forces (Feyter, 2007). It is imperative that the ability of the State to safeguard the

population against violation of their rights by third parties can depend on the human rights focus of their policy stance.

The *World 3.0* form of globalisation significantly changes the dynamics of the role of the State in fulfilling ESC rights. What would be situation of the protection and promotion of human rights in general, and ESC rights in specific, if the current form of globalisation is transformed through better integration and regulatory mechanism? What forms of transformations are possible for individuals to protect their ESC rights? How would *World 3.0* globalisation affect the State's ability to protect, respect and fulfil ESC rights, and maintain its policy autonomy, while at the same time increase international co-operation? These questions are addressed next.

4.1 Redefining the role of the State and the market in ESC rights

The essential features of *World 3.0* will theoretically allow governments to exercise policy autonomy at domestic level through enhanced and better integrated regulatory exercise. This addresses the many criticisms of the current form of globalisation, which is seen as a force that challenges the authority and sovereignty of the State to implement the human rights polices effectively. Despite the apparent incredulity, it is far more likely that the current problems associated with globalisation are not merely the failure of globalisation, but have their roots in the way it is governed (World Commission on the Social Dimension of Globalization, 2004). This is clearly identifiable from the institutional weakness in many parts of the world that have exacerbated the effects of weaknesses in key global rules.

The magnitude of wealth brought in through as a result of increased trade and investment allows for State-sponsored welfare and ESC rights programmes (Dunoff, 1999). Better market integration helps remove protective tariffs, subsidies, and other restrictions to trade which often are the causes of poor quality of life for many. For example, it is identified that the problem of hunger has a lot to do with price and distribution within and across countries than on the adequacy of production (Food and Agricultural Organization, 2009). Moreover, the movement of human capital across States, particularly from less developed to developed States, is seen as a challenge to human rights advancement in the less developed countries (Govindjee & Taiwo, 2012).

States which are better integrated into the world are likely to be better governed and less corrupt, and it is argued that trade liberalisation and other

forms of opening up significantly reduce corruption in a State (Joseph, 2011). If this approach is properly employed in the service of human rights in *World 3.0* the State can play even a more significant role, in better collaboration with non-State actors and international community, in the realisation of human rights in general and ESC rights, in particular.

4.2 Realising rights through individual empowerment

Globalisation needs to have a strong social dimension which respects human rights and individual dignity. For this to be a reality, it is suggested that globalisation should have a strong focus on people, their rights and autonomy; is based on shared solidarity, with special emphasis on addressing inequality and poverty (World Commission on the Social Dimension of Globalization, 2004). Individuals' capacity and capabilities to pursue market-based fulfilment of basic needs and essential requirements of life would be better facilitated in this market mechanism. Individuals can thus be more likely to enjoy ESC rights better without direct intervention of the government. Likewise, the further integration of the world economy allows the realisation of these rights to be more practical, due to access to resources, technologies, and international co-operation.

Taking the three main areas of focus of more market integration, better State regulation and rooted cosmopolitanism in *World 3.0*, individuals are more likely to be able to exercise their agency in the market, with the government and across borders. Better market integration, given that the rules of interaction are fair, would create more economic opportunities for all States. This can allow individuals and societies to open further avenues for human creativity, ingenuity, time and energy to improve their socio-economic situation. Better regulatory authority of the government is expected to create the much-needed checks on market-based exploitation of the vulnerable and create a more comprehensive system of social security and empowerment. The cosmopolitan outlook of *World 3.0*, which is still rooted in the individual societal values, is more likely provide opportunities to create room for better exchange of ideas and cultural values across borders, thereby creating a more conducive environment for the protection of economic, social and cultural rights.

4.3 Expanding opportunities for ESC rights through international co-operation

International co-operation and assistance are key principles of today's global dynamics (Coomans, 2011; Jian & Haozhe, 2021). Following from the work

of the ESCR Committee, Carmona (2009) identify that there is a duty for developing States to 'actively seek' international assistance and co-operation targeted specifically for the realisation of rights, under the rubric of Article 2(1) of ICESCR. However, the current international co-operation arrangements lack a proper focus on human rights, particularly ESC rights, which could be addressed in the *World 3.0* scenario.

It has been argued that 'everyone has an ethical as well as a legal obligation to protect the human rights of all other people' (Skogly, 2003; p. 274). Thus, extraterritorial obligations, particularly in the nature of international assistance and co-operation are central to the international human rights regime. Hence, while the construction of an alternative internationalism or cosmopolitan solidarity are offered as remedies to the adverse consequences of the current form of globalisation (O'Connell, 2011), the eventual solution in *World 3.0* could be in the form of a better coordinated and structured approach to international assistance and co-operation for the realisation of ESC rights.

Globalisation creates opportunities for people not only to influence their own government but also other governments for better protection of human rights, through social, political and economic interactions (Livingstone, 1999). Hence, *World 3.0* is characterised by more integrated markets and increased involvement of private-sector enterprises and multinational corporations in the provision of basic goods and services within the market mechanism. Therefore, international assistance and co-operation in the *World 3.0* scenario could be better established and with a greater focus on the socio-economic empowerment of the individuals, particularly in the developing world. The recognition of a stronger extraterritorial human rights obligation is argued to be supported by both legal and moral arguments, and such entrenchment will significantly change the overall realisation of ESC rights in developing countries.

5. Conclusions

Despite the positive aspects of social and economic interactions globalisation facilitates, the positive impact on human rights that these interactions facilitate have not been sufficiently studied and appreciated. The model of globalisation envisioned in *World 3.0* provides a fresh set of ideas to approach the question of how globalisation and human rights, particularly ESC rights, can interact for mutually beneficial outcomes. And no matter how strong the intellectual arguments against globalisation forces are, the current world's economic and political realities and environmental trends point towards a future of more globalisation to overcome and address emerging global human rights

challenges.

While the process of globalisation has produced enormous avenues and opportunities for wealth creation on the back of market-led economic growth driven only by profit, there is no denying that unfettered markets continue to pose unacceptable risks, and therefore a significant level of State intervention and regulation of markets is necessary to maximise the synergy of the market for the benefit of human rights. Such an approach creates a win-win situation for human rights and globalisation. This article's approach to address the potential benefits in *World 3.0* form of globalisation – which is characterised by better market integration, State regulation and rooted cosmopolitanism – provided the opportunity to look into the process of globalisation beyond the simple rhetorical notions of globalisation's untamed impact on lives.

There is a need to transform the quality and scope of State engagement in the realisation of human rights and enhance not only its role as the administrator and provider but also as the facilitator and catalyst of human rights realisation, which combine the synergy from domestic and global actors connected through the forces of globalisation and integration. This could be particularly more realistic and achievable in *World 3.0*, characterised by more integration and effective regulation.

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The challenges to digitalization of schools in the Maldives

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Abstract

Digitalization of schools has the potential to make learning cost-effective and equitable for all children of the Maldives. It can overcome barriers to education due to resource shortages in the remote small island schools of the Maldives (Ministry of Education, 2019a). This study evaluates the effectiveness, and explores the challenges of the school digitalization program initiated by the Maldives Ministry of Education, in 1986 and expanded on ever since. A qualitative research process using document analysis and one-to-one semi-structured interviews was used. The data showed that teachers were willing to integrate ICT into their teaching since they believed that integration of ICT promotes children's interest, participation and engagement in learning. However, the slow internet speeds and exorbitant costs of internet connectivity prevented even the most competent teachers from using ICT effectively in their classrooms. Other major factors at organizational level which hinder the effort of digitalization of schools of the Maldives was found to be the lack of a digital education policy and strategy, lack of teacher training in ICT education, and limited awareness from school management regarding the process and the concept of digitalization. Limited internet access, unfamiliarity with classroom management of devices, cost of replacing damaged or old equipment; and unreliable technical support prevented teachers from relying on ICT as a teaching tool. Additionally, lack of exposure of students and parents to the use of ICT for learning contribute to the challenges of digitalization. It is recommended that awareness programs for key stakeholders including teachers, students, parents, school IT technicians, businesses, internet providers, university lecturers and public are conducted to overcome the existing challenges of digitalization, so that digitalization of schools can become a collaborative, transformative process, involving all of the stakeholders at multiple levels.

Key words: digitalization of schools; ICT in education

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Introduction

The continuing global digital revolution is highly likely to result in the development of more powerful, spontaneous, interactive, and efficient communication modes, along with increased integration of rich media (Huang & Liaw, 2018). With enhanced broadband speeds and internet access, lessons can be taught using chatbots, augmented and virtual reality, supported by artificial intelligence sources, predictive analytics and personalised learning systems. The tools students use can be desktop computers, tablet computers, smart televisions, radios, mobile phones, headsets, robots, etc. (Vuorikari, Punie, Gomez, & Van Den Brande, 2016). Digital technology can provide education in many different forms; these include virtual learning, e-learning, distance learning, and mobile learning, using relevant content and artefacts, including teacher produced content. Technology enhanced learning has the potential to enhance the students learning experience by facilitating self-paced learning, lowering inhibition thresholds for asking questions, and allowing access to learning on an as and when needed basis (Kamath, 2015).

Digitalization of schools is mostly defined in literature to mean using digital technologies in teaching and learning. These include the use of online courses, online examinations, digital textbooks, animations, presentations, informative documentaries, simulations, games and use of online platforms for synchronous and asynchronous lessons, as well as use of digital tools for assessment, feedback, and for communication with students and parents. The students are given opportunities for independent and collaborative online research as homework and class based projects with time allocated for children to share their independent and collaborative research with other children in classroom settings and elsewhere. This can generate deeper language skills and content knowledge (Sunday, Ayooluwa, Pascal, & Olaniyi, 2015).

According to social constructivist theory of learning, students need to participate actively and collaboratively in a lesson to learn something new. Digital tools which stimulate maximum engagement, motivation and collaborative learning are needed to improve quality of teaching and learning (Riehemann & Jucks, 2017). Pane, Steiner, Baird & Hamilton (2015) suggest that computer assisted learning is effective when technology is combined with pedagogy to promote student learning in groups and allows for timely and productive feedback from their peers and their teachers. Fullan and Hargreaves (2020) advise teachers to consider active inclusive involvement of parents to develop a collaborative professional environment that has greater strength and depth, while ensuring that digital learning has psychic rewards for both children and teachers.

Internationally, virtual personalised learning is becoming the new norm in education with platforms such as Khan Academy, StraighterLine, Udemy, EdX, and Coursera offering a plethora of courses at affordable prices, including courses on how to integrate ICT into school education. Moodle, Tencent Education, Edmodo, Schoology, Blackboard, and Google Classroom are some of the cloud based platforms used by schools to offer blended learning to school age children. Digital expertise of teachers need to not only include knowledge of apps, tabs, platforms and other resources but to have the capacity to decide if the digital resource adds value to enhance learning, compared to other cheaper resources. They also need to identify, minimise and manage risks that children may be exposed to while engaging in digital teaching and learning.

The Maldives' Ministry of Education (2019a) described the digitalization of Maldivian schools as on the emerging-applying phase on the Morel's Matrix for ICT integration in schools which has four phases (1) emerging, (2) applying, (3) integrating, and (4) transforming. On the Morel's Matrix, emerging/applying means the ICT provision is teacher-centred, and driven by a few interested individuals. For provision to be transformative, it will have to be learner-centred and promote collaborative experiential learning, critical thinking, creativity and innovation. In transformation of ICT, entire learning community of teachers, students, parents and support staff will be involved and lessons will cater to different learning styles, interests and goals of achievement for children. With this vision of transforming learning through ICT, Ministry of Education's digital school project aims to make the schools more technology-friendly and meet the rising standards of the modernising world, by ensuring collaboration between schools, businesses, industries, internet service providers, teacher training colleges, families and communities to achieve this objective.

Since the digitalization process is at its infancy, it is necessary to conduct relevant studies to determine the advantages and disadvantages as well as the effectiveness of this process in the Maldives. Therefore, a thorough analysis of the digitalisation program was conducted to analyse the effectiveness of the program and the obstacles faced at policy and planning level and at school level. Recommendations are made for solutions that would overcome some of the major challenges, by considering the conditions that could enhance the digitalization process.

Methodology

In order to achieve the objective, a qualitative research process using one-to-one semi-structured interviews and secondary document analysis were used. Documents reviewed include Ministry of Education policy and planning documents, circulars, news reports, internet provider websites, non-governmental organizations' documentation and academic research literature.

Nine teachers and one principal from three different public schools in Male' were interviewed using a semi-structured interview format, in August 2019. The schools were chosen based on a high level of digital technology use.

Consent was obtained from the school management and Ministry of Education to conduct the study. Participants were selected by the researchers depending on their knowledge and experience with use of digital tools in teaching. The questions used in the interviews focussed on generating information regarding the effectiveness of the school digitalizing program and barriers to success.

The interview questions were on planning and implementing digital technology, challenges, effectiveness, and recommendations. Prior to the interviews, the questions used were pilot tested to see the sufficiency of the questions to generate the required data. The questions were asked in English, for ease of transcription. The participants were given the option to answer in English or Dhivehi. The questions were provided prior to the interview, for the participants to become familiar with the questions, so that they can give thought out responses. The interviews were audio recorded with the participants' permission. Each interview lasted for 20 to 35 minutes. Interviews were conducted at a location quiet and free from distraction (meeting room or a vacant classroom) provided by the research school upon request. The data collected was analysed using content analysis (Patton, 1990).

Findings from the document analysis

This section includes analysis of demographics, internet connectivity and access to broadband and artefacts, curriculum, teacher training, virtual learning and other policy developments.

Demographics

According to the latest educational statistics, Maldivian school system currently has approximately 89,000 children (25 percent of the Maldivian national population), in 348 schools, taught by 10,424 teachers of whom, 7458 are women. 22 percent of teachers are expatriates, and 13 percent are untrained, temporary teachers (Ministry of Education, 2019b).

Majority of Maldivian parents use smart mobile phones, the internet and instant messaging apps to access information and advice provided by their children's schools about their children, at times with the assistance of their children to access these services (Zahir, et al., 2020).

Availability of ICT equipment in schools

In the Maldives, in general, parent teacher associations and individual community members provide ICT equipment to schools while the Ministry of Education provides internet connectivity costs. A rapid baseline review of technology infrastructure and ICT integration conducted by Ministry of Education in February 2018 showed that out of 172 schools that participated in the survey, ICT related gadgets available to use in the classrooms included a total of 809 smart TVs, 415 Projectors, 90 smartboards, and 277 computer/ laptops/iPads. The model of provision is for each school to have a computer lab with about 15 desktop computers for a whole class of thirty children to join in at the same time (Ministry of Education, 2019a).

Tablet computers had been given to all of the school children from Grade 3 and above, across the Maldives in 2018, by the Ministry of Education. These tablets can be taken home by children. However, there is a gross shortage of ICT equipment in Maldivian schools, especially for teaching purposes, including modelling to the whole class, and for children to investigate using a range of ICT equipment. Equipment is mainly available only in schools in Male' and in other larger schools in the atolls, causing huge inequity issues for those children from smaller schools. Children who are marginalised, in underserved communities can be the most vulnerable children in the Maldives, who can benefit the most from digitally competent teachers and well resourced schools.

Access to digital equipment

According to the Ministry of Education survey of February 2018; 156 (90.7 percent) of the responding schools stated they provide access to computers to their teachers. This meant that 5,932 teachers accessed a total of 1,018 computers provided by the schools. 160 (93.0 percent) of the schools stated they provide internet access to their teachers and 133 (71.5 percent) of the schools stated they provide computer access to students. However, this limited access is problematic because of damage to equipment and the necessity to upgrade them on a regular basis (Ministry of Education, 2019a).

The 2018 survey by Ministry of Education (2019a) showed that Information Technology (IT) technical staffs were employed only in 57 of the responding schools with altogether 64 staff. Most of the other schools stated that the principal or teachers took the responsibility of technical troubleshooting. A few schools stated that the technical support services were outsourced. Additional to minor repair and maintenance services, prevention of breaches to internet safety, will require a full time trained staff member to be available at each school who can respond appropriately and provide support to the teachers.

Internet connectivity

The Maldives has two fibre-optic submarine cable networks of over 1200kms each, running across the length of the country, which support provision of fixed broadband and mobile broadband services. 3G to 4G mobile internet connections are available in all of the inhabited islands. The two major networks are owned by the two international telecommunication providers operating in the Maldives, Dhiraagu and Ooredhoo. Focus Infocom Private Limited is a local service provider who offers the highest internet speeds in the Maldives, but currently provides their services mostly for commercial use.

Most of the islands in the Maldives have an optical fibre internet connection. The speeds served to schools range from 4-5Mbps to 25Mbps in island schools, with up to 30Mbps in Male' schools. Internet providers currently have the capacity to provide up to 100Mbps in the islands and 1Gbps in Male'. Of the 213 schools connected via Digital School Network, Ministry of Education described the bandwidth as follows: 4 Mbps in 74 schools, 8 Mbps in 75 schools, 12 Mbps in 24 schools, 16 Mbps in 15 schools, 20 Mbps in 6 schools, 24 Mbps in 12 schools, 28 Mbps in 6 schools (a total of 2 Gbps). (Ministry of Education, 2019a)

These bandwidths are shared by the students and as well as the school office and teachers. “Current minimum of 4 Mbps is not enough even for 2 classes to connect concurrently” (Ministry of Education, 2019a).

According to the Ministry of Education, 6 Gbps total speed would barely suffice, but costs would be prohibitive for higher bandwidths since internet prices are very high in the Maldives. “The network is designed in such a way that the service provider cannot be changed from Dhiraagu to another. With such high internet prices, sustainability of the digitalisation project is questionable” (Ministry of Education, 2019a). However, Government of the Maldives holds 42 percent of shares in Dhiraagu with the Maldivian public holding 6 percent additional shares, and the company has the capacity to provide the services to the Ministry of Education requirements.

The most underserved and marginalised communities in the Maldives do not have broadband internet, preventing digital technology users from living in these communities. This limits any window of opportunity to digital teaching and learning for the poorest children and families of the Maldives.

Curriculum adaptation

Information and Communication Technology was introduced to Maldivian secondary school students as early as 1986, when the first computers were brought to the country by Ministry of Planning and Development. Soon after, the larger secondary schools in Male’ had computer laboratories. By 2004, computer science was included in the national curriculum and every child was mandated to be computer literate before leaving secondary school. The current National curriculum framework introduced in January 2015 and the Inclusive Education Policy implemented in January 2013 strongly emphasizes the use of information technology in teaching and learning.

The most significant change in the new curriculum is the eight key competencies through which students are prepared for lifelong learning. Each key competency is built on a combination of cognitive and practical skills, knowledge, values, attitudes, and other social and behavioural components. One of the eight key competencies is on ‘using Technology and the media’. According to the national curriculum, usage of technology and media enhances the ability to use a variety of technologies as a tool for learning, communication, and entertainment. Thus, the school management are accountable to include ICT in teaching and learning starting from early childhood stage. The inclusive education policy

implemented in the Maldives (Ministry of Education, 2013), contains guidelines principles, roles, and responsibilities necessary for the implementation of inclusive education in Maldives. This policy outlines modifications that need to be made to teaching methods, equipment and materials required, roles and responsibilities of stakeholders that are required to make this policy feasible (Ministry of Education, 2019a)

In the Ministry of Education survey of 2018, only 87 out of the 172 schools offered computer related subjects including Computer Science for Grade 8-10; Business Studies for Grade 7-10, BTEC/Dhasvaaru vocational subjects; ICT foundation to Key Stage 1-3; and a very few schools offered coding as an extracurricular activity called the Coding Club. Women in Tech Maldives, a civil society organisation in the Maldives collaborates with the Ministry of Education to promote coding as an extracurricular activity for girls.

Out of the 127 schools who participated in the rapid review of ICT in schools by the Ministry of Education, 75 schools listed 131 teachers assigned to computer-related subjects, 91 percent of them were expatriate teachers and 64 percent of all ICT related teachers were male. This indicates that unless there is a drive to train teachers, especially local women teachers, specialising in computer science and providing a salary incentive to remain a computer science teacher, there will be inequity in access to computer science education by Maldivian children.

Teacher Training

A majority of international funding received following the Tsunami of 2004 was utilised to streamline and optimize teaching, learning and school management using information technology. A major achievement of the funding was the establishment of 20 teacher resource centres (TRCs) in 20 atolls, with desktop computers, smart white boards, and internet access for virtual learning by teachers. Staff who led continuous professional development of teachers were trained on how to do online teaching using Moodle. The Ministry of Education, in collaboration with UNICEF, used the facilities to begin training school management professionals on virtual learning platforms. By 2018 there were 23 TRCs that were strategically located throughout the country. The TRC functions as the central resource hub for the islands in each atoll and is connected with the National Institute of Education (NIE) as the oversight body. The teacher educators in these training hubs have been trained on virtual learning (Saeed & Moreira, 2010; Ministry of Education, 2019a),

The Ministry of Education's 3 year Master Plan of 2015 -2018 identified 10 deliverables on ICT, including training all of the teachers in ICT-literacy and ICT integration, allowing for distance education courses to be accredited as continuous professional development of all teachers. When children were given tablet computers, teachers were offered a mandatory course to develop familiarity with use of Google Classroom.

UNICEF supported the widening of this training during the Covid-19 pandemic. 3,885 teachers in government schools including 2,641 female teachers were trained on the use of Google's G Suite from July to November 2020. This represents 42.5 per cent of the teaching workforce in government schools (UNICEF, 2021). This training covered the theory and delivery of content, and the creation, editing and posting of content on various media outlets to support online teaching and distance learning (Nishan & Mohamed, 2021).

In-house training was conducted by school staff members who were more familiar with the Google Classroom Application, with 100 percent of staff in some schools completing the Google Certified Educator Level 1 training, while others achieved Level 2, and the Trainer levels.

A study done by Shibana in 2013 in 5 Maldivian schools highlighted that 9 percent of teachers surveyed identified their computer usage as "not very friendly" with only 25 percent self-identifying themselves as "advanced users". Hoque, Samad, Siraj, and Ziyadh (2012), found that though digital tools are made available in schools of the Maldives, they are not used effectively for learning, rather used merely for administrative purposes.

In general, even though a few digital tools are available, due to low competency and technical knowledge, teachers only use these tools to deliver content to make it interesting for learners, rather than because of the impact on students' ICT skills or knowledge (Adam, 2015). Muhaimin (2019) stated that science teachers' low technological knowledge was the main reason for the insufficient use of technology by science teachers. Teacher's pedagogical habits rely on cultural practices relating to learning norms and institutional context (Adam, 2014), indicating that a paradigm shift in how teachers and school managers perceive ICT may be necessary for effective digitalisation of schools.

Virtual learning

By the end of 2018, there were 9 schools from the outer islands/atolls that were connected to Iskandhar School in Malé so that students can join lessons virtually if they did not have the subject teacher in their own school (Ministry of Education, 2019a).

The virtual learning program expanded dramatically during the corona virus pandemic of 2019, with extensive collaboration between Ministry of Education and internet service providers. The post-pandemic impact of the exposure to virtual learning and internet access for all of the children to continue with remote learning is yet to be seen.

Policy level developments

Maldives Education Management Information System (MEMIS) is an open source software system adapted to the Maldivian context and introduced to Maldivian schools in 2017, which is used for monitoring students' enrolment, attendance and their academic progress. Additional features in MEMIS include students' health screening data, data on children with learning disabilities, teacher qualifications and continuous professional development, allowing for efficiency in identifying gaps in provision. There are plans to also monitor availability of physical resources through the MEMIS (Ministry of Education, 2019a). Herodotou, et al. (2019) suggests that analytical data should not only identify students at risk, but also identify contextual factors involved in poor performance of individual students.

There is a national policy to ensure all schools had ICT equipment to a nationally acceptable standard, and to have an education portal providing access to quality teaching and learning resources. The Ministry of Education's online platform, Fila, is a resource repository that includes videos of previously televised lessons, and digital resources produced by National Institute of Education. Schools can also share their resources with other teachers through this platform. However, long term sustainability of the platform will require higher levels of organisation, storage and control of access to archived resources. The national policy also expects schools to draw up their own ICT in education and development plans (Ministry of Education, 2019). However, it is unclear, how the equipment and training will be funded and made sustainable, since most of the previous funding have been funding provided through non-governmental organizations, and the resourcing has not been specifically targeted to develop children's digital competence in security, integrity, information and knowledge

searching, critical engagement in digital content evaluation and production.

Findings from the interviews

The effectiveness of technology in the classroom depends on the teacher's ability to use it appropriately in the teaching and learning process. From the finding of the research it is evident that teachers have a positive perception towards integrating technology in teaching and learning. Participants noted that current digitalization program conducted by the Ministry of Education has faced a lot of challenges to fulfil the requirements of digitalization. The most significant challenges highlighted by teachers include insufficient teacher training and support from school management, inadequate technical support, improper management practices, imperfect policy and strategic planning, as well as lack of awareness programs to parents and students.

Effectiveness

One of the key factors that contribute to the effectiveness of digitalization of education is the usability of various tools in classroom deliveries. Nonetheless this depends on other key factors such as teacher competency, availability of tools and support service. Overall there is a positive perception towards the use of digital technology and tablet computers from all of the participants. Participants highlighted that, in general, using technology in teaching and learning was found to be beneficial. Regarding implementation of digital tools one participant quoted;

> *"I am positive about it; I think it is a good thing. Even though we have not incorporated ICT in mainstream teaching and learning I believe that most of the students understand lessons much better while teaching with digitalised tools than normal classroom teaching without ICT."*

Adam (2015), in her study on enhancing technology-integrated pedagogical practices in Maldives stated that the enthusiasm of teachers for learning new technology related ideas is high, however teachers require institutional support in learning complicated tools and their usability in delivering lessons. These tools promote student's attention, interest and minimise boredom during the lessons. According to the findings, the teachers believed that the students were more attentive and were more involved and engaged in learning when lessons were conducted using tablet computers. Regarding the participation of students during classrooms with technological tools, one participant noted as

follows;

> *"Students are more interested in lessons when these tools are utilized. They understand more; also they concentrate more when tablets are used. I feel that I have done less work when tablets are used to get students attention in the lesson. They are very attentive, when a work is assigned, they try to complete it. Students are more competitive to finish the work as soon as possible, and they try to do it better than the other students. Rather than giving work on the books, they are more into the lesson when work is assigned through the tablet computers. And it is helpful for me as a teacher too."*

Cassidy (2016) also suggested that motivation gives way to active learning which is student centred. Motivalla (2007) highlighted in her research, that when technology is used along with learner centred instruction, it improves learning, promoting cognitive development.

Challenges

Participants showed a positive attitude towards incorporating technology in teaching and learning, however most of the participants were shy of using the tablet computers, due to insufficient knowledge on how to use Google Classroom and other digital tools. Participants also found it difficult to identify and choose technological tools which match the learning objectives for the lessons.

Participants believed that effective training plays a significant role in implementing this program successfully; however the training conducted by Ministry of Education had no practical sessions. Although all of the participants had participated in the G-Suite training programme, most of the participants agreed that the training received was not sufficient to practically use relevant tools in teaching. Participants also highlighted that the training received was not adequate enough, to give them confidence to continuously conduct lessons in a virtual classroom. One participant commented on the efficiency of training as follows;

> *"The training was not sufficient. Ministry conducted a swift training session for the teachers regarding Google Classroom which was not much of a help to the teachers to fully understand the concept and use it. Not many practical sessions were conducted."*

According to the participants, the training was conducted at a fast pace, and only at a superficial level, that most participants failed to understand what was taught in the program. This reflected that a much better planned training including more technological pedagogies are needed in a sustainable manner. Shibana (2016), indicates in her study regarding challenges in transforming education in the Maldives, that digitalization requires continuous tuning of the system, with inclusion of ICT in education in preservice teacher training programs as well as in in-service teacher training programs. Jones (2017) stated that teachers were unable to use technology in the classroom in transformative ways not because of lack of technological knowledge but lack of knowledge about technological tools that are more interactive. Teachers need to see other teachers using digital tools effectively and collaborate with other teachers in team teaching, to gain confidence to use digital tools in their own classrooms. Adam (2015) found that many teachers raised concern regarding the formally designed workshop style professional development mechanism in schools as they were not organised well enough to enhance teachers' pedagogical practices. Most participants highlighted that this knowledge could be acquired best through hands-on practical sessions and observation of classrooms where digital tools are used efficiently and effectively. Due to lack of proper training, knowledge and required technical skills, the participants in this study found it difficult to apply different pedagogical approaches to achieve the range of learning outcomes identified in the National Curriculum.

Connectivity issues

In order to use digital tools and ICT in education, schools must be equipped with proper technical support and maintenance mechanisms. Technical issues are a major concern for the teachers while implementing digital tools in classrooms.

Inadequate internet access was indicated as a major challenge by all of the participants. Due to slow internet connection, students found it difficult to use the tablets during the class hours, thus lessons conducted even by competent teachers were not satisfactory. Although smart TVs and projectors were available, usually teachers downloaded the material and brought it to the class as internet access may not be available during class hours. Limited accessibility and networking connection are the biggest challenges in digitalization of the schools in the Maldives.

Lack of technical support

Some participants highlighted that managements of some schools show positive attitude towards technology and encourage use of digital technology in the classes, and ensure that computers, digital projectors, and smart TVs are available for all of the teachers to use. Unfortunately lack of technical support during lesson time and length of time taken to repair equipment were a major hindrance to integrating ICT in classroom teaching in Male' schools. Participants highlighted that technical support provided in almost all of the schools were not enough as most of the schools had one technician, who attends to all the technical problems within the school and that technicians were most of the time unavailable. Either the technician was too busy, or absent due to low motivation caused by higher workload and insufficient salary. This resulted in unattended technical issues.

According to Lewis (2003), without support in the classroom and respective to whole school resources, teachers cannot be expected to deliver a good lesson using technological tools. Rapid technical support would build a positive perception in using the technology by teachers. Participants noted that if a tool gets misplaced or damaged it takes a while to repair. According to Kozma (2008), a teacher has no interest in using technology if they face technical problems that require a long time to resolve. Shibana (2016) suggested that implementation of technological infrastructure must address all of the issues regarding tools, content development, networks, and technological support. However, it is worth to note that all of the research schools possessed modern technological tools, but the challenge was lack of proper maintenance.

Policy and Strategic Planning

Policy and strategic planning is a vital component in implementing digital education. Maldives does not have a policy on digitalization. Although many initiatives have been implemented in order to improve digital education, education sector of Maldives requires urgent national policy and strategy direction regarding digitalization of schools (Shibana, 2016). Lack of clear policies led to issues in implementation at school level. There is no timeline in achieving digital goals, thus the successful rate of progressive implementation cannot be weighed. This closes the doors for further improvements. Lack of formulated policies, strategic direction and timelines for implementation fuels contradiction among stakeholders regarding their roles and responsibilities.

Absence of specific performance indicators and monitoring frameworks was

highlighted in the education sector analytical report of Ministry of Education (2019a). Likewise, the findings in this research revealed that participants from some schools didn't give much consideration to integrate technology in their lessons as they did not get enough support from the management. Participants highlighted that there is no mechanism established in the school to monitor technological lessons conducted or to understand teacher's regular incorporation of technology in lessons. Additionally there is no established mechanism to give and receive feedback regarding the difficulties teachers face while using digital tools in classrooms. They also highlighted that when tools get damaged, the time taken to repair or replace also reflects low support from the management. This finding is supported by Phoele, Moakofhi, Phiri, & Leteane (2017) in their study that one of the hindrances to integrate technology in class was lack of support at leadership level. Amanuel (2019) also highlighted that lack of support from top management was one of the challenges to integrate ICT in teaching and learning.

Another issue according to the participants was awareness of students and parents towards digital platforms and tools. Participants noted that parents and students were not much aware of how to use mobile phones for enhancing learning, and to improve commitment to better understand subject content. Also students in Key Stage One had little or no understanding on how to use the given tablet computers. Further study needs to be carried out to determine level of awareness of students and parents towards digitalization of education and level of use of digital tools for learning purposes, whilst identifying strategies to increase collaborative practice inclusive of parents (Fullan & Hargreaves, 2021).

In summary, it is evident that the participants believed that using digital technology has relative advantage, however proper utilization of digital tools in the classroom was considered complex. At its initial stage of digitalization, there has not been any observable difference in student performance due to limited classes with technological practice. Participants suggested that providing good internet access with respective to strength and speed, providing effective teacher training, providing technical support, providing good technical facilities and carrying out effective awareness programs to parents and students, reducing teachers' workload, providing guidance and monitoring digital lesson more closely would make this program a much better one. Thus, it could be argued that digitalisation of teaching and learning in Maldivian schools needs concerted effort and collaboration among all of the stakeholders in attaining long term goals.

Conclusions

This study determined factors that promote digital teaching and learning and barriers that need to be addressed in order to successfully implement digital teaching and learning in Maldivian school system. It is evident that, stakeholders of this sector especially teachers believe incorporating technology in teaching and learning is beneficial in delivering lessons. The involvement and contribution by the students are high during classes taught using digital tools. However, individual teachers lack pedagogical knowledge, technical skill and know-how to confidently prepare personalised digital content, and to select an appropriate tool to effectively deliver the content which is the only proper way to trigger student's cognitive development. Several additional challenges hinder the effort of digitalization of schools of Maldives. Major findings include internet inequality of access, despite availability of the physical infrastructure; insufficient teacher training and support from management, inadequate technical support, improper management practices, lack of evidence based policy, strategy, training, and monitoring as well as lack of awareness programs for parents and students.

Currently, there is no conceptualization of what digitalisation of schools means, and what are the processes through which this would be achieved. A shared collaborative envisioning process is needed where students, teachers, parents, librarians, school principals, school health workers, counsellors, community health workers, curriculum developers, in-service teacher educators, policy makers, technologists, internet service providers, charitable organisations, and parent teacher associations come together, to explore what is needed in terms of transformation of learning through digitalization. Furthermore, awareness programs for key stakeholders and public are advised to overcome the existing challenges of digitalization.

Recommendations

Since digitalization is a key component of modern education, Maldivian government needs to do much more to support digitalisation of Maldivian schools. The following recommendations are derived from the findings of this study, to improve the digitalization of education sector in Maldives.

Absence of a digitalization policy undermines the current digitalization practices. It was observed that the program launched in the Maldives does not follow an evidence based approach to development, and does not reflect or address the challenges faced by the schools. An evidence based approach could help to

draw up policy, strategies, guidelines and monitoring mechanisms that should be followed by stakeholders operating at different levels of the school system. If issues arise due to negligence of any stakeholder, it would be easy to solve when clear roles, duties and tasks are allocated. It will also make it easier for school management teams, parents, teachers, school ICT technicians, training institutions, internet service providers, equipment suppliers, funding agencies and the Ministry of Education to work collaboratively to make the digitalisation program more successful and innovative.

Another recommendation is to enhance teacher competence by means of both pre-service and in-service teacher training. It is important to formulate a training policy that concentrates on all facets of digitalisation including fundamental proficiency training in computer science teaching in all of the schools of the Maldives, and methods of application of technology in teaching all of the subjects, along with a solid technological pedagogy with practical sessions, including international visits to schools abroad to observe how digital technology can be used in classroom settings.

Along with teacher training, it's also important to formulate a monitoring mechanism. Through such a mechanism, the school management can support integration of digital technology across all of the subjects, as well as ensure national policy is followed. Formulation of an effective monitoring framework is mandatory to ensure teachers use technology regularly and effectively during lessons. This could be carried out through lesson plan checks, coordination meetings and lesson observations.

For collaborative online learning to happen, parents need to be trained on how to use online digital tools and to support their children's home-based learning in a safe manner. Parents need to be taught how to follow the online safety guidelines developed for parents, by the Ministry of Education recently. If trained, parents can be a valuable asset in improving children's learning through use of digital technology.

The internet connections available in most schools were upgraded recently. Although internet is available in most of the schools, it is merely sufficient for communication and administrative purposes. The low speed and lack of capacity for multi device usage hinders the usability of digital tools in a class room and is not sufficient for more than two classrooms to use internet simultaneously. Therefore, it is vital that Maldivian government speeds up policy interventions to upgrade and enhance internet connections, ensure continuous upgrades to equipment required, and to maintain the quality of broadband services

provided.

A much stronger firewall and security is also required to block the unwanted popups and prohibit students in exploring other irrelevant content during class hours. Additionally, technicians and technical assistants with proper technological knowledge should be employed in schools to address the issues raised by the participants. It's important that teachers receive full technical support to aid the process of incorporation of technology in the classroom in a continuous manner. Unless technicians have a salary which can support a family life, have regular training opportunities to continuously learn to maintain and repair equipment, retention of IT technicians will continue to be an ongoing concern.

This research explored the challenges generally faced by the teachers in implementing digitalization in classrooms; further research needs to be done from students, parents and other stakeholders' perspective too. Sustained action research by teachers on digital teaching, learning and assessment exploring how to design collaborative interventions can not only benefit the students but motivate the teachers to engage in digital pedagogies.

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