# Technological Advancement and Changing Skills: Imperative for a Paradigm Shift in Education Delivery in Zambia

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## Abstract

Technological advancements in the internet, automation, artificial intelligence and robotics are impacting all areas of our lives, including education. These changes are rapidly influencing the skill set of 21st Century learners born in the internet age. While these changes are taking place, the way children learn continues to be the same. Education reforms embracing these changes are needed to meet the needs of 21st Century learners. Our learners must be prepared to fill various roles as workers, parents, citizens, and consumers. A culture of learning, unlearning and relearning is necessary to apply their knowledge and skills effectively to the rapidly changing world. Therefore, we need a paradigm shift in the education system to address these gaps brought about by technological advancement and changing skills. The paper addresses the learner, instructor, learning environment and the administration side of the education sector. Finally, the paper ends with some suggestions for developing a learner who embraces learning, unlearning and relearning culture.

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## 1. Introduction

Check the social apps, look through today's mail, flip through the TV channels, browse the emails and check the internet connection. This is the life into which today's child is born, shaping their lifestyle. The point is that we live in technological advancement. A technological world where the internet, automation, artificial intelligence and robotics are impacting all areas of our lives, including education (Kai-Fu, 2018). These changes have triggered dramatic changes in how people interact with one another (Vicki, 2002), exchange content and function in society. The changes in technology have furthermore affected the world of work. According to (Mumba, 2019), a broad swath of occupations is at risk of transition

or elimination through automation and artificial intelligence.

Furthermore, McKinsey Global Institute (2018) has highly experienced such risks in developed countries. However, the effects have also started to be felt in many developing economies and industries (OECD, 2018). Some scholars have indicated that the pace at which this is happening is quickening (OECD, 2018; Kai-Fu, 2018; Mumba, 2019). However, such a transformation in skills is not new; it has been happening since the inception of humankind (Brynjolfsson and McAfee, 2011). Brynjolfsson and McAfee (2011), skills often move from the arcane to the user to the universal. Long division, for example, was primarily the province of mathematicians and scientists until the 19th Century. Now it is taught in elementary schools. More recently, we see a similar pattern with coding, data science, 21st-century or "soft" skills and other on-the-job competencies (Mahmud and Wong, 2022).

Despite significant academic attention on how technological advancement affects job skills and occupations (e.g., Acemoglu and Auto, 2011; Brynjolfsson and McAfee, 2014), there is less understanding of how education institutions and industry can work together to respond to the effects of technological change. Understanding so, it is time for learners, educators, and education administrators to work with the industries and sit down to look at which skills contribute to their value over time. Moreover, if such a set of critical skills exists, how do these skills interact, and what do they mean? Thus, given these changes, one can say that it is now more critical than ever that education prepares its students for one thing that machines will never be able to do but only humans. A central concern is how to bolster the educator, the administrator and the industry for serious education reforms embracing these changes to meet the needs of a 21st Century learner.

Although technological transformation has been advancing, the way children learn continues to be the same (Trenerry, Chng, Wang, Suhaila, Lim, Lu and Oh, 2021). Adoption and integration have been slow in developing countries (World Economic Forum, 2019). Urgent education reforms embracing these changes are needed to meet the needs of the 21st Century Learner. Our learners must be prepared to fill various roles as workers, parents, citizens, and consumers of large amounts of information. Simply put, our learners must know how to deal with technology and use it as part of their learning (Mahmud and Wong, 2022). Trenerry et al. (2021) proper usage of technology is becoming a skill essential for survival in today's world. A culture of learning, unlearning and relearning is necessary to apply their knowledge and skills effectively to the rapidly changing world (Mumba, 2019). Therefore, we need a paradigm shift in the education system to address these gaps brought about by technological advancement and changing skills.

Saykili (2019) summarises today's technological advancements forcing the education sector globally to transform and adapt to the 21st Century. Among these changes influencing the way education is delivered include; knowledge access and dissemination roles that have shifted away from solely the sole responsibilities of the education providers. Nevertheless, the role of a teacher is now the responsibility of everyone as learners can access education information from everywhere. Today, we are inundated with information due to technological advances over the past years (Vicki, 2002). According to Vicki (2002), the amount of information we confront daily is more than most people had to contend with within an entire lifetime, only a little more than 100 years ago. More information has been produced in the past 30 years than combined in the previous 5000 years (Mahmud and Wong, 2022). Information is being produced rapidly, and

this supply is expected to double every two years (Vicki, 2002). These changes will keep coming in different forms and influencing our lives; hence, they must be adopted and embraced.

Other changes include digital platforms bearing new interactions and affective expression schemes, new ways to express culture and social media effects, big data and learning analytics, massive online open courses (MOOCs and open educational resources (OER), among many others (Saykili, 2019). Others are educational games and the advancement of digital platforms enabling increased interaction and collaboration between and among educators and learners. Digital or web-based learning is increasingly becoming part of learning. According to Vlachopoulos and Makri (2017), interaction and collaboration via digital platforms attract significant interest among tutors, students and game designers. Most researchers agree on the supplementary role that games can play (Sitzmann, 2011; Vlachopoulos and Makri, 2017)). Moreover, research findings have shown that games are effective learning methods as they promote knowledge acquisition (Smetana and Bell, 2012; Backlund and Hendrix, 2013), content understanding and concept learning (Connoly et al., 2012; Fu et al., 2016).

However, it is highlighted in the literature that the technological changes and advantages triggered by digital connective technologies have not received serious attention from educational institutions and are struggling to adopt them (Lonka, 2015). Education providers are facing various challenges peculiar to the 21st Century, including the changing and diversified learner profiles, increased learner activities, poor digital skills, scarce resources, increased market-based competition and challenges of internet connectivity, lack of modern infrastructures, among many others, especially in developing countries (Fu et al., 2016).

Other challenges facing the education sector include structural and administrative issues. These have been grouped into three broad areas; 1) changes in the delivery of services and finance of these services, 2) changes in the administrative processes, and 3) changes in the learning and teaching paradigm (Drake and Reid, 2020). Globally, digital tools are a solution to the structural and administrative challenges facing the education sector today, especially to the challenges posed by pandemics such as Covid-19 (Drake and Reid, 2020). Distance learning tools, sophisticated learning management systems, online social network tools, virtual and augmented reality, OER and MOOCs are seen as innovations offering equal educational opportunities for all to access quality educational content and support lifelong learning (Vega, 2013). Hence, education institutions and other players need to redesign their structures and operations, keeping the potential alongside the challenges of technological advancement.

However, there have been growing calls for reforms in the education system. The calls that education needs to be responsive to societal changes. The call that education is no longer in the condition to effectively respond to the current challenges and new societal needs in the technological age thus become part of the problem (Kukeska, Brockova and Serafinmovic, 2020). The traditional education structure must be sent to the past to fully transform the modern learning system. The World Academy of Art and Science, in the overview of the future of education, puts it that:

> As it is widely practised around the world today, it (education) still largely functions according to a model of
> pedagogy that predates the telegraph, telephone, motion pictures, radio, television and the internet. It still

*emphasizes the memorization of facts at a time when the ordinary smartphone provides instantaneous access to more information than any individual has ever committed to memory. It still fosters passive submission and obedience to authority at a time when the world needs individuals with the self-reliance, initiative, and problem-solving capabilities to fashion new solutions rather than merely regurgitate old ones. It still emphasizes getting the right answers to questions based on prevailing theories when developing the capacity to ask the right questions may be of far greater adaptive value. It prepares youth for increasingly scarce salaried jobs rather than imparting the capacity to create new jobs through self-employment and entrepreneurship. It still fosters a highly competitive, individualistic learning mode in a network society where cooperation and teamwork are the principal modes of work. It still fosters highly specialized, compartmentalized knowledge within narrow disciplinary fields at a time when the issue of the most serious problems from complex interactions between fields of activity" (WAAS, 2015).*

A new paradigm is, therefore, imperative in education to address the rapid changes and pressing challenges facing our society today. According to Kukeska, Brockova and Serafinmovic (2020), future education should be made relevant to the rapidly changing needs of society, the changing skills in the labour market, the growing shortage of attitudes and skills needed to promote entrepreneurship and full employment, the values needed for social harmony and problem-solving and the individuality needed for leadership, independent thinking and creativity (Jacobs, 2014). Alberto Zucconi and other academicians identified the need for the fundamental contours of the needed paradigm shift in education delivery:

**Table 1.** Contours of the Needed Paradigm Shift in Education Delivery

| Old Paradigm | New Paradigm |
|---|---|
| Subject-centred | Learner-centred |
| Passive transfer | Active learning |
| Competitive individual | Collaborative group learning |
| Standardized competencies and conformity | Customized, creative individuality |
| information | values |
| Abstract knowledge | Understanding and critical analysis |
| Mechanistic, reductionist thinking | Organic, integrated, interdisciplinary and transdisciplinary thinking |
| Transfer of mental knowledge | Development of the whole personality |
| Fragmented and compartmentalized knowledge | Contextual knowledge |

*Source: Jacobs and Zucconi, 2018, 4, table 1.*

The proliferation of digital technologies and cultures profoundly impacts learning, prompting questions that need answers. How will technology change our conceptions of learning? How will new ways of learning impact our uses of technology? How will teachers and lecturers' roles change, what will they need to know, and what will we see learners doing in the

future? Given these questions, the paper addresses the learner, instructor, learning environments and the administration side of the education sector and how the technological changes impact them in the digital age.

## 1.1. The Learner

A learner is a fundamental element in the education system that needs attention. Education systems do exist because of the learner. The population of learners is increasing, and the learner profiles are changing and diversifying daily (Saykili, 2019). Today, in many countries, we have more and more people desiring to go back to school after graduation for many reasons, among them mainly personal and professional development needs since the skills and the qualities acquired at the time in school are not sufficient to tackle the problems faced in professional life in the 21st Century (Dede, 2009). Besides (The World Bank Group, 2019), technological changes are transforming today's workplaces. Sahin and Alkan (2016) estimated that around 65% of primary school children today will work in jobs that do not exist now. Therefore, to be fully prepared for tomorrow's work, learners need to develop 21st Century skills, "soft skills," or deep learning. Thus, one of the critical questions that education needs to answer is what it means to be an educated person in the 21st Century (Glenn, 2008).

According to the World Economic Forum (2019), the fourth industrial revolution will favour those with strong digital skills and capabilities like creativity and teamwork, which machines find harder to replicate. Acemoglu and Autor (2011) have divided skills into cross-functional and specialized skills, where differentiation refers to the frequency with which those skills occur across all industries as opposed to an industry or profession. Others have categorized skills into technical and soft (the ability to use and develop technology) versus working within human interaction.

Furthermore, McKinsey Global Institute (2018) have listed the newest in-demand skills, often referred to as emerging skills. Cognitive skills commonly cover conceptual thinking and the ability to process thoughts and perform various mental activities and are most closely associated with learning, reasoning and problem-solving. Complementary to skills, experts increasingly consider attitudes a vital ingredient of the competency model, moving away from the more static and deterministic nature of knowledge and abilities (Frey and Osborne, 2017). Attitudes are consistent behaviours, emotional intelligence traits and beliefs that individuals exhibit that influence their approach to various things such as ideas, persons and situations. Attitudes are learned and often a big part of the driving force of learning and the approach to doing tasks.

Many individuals and organizations have proposed lists of competencies they believe to be necessary beyond the 21st Century (Lonka, 2015; Frey and Osborne, 2017; Drake and Reid, 2020). The competencies vary widely, ranging from critical thinking and argumentation to flexibility and empathy. The Business-Higher Education Forum (2018) has organized these skills into three domains:

1. The cognitive domain; includes thinking, reasoning, and related skills;
2. The intrapersonal domain; involves self-management, including the ability to regulate one's behaviour and emotions to reach goals; and
3. The interpersonal domain; involves expressing information to others, interpreting others' messages, and responding appropriately.

A good body of research on the 21st Century competencies has shown that these skills are related to desired outcomes in education, work, and other areas of life (Sitzmann, 2011; Vlachopoulos and Makri, 2017). For instance, the cognitive competencies show consistent, positive correlations of modest size with students' achieving higher levels of education, higher earnings, and better health (Piketty, 2014). On the other hand, consciousness (including organization, responsibility, and hardworking) shows the most vital relationship with the same desirable outcomes among intrapersonal competencies. On the contrary, antisocial behaviour and poor interpersonal skills (such as communication) are related to poorer outcomes (Lonka, 2015).

Furthermore, the learners' profiles are also changing. Today's learners have already integrated digital tools into most things they do (Oblinger, 2008). The tools learners use so skilfully in their daily lives are already reshaping learning styles and habits (Dede, 2005). Learners, therefore, start education with a different mindset from those of the generation before them (Siemens, 2006). According to Vicki (2002), a learner of today is equipped with different skills such as;

1. Multiprocessing; which refers to the ability to multitask;
2. Information navigation and screen and image literacy besides text literacy
3. Constantly discovering new things while browsing digital libraries
4. Learning in situations; the learners learn in different situations and are learning different things daily.

Today learners are surrounded by computers, mobile devices such as smartphones, tablets and applications installed on these devices. The combined technologies and applications shape learners' thinking and behaviour (Glenn, 2008). Moreover, there is nothing that the school can do. Today's learners are more willing than ever to create online learning communities and take active roles in these communities (Glenn, 2008; Lonka, 2015). Understanding so, Vicki (2002) states that learning in the digital age is as social as it is cognitive for today's learners. For them, learning is a concrete aspect rather than abstract, intertwined with discovery and reasoning.

The digital, therefore, are not only places where they access information and social resources but also platforms for learning through the social construction of knowledge. Within this regard, these learners are both consumers and producers of information (Saykili, 2019). Lonka (2015) summarised that the students who quickly get distracted and bored are the most competent digital users. Besides, the fact that learners can skilfully use digital tools and environments may not necessarily translate well into their ability to utilize them for educational purposes. Therefore, one can ask, are these students not possessing the skills to utilize the digital tools and platforms in their learning, or are they not provided the opportunity to learn using these tools? What is certain is that traditional teaching methods fail to attract a learner of today (Sahin and Alkan, 2016).

## 1.2. The Teacher or Instructor

The technological advancements witnessed today are also triggering debates about the roles and responsibilities of teachers in education delivery. According to Drake and Reid (2020), teachers must be equipped with new skills and qualifications to fully function well in discharging their duties. The role of the teacher in education delivery is changing

(Saykili, 2019). In this digital age, where information and knowledge are distributed across digital networks, the teacher is no longer the sole provider of information and knowledge (Dowden, 2011). Thus, learners can now access information and knowledge not only at schools from instructors or libraries from printed books but also from digital repositories, websites, social media and online learning communities and networks.

The information-providing role is insufficient in the digital age (Saykili, 2019). Simply put, learners in the digital age can access various online resources and knowledge experts through online social connections. The current role of the teacher remains that of an information provider. However, this is at variance with what the learner of today expects. Because the learners are exposed to information that is sometimes at odds with that presented by the instructors, the information provided is constantly questioned (Mahmud and Wong, 2022). Therefore, the role of the teacher needs to change from that of an information provider to that of a guide.

Further, the instructors' role needs to be learning designer, context and resources provider and facilitator for developing high-order skills (Saykili, 2019). Besides, the fundamental role of the provider must be that of a learning engineer who designs effective and engaging learning environments that address the skills and characteristics of the 21st Century learner through digital innovations (Piketty, 2014). In a joint report published by the American Association of Colleges of Teacher Education (AACTE), the instructor must have the following skills in order to respond to the needs of a 21st Century learner (AACTE and P21, 2010, pp. 11-12):

1. Successfully aligning technologies with content and pedagogy and developing the ability to use technologies to meet specific learning needs creatively,
2. Aligning instruction with standards, notably whose standards embody 21st-century skills and knowledge,
3. Balancing direct instruction strategically with project-oriented methods,
4. Applying child and adolescent development knowledge to educator preparation and education policy,
5. Using a range of assessment strategies to evaluate student performance and differentiate instruction (including but not limited to formative, portfolio-based, curriculum embedded and summative),
6. Participating actively in learning communities; tapping the expertise within a school or school district through coaching, mentoring, knowledge-sharing and team teaching;
7. Acting as mentors and peer coaches with fellow educators;
8. Using a range of strategies (such as formative assessments) to reach diverse students and to create environments that support differentiated teaching and learning;
9. Pursuing continuous learning opportunities and embracing career-long learning as a professional ethic.

## 1.3. The Learning Environment

We observe a shift from traditional learning through information acquisition models toward collaborative knowledge construction models of learning in the digital age. At this time, informal learning plays a vital role in shaping the learning activities of the individual (Lonka, 2015). Thus, (Mahmud and Wong, 2022) developing collective cultural practices and organizational and physical structures to support collaborative knowledge construction is vital for educational institutions.

On the other hand, education providers are currently struggling to provide the required organizational and physical structures for such practices. Collins and Halverson (2008) underscore the mismatch between the pedagogical and technological innovations and the current structures of education. According to Collins and Halverson (2008), in order to meet the desired changes in the education sector, the learning environments should make the following technology-based reforms:

A. The transition from standardized learning to individual learning: the standardized practice expects every learner to learn the same content in the same way and simultaneously. However, this practice is against the very nature of human learning, considering individual differences. Individualization is one of the most significant advantages that the current digital innovations have brought up. These innovations determine learning styles and interests and pinpoint each individual's challenges and difficulties through the big data collected throughout the educational process.

B. The transition from standardized evaluations to specialization: standardized learning assessed through multiple choice tests implies that learners must learn the same content. Digital technologies help to identify the learners' tendencies and provide individualized evaluation tools. However, this is far from realizing the 21st Century skills.

C. The transition from the knowledge-in-the-mind model to the knowledge-in-external-resources model: according to the traditional model, learning means internalizing without referring to external resources. Thus, the model assesses the learner's ability to recall information without referring to books, computers or web pages. However, individuals in their day-to-day practices and professional life solve problems by referring to external sources for information to achieve specific tasks. Access their ability to effectively and efficiently access and utilize external resources plays a vital role in functioning effectively in social and professional life in the digital age.

D. The transition from content coverage to knowledge discovery model: according to Saykili (2019), in the traditional school model, the primary objective is to teach the learners all the information they will need after graduation. The curriculum has become loaded with increased knowledge and information that keeps increasing exponentially, and knowledge is constantly updating.

E. The transition from learning through acquisition to learning by doing: the traditional learning model requires the learner to acquire factual information, concepts, procedures, theories and formulas (Saykili, 2019). On the other hand, (Glenn, 2008) digital tools help learners to carry out practice-based meaningful tasks. For this reason, these technologies create learning environments suitable for learning by doing.

The above pedagogical shifts require the transition from one-dimensional learning spaces (classroom, library, lab) to multidimensional collaborative learning spaces (physical, virtual and online) (Saykili, 2019). For learners to experience deep learning in the digital age, creating hybrid learning environments composed of socio-digital participation schemes that utilize digital, mobile, virtual, online, social and physical spaces is recommended (Lonka, 2015). Research has shown that learners develop better learning outcomes when exposed to hybrid learning environments than in single learning spaces (Glenn, 2008). Thus, it is imperative to develop hybrid learning environments that fully take advantage of physical, virtual, online and digital tools (Vega, 2013).

## 1.4. The Administration

The digital innovations in the 21st Century impact not only the learner, instructor, and learning environments but also reshape the administrative functions of the education sector (Mahmud and Wong, 2022). For instance, online social network tools enable constant contact with the graduates, and these career development practices are carried further after graduation. Besides, the student information system makes student affairs tasks more accessible (Vega, 2013), such as course registration and scholarships. According to (Mahmud and Wong, 2022), digital libraries and learning management systems enable learners to access course resources regardless of time and space. However, the digital age does not only imply adopting technological devices for logistical reasons (Edwards and Willis, 2000). The digital age also indicates a mind change for the realization of 21st Century skills (Cabellon and Junco, 2015). Lonka (2015) mentioned the discrepancies between the administrative functions of educational institutions and digital competencies and the informal learning practices of learners today. Therefore, administrators and policymakers involved in education delivery need to increase their understanding of how technological tools shape learning in the 21st Century and how these technologies impact the interactions between learners, instructors and learning resources. They must also work collaboratively with learning designers and experts to design adequate hybrid learning spaces for meaningful and deep learning (Collins and Halverson, 2009). Failure to develop political, administrative and pedagogical support will hinder the realization of the full potential the innovative digital technologies might bring into the education space (Vega, 2013). For example, in Finland, it was reported that access to digital devices was sufficient; however, there was a lack of understanding of how to utilize these tools for academic purposes (Lonka, 2015). In Zambia, for instance, we have seen computers introduced in schools. However, there are reports of implementation challenges due to the lack of computers and skilled staffing.

These examples show that without the required administrative, pedagogical and legal policies in place, integrating these advanced technologies into learning environments might cause damages rather than benefits in terms of supporting meaningful learning. Therefore, practical administrative functions must be first developed when supporting digital connective technologies (Vega, 2013).

## 2. Conclusions and Suggestions

We live in a globalized world, and digital technologies have significantly changed the world in which we live. Computers, cell phones, integrated digital devices and the internet have entered our lives' pores. On the other hand, education remains the most remarkable technology invented by man. However, it is not in shape to be a partner of the new inventions but remains static and relay on the traditional model. Therefore, we need a new paradigm. With great accuracy, scholars Garry Jacobs and Alberto Zunnoni identified the fundamental Contours of the Needed Paradigm Shift in Education.

Nevertheless, the identified and mentioned paradigm can only occur through systematic, deliberate, consistent and sustainable policies. Further, it is observed in the 21st Century that as the skills the learners need to develop change, so should instructors' roles and skill sets. Besides, the variety of learning environments where learners can construct knowledge is also increasing. However, due to its traditional administrative structures, education has failed to deal with

these changes. There is, therefore, a need to overcome the traditional teaching paradigm and support the learning paradigm in every dimension of the education sector to produce a responsive learner. There is a need to equip learners with skills such as accessing accurate and up-to-date information and a need to instil a culture of learning, unlearning and relearning. Further research is also needed to explore the 21st Century skills in the labour force in Zambia for the employability of our graduates at different levels of education.

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