

An Evaluation of ICT in Entrepreneurial Heritage Based Teacher Education 5.0 Curriculum of Zimbabwe

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ABSTRACT

This paper evaluates emerging information and communication technologies (ICT) issues in the teacher education (TE) curriculum as one of the gaps in the drive towards realisation of Heritage Based Education 5.0 (HBE 5.0) policy in Zimbabwe. The perceived gaps in ICT based strategies and/or methodologies were as a result of the policy shift from Education 3.0 to 5.0 which created a misalignment between policy and practice. This study, in addition to enhancement of perspectives on entrepreneurship and innovation, sought to add to literature on ICT in TE in the context of HBE 5.0 policy. The study was guided by the Unified Progression Model (UPM), the Constructive Alignment Theory (CAT) and the constructivist-interpretivist philosophy and paradigm. The research adopted the qualitative study approach and the embedded multiple case study method. The study found that there is need for TE to embrace emerging ICTs more than ever before, if they are to meet the demands of HBE 5.0 policy. This study, therefore, suggested and recommended the Programmatic Framework for Entrepreneurial Teacher Education (PFETE), for the Zimbabwean context. The study contributes to ICT in TE discourse by making multiple theoretical insights. The study, therefore, complements the extant perspectives on emerging ICTs in TE for innovation, industrialisation and sustainable development.

Key Words: Curriculum, Entrepreneurial Teacher Education, Entrepreneurship, Heritage based Education 5.0, Information and Communication Technology (ICT), Sustainable Development.

BACKGROUND TO THE STUDY

The introduction, by government through Ministry of Higher and Tertiary Education, Innovation Science and Technology Development (MHTEISTD), of the new Heritage Based Education 5.0 (HBE 5.0) policy framework ushered in a new tertiary education era in Zimbabwe. According to Ndanga (2021), the government would completely re-configure the HTE system from the tripartite education system of Teaching, Researching, and Community-service (Education 3.0), which produced only job-seeking graduates, to one that included Innovation and Industrialization, which would produce entrepreneurs, high-quality goods, and other types of value-added services. The HBE 5.0 policy guided the intended curriculum for tertiary education, replacing Education 3.0. Thereafter, it seemed there was a large misalignment between the intended and the implemented curricula in Higher and Tertiary Education Institutions (HTEIs), including teachers' colleges, in Zimbabwe. This was viewed as inhibiting the realisation of the envisaged industrialisation and sustainable socio-economic development in Zimbabwe (GOZ, 2020). There were calls for the realignment of curricula with policy and this was a clear indication that there were some gaps that existed. There were emerging challenges and opportunities in achieving Education 5.0 practice. One of the perceived gaps, which is the concern of this paper, was the place and nature of ICTs in heritage-based education 5.0 teacher education curriculum; both theory and practice. "In today's business environment, technology is the key driver for economic growth in the world over and Zimbabwe cannot be an exception." (Zvavahera, et al., 2018: 65). It appeared there was lack of relevant and appropriate ICT culture in teacher education contrary to the new HBE 5.0 policy guidelines.

REVIEW OF RELATED LITERATURE

Theoretical Framework

The Unified Progression Model (UPM)

Lackeus (2015) states that four progression models by Gibb (2008), Benker et al. (2011), Rasmussen and Nybje (2013), and Lackeus (2013) are the foundation of the UPM framework. This model is highly relevant to the research study because it was created for use in the study of EE. The generic qualities of this model also contributed to its selection for this investigation. Lackeus (2015) observed that the UPM was developed using four progression models, all of which shared generic properties. A team-based approach, an emphasis on creating value, connecting to the outside world, and allowing students to use their knowledge and abilities are some of these general characteristics. Because these traits resemble those of the HTE 5.0 policy, the researcher considered them essential to the study.

According to Deveci & Seikkula-Leino (2018) and Gibb (2008), entrepreneurship education focuses on teaching students how to learn "for," "through," and "about" entrepreneurship. Equally so, ideal ICT education implies students learning "about", "for", and "through" ICT. Articulated in the UPM and of interest to this study were the three steps which are; education through entrepreneurship; education about and through entrepreneurship; and education about, for and through entrepreneurship. This study was informed by this categorisation of EE and this dovetails well with ICT education. According to Kakouris and Liargovas (2020), the "about" mode adheres to the positivistic paradigm, the "for" mode adheres to the vocational education and training paradigm, and the "through" mode is inherently transformational. So, ICT and indeed entrepreneurship education is positivistic, vocational and transformational. This argument challenges the notion that all three modes are just positivistic and nothing else.

Lackeus (2020) identified and compared three different pedagogical approaches based on three different definitions of entrepreneurship. These were: (1) Idea and Artefact-Creation Pedagogy (IACP), which is based on opportunity identification and creation; (2) Value-Creation Pedagogy (VaCP), which is based on value creation; and (3) Venture-Creation Pedagogy (VeCP), which is based on organization creation. Much as the UPM guided this study, preliminary investigations pointed to emerging ICT issues and gaps in all these pedagogies.

The Constructive alignment theory (CAT).

The Constructive alignment theory (CAT) is an example of an outcome-based education (OBE) framework (Biggs, 2014). The theory was developed by John Biggs and has its roots in curriculum theory and constructivism (Adusei, 2016). The CAT represents the marriage between a constructivist understanding of learning and an aligned design for teaching (Adusei, 2016; Biggs & Tang, 2011). The CAT is an outcomes-based approach where student centred learning outcomes are defined before the actual teaching takes place (Biggs & Tang, 2011). The focus of CAT is on what and how students learn and not the topics the lecturer teaches. The CAT because of its emphasis on outcome-based teaching and learning is in sync with the heritage based HTE 5.0 policy in Zimbabwe, and can therefore, be useful in enhancing digitalisation and ICT pedagogy in HTEIs. Embracing the CAT for ICT education in HTEIs would go a long way in enhancing sustainable economic development. "Constructive alignment offers a different approach for curriculum developers, enabling educators to consider the end product (outcomes) and then form teaching, learning and assessment activities which match" (Joseph & Juwah, 2011; 2). This paper argues that, there were some emerging ICT issues and gaps in TE that the constructive alignment process, given its emphasis on what and how students learn, could help address.

Programmatic Framework for Entrepreneurial Teacher Education (PFETE)

The proposed theoretical framework for this study is the recommended Programmatic Framework for Entrepreneurial Teacher Education (PFETE). The key concepts that featured in this framework were

entrepreneurship, entrepreneurship education, innovation, value creation and HTE 5.0. The PFETE like Lakeus’ (2015) model, has three steps which, in this respect, are three years of pre-service teacher education.

In this study’s theoretical framework, EE and ICT are viewed as crosscut themes in the TE curriculum. However, ICT would take a key role as a catalyst in addressing the entrepreneurial needs of student teachers. Over and above aiming at skill-based value creation, ICT, in this context, is expected to be used as a tool to enhance and expedite sustainable venture creation.

In the first year, students take action by addressing societal challenges and everyday problems based on own interests and ideas integrated into core subjects of the TE curriculum, “through” ICT, “for” ICT, and “about” ICT. This, according to Lakeus (2015), spurs creativity, engagement, self-efficacy and also uncertainty and ambiguity.

During the second year, TE continues on embedded approach but with more emphasis on acting on curriculum knowledge, that should include indigenous knowledge and ICT, as per HTE 5.0 policy framework.

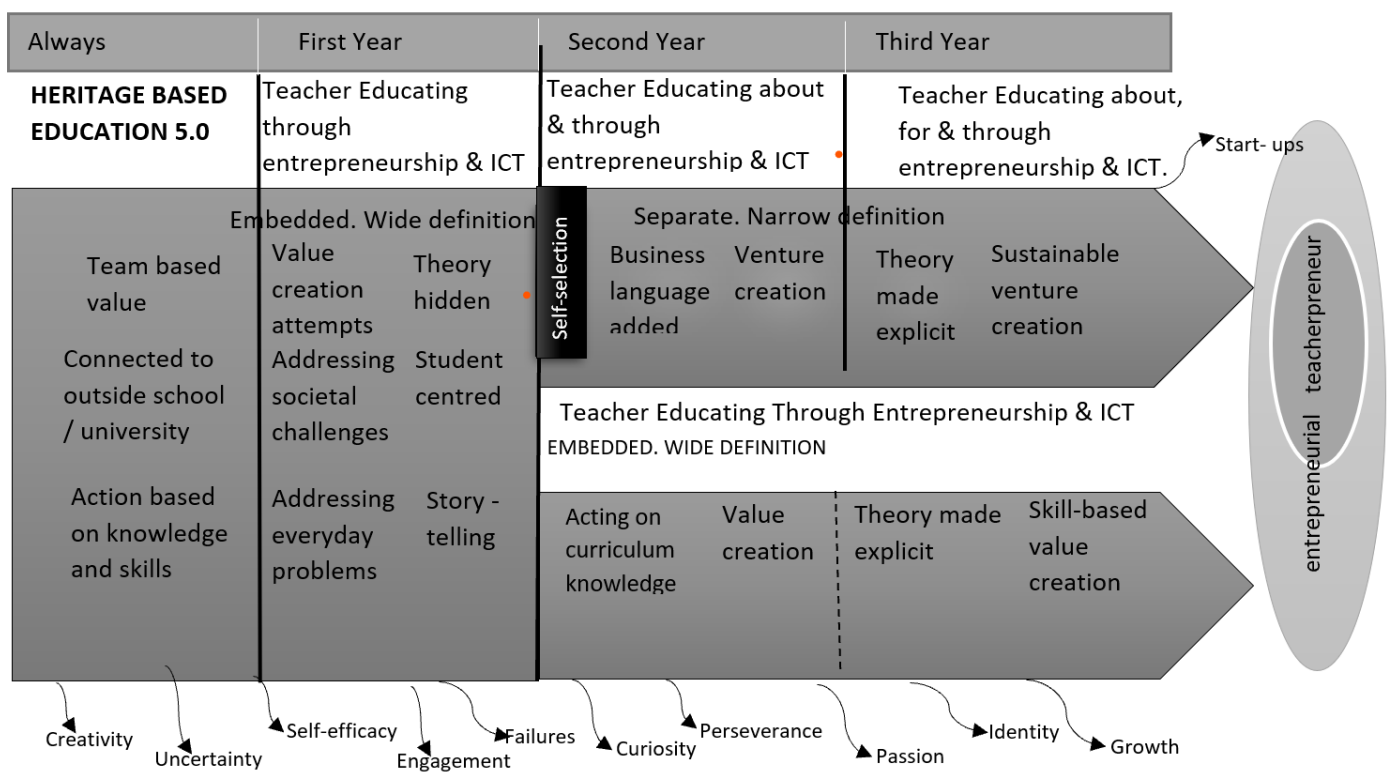


Figure 2.2 The Programmatic Framework for Entrepreneurial Teacher Education (PFETE)

Adapted from Lackeus (2015)

In the third year, the diploma in education study, would focus on making theory explicit through enhancing skill-based value creation and promoting sustainable venture creation (Lackeus, 2015). Ideally, the outcome of this whole process would be an ICT skilled teacherpreneur graduates with entrepreneurial and ICT orientation, and also being entrepreneurs in their own right. It is hoped that, such teachers would be ICT compliant and useful in the sustainable socio-economic development of the nation. ICT knowledge and skills would enhance the ease of creating and doing business.

Empirical Review

Immersive and Interactive Technology in TE

Entrepreneurship education has emerged in different educational contexts, primarily to develop an entrepreneurial culture, to create new ventures and to foster entrepreneurial mind-sets through education and

learning (Kuratko, 2005; OECD, 2015; Rahim et al., 2021). There are various emerging issues in entrepreneurship education in different countries of the world. The first national aspiration of the Malaysia Education Blueprint, Higher Education (MEB, HE) (2015-2025), is the development of holistic, entrepreneurial and balanced graduates. "It is important to move from a world of job seekers to a world of job creators" (MEB, HE, 2015-2025: E12). Malaysia is also advancing immersive and interactive experiences in education by combining Education 5.0 and Industry 4.0 in its approach. The intension is to engage learners from the current generation whose style of learning is unique to the digital world (Kamal et al., 2019).

Japan is looking at leveraging the tools of the Fourth Industrial Revolution (4IR) that is, new technology like Artificial intelligence, Robotics, Big data, and the Internet of Things (IoT); also referred to as the Sharing Economy, to create the new Society 5.0 (Rahim, 2021). The Japanese education system is one of the highest performing although they are facing some significant socio-economic and demographic challenges (OECD, 2020). By examining problems and solutions posed by Japan in the Society 5.0 model, pathways for students, focusing on problem-solving, can be created and EE is a promising model for education that seeks solutions (Kamal et al., 2019). ICT would be handy in developing and implementing various models for education.

Peredaryenko (2020) analysed educational systems changes introduced by these countries and discerned three common trends which are; the development of human strength, early inclusion of the 4IR elements into the education curriculum and transcending the humanities/science divide. However, these changes were not without challenges. According to Kamal et al. (2019), developing immersive and interactive educational experiences is a significant challenge for educators, particularly for those who lack technological expertise and do not see the need to spend money on producing technology-based educational content. The need to invest in the creation of technology-based educational content might be hampered by a lack of funding.

Digital Approach: Access and Inclusion

Entrepreneurship should be content with tough competition, tight finances and the need to maximise every growth opportunity and this cannot be done without staying at the top of the latest technology (Permatasari & Iqbal, 2019). Therefore, embracing the digital approach would remain a top priority in EE. The focus of the Digital approach in EE would be to capacitate teacherpreneurs in managing the process of converting old processes to new digital techniques to enhance efficiency and keep up with quickly changing market needs. Since the beginning of the 21st Century, universities have expanded their role to include contributions towards cultural, social and economic development through knowledge and technology transfer activities (Colombelli et al., 2022). Modern digital innovation requires the utilisation of the following: a broad ICT knowledge base, customer experiences, artificial intelligence, and supply chain advances such as; IoT, Big data, and Virtual Augmented Reality (VAR) (Tim, 2009).

The Estonian government initiated a digital transformation programme to increase its process efficiency and how it delivers public services to the general populace (OECD, 2022). They initiated full coverage of the digital mobile phone network and established a secure data exchange environment. The Estonia e-government and comprehensive data infrastructure for public service initiative saw 99% of their public service accessible online via a one-time login gateway (OECD, 2022). This was an innovative way of improving government efficiency and productivity. The OECD (2022) identified three lessons that should be learnt from the Estonian case, which would be significant to this research study. The first lesson was that the government had to reconsider how it operated, what its purpose was, and the issues that the previous administration was dealing with to construct Estonia's digital infrastructure. This has a vague resemblance to design thinking. The second lesson was that; the creation of data infrastructure required the creation of a suitable regulatory environment that guaranteed trust in the new system. The third lesson was that; the provision of the right incentives with flexibility to implement change and avoid barriers to adoption was necessary (OECD, 2022).

Through the Ministries of Education and Research and Economic Affairs and Energy, the German government has launched a nationwide strategic plan called Industrie 4.0 (Industry 4.0 [140]) (EC, 2017). IoTs are prioritized highly in the government's Digital Agenda, which focuses on the digital economy and digital workplaces and is intended to increase digitalization through smart factories (Industrie 4.0 platform, 140) (OECD, 2017). Germany's integration of the online and industrial production worlds is known as "Industrie

4.0." "Ten future projects were developed to support the High-Tech Strategy," according to the EC (2017: 3), which was part of the German government's action plan: High-Tech Strategy 2020, which was launched in March 2012. Germany appeared to be one of the nations setting the pace for digitalisation.

In Switzerland, Ahmad et al. (2022: 1) explored how the technologies of Industry 4.0 could be incorporated into Massive Open Online Courses (MOOCs), and

They proposed MOOCs 5.0, which would use Industry 4.0 technologies like the Internet of Things, Cloud computing, Big Data, Artificial intelligence, Machine learning, Blockchain, Gamification Technology, and the Metaverse to develop better universal access, better learner engagement, adaptive learning, greater collaboration, security, and curiosity. It would also incorporate the zones of ethics and humanism while also giving students access to a variety of learning opportunities.

Given the emerging global challenges of pandemics like COVID-19, HTEIs seemed to have no other choice but to enhance MOOCs in their curricula. The Zimbabwean context had the same challenges.

To promote immersive and interactive learning experiences, Malaysia (a smart nation) fused together Industry 4.0 and Education 5.0 (OECD, 2020). The objective was to engage learners from the current generation early enough because their learning style was particular to the then current digital world (Kamal et al., 2017). For educators without the necessary technical skills, it could be difficult to create an immersive and interactive learning environment. According to Kamal et al. (2017), gamification (the process of incorporating game-based elements into educational simulations) and immersive, interactive learning experiences were the future of teaching and learning. However, they cited challenges such as a lack of technical and programming knowledge, a lack of funding, and a lack of time for content development, as having an impact on program implementation (OECD, 2020). The Zimbabwean context was having similar obstacles. Immersive and interactive experiences in education had become inevitable and HTEIs had to keep up with the pace.

In a study to look at how venture capital (VC) invests in new technology ventures in developing nations, Choi (2013: 91) found that "... there is market failure in developing countries, VCs judge the endorsement by (business groups) BGs and government as an important factor for their investment decision making." They advised emerging technology companies in poor nations to strategically work with BGs or obtain government accreditation (Choi, 2013). This could be a lesson for new technology entrepreneurs in Zimbabwe as well, that they should engage both government and business to have more impact.

In a mixed-method descriptive study, Soliman and Abdou (2022) explored the challenges and opportunities of digital entrepreneurship (DE) in Egyptian higher education and offered suggestions on how to hasten DE. They did this by using a questionnaire and a semi-structured interview guide for the quantitative and qualitative processes, respectively. They made six recommendations appearing in Box 2.5.

Box 1: Recommendations for improving DE in Egypt

Recommendations for improving DE in Egypt

- a) The development and offer of appropriate courses with the right methodology; finding and training instructors in need of entrepreneurial methodologies in teaching and evaluation; establishing funding support; and creating entrepreneurship labs and incubators;
- b) Adoption of methodologies that enhance autonomy and student independence;
- c) Reconsider the evaluation system in a way that reinforces and rewards creativity and innovation, (establish a centre that creates a direct link between students and entrepreneurs);
- d) Further stimulate research in entrepreneurship in the higher degrees;
- e) Building partnerships with private and public support groups; and
- f) Opening a direct reporting system with policy makers and the government.

Source: Soliman & Abdou (2022).

In a study titled *Digitalisation in Teaching and Education in Kenya*, Barasa (2021) noted that the government was prioritising ICT in teaching and learning at both basic and higher education levels through collaborations with international agencies and organisations. They reported that the Digital Literacy Programme was initiated in 2016 to provide schools with digital equipment and train teachers on handling digital learning content. Teachers were trained in ICT to improve their requisite ICT competencies. The lack of teacher preparation and ongoing professional development, the scarcity of opportunities for the pedagogical use of digital technologies, the high cost of digital devices, and funding issues presented difficulties (Barasa, 2021). These challenges were affecting ICT programmes and ICT capacity building of teachers.

To determine how policy was promoting digital access and inclusion, Manda and Backhouse (2018) conducted a study on smart governance (e-government) and digital transformation in South Africa. They looked at the difficulties South Africa was having in enacting laws to advance inclusion and access to digital technology. According to their research, government departments tasked with managing the transition suffered from a lack of coordination and fragmented cohesion, which contributed to difficulties with the implementation of policy reform (the digital transformation agenda). Power and politics have negatively impacted digital transformation policy implementation. They noted that the promotion of digital inclusion, which allowed people to take advantage of the social and economic benefits of the digital revolution, depended heavily on citizens' e-readiness (e-literacy and e-skills). Unfortunately, it appeared that there was a lack of a more forceful and comprehensive approach to the historical injustice-related inequities (Manda & Backhouse, 2018). There was probably a need to research on how power and politics could positively influence digital transformation implementation, especially in emerging economies.

“Zimbabwe’s Higher and Tertiary Education lacks a comprehensive information management system and this constrains performance, monitoring, and weakens the foundation for evidence-based policymaking” (GOZ, 2020: 150). The suggested programmes to increase ICT literacy in Zimbabwe are shown in Box 2.6.

Box 2.6 Programmes to Increase ICT Literacy in Zimbabwe

Programmes to Increase ICT Literacy in Zimbabwe

- a) ICTs critical Skills Audit;
- b) Implementation of ICT Literacy Research and Development Programme;
- c) ICT Capacity Development, and;
- d) ICT Application Services.

Source; NDS1 (2021-2025) in GOZ (2020: 134)

From the various cases sighted above, it was concluded that entrepreneurial practices in HTEIs like teachers’ colleges could lead them to industrialisation if they could; 1) develop vital entrepreneurial competencies and MBKSA (for example, improved entrepreneurial intentions, initiative and implementation) in staff, students and society; 2) establish a strong connection with industry and society; 3) be practically oriented, entrepreneurial and innovative; and 4. embrace emerging technologies including ICT and innovative methodologies. Design Thinking and Digital approaches were identified as innovative methodologies that could be employed to enhance HBTE 5.0 for industrialisation (GOZ, 2020). Various countries have adopted different strategies, against the backdrop of various challenges and gaps, in their initiatives to harness the opportunities and benefits brought about by EE, entrepreneurship and innovation in the 4IR and beyond. The following section examined entrepreneurial TE curriculum review and transformation in the context of aligning with ICT policy.

METHODOLOGY

This study used the qualitative research approach. Qualitative research deals with respondents’ personal accounts, opinions and descriptions (Saunders, et al., 2019). According to Holloway & Galvin (2016), the interpretive approach to social reality serves as the foundation for qualitative research. In this study, qualitative research conveys a richness and intensity of detail in a way that any research type cannot (Holloway & Galvin, 2016). According to Mishra (2016), the term "qualitative research" refers to research methodologies that are

ethnographic, phenomenological, naturalistic, anthropological, field, or participant observer. According to Altheide & Schneider (2013), the richness and intensity of detail, the flexibility in data generation that qualitative research allows and the robust data that is generated, characterises qualitative research. The use of qualitative research approach was justified in this study on ICT, entrepreneurship and HBE 5.0 because of these characteristics. The descriptive, methodological and interactive nature of the approach also pushed the researcher towards using the qualitative research methodology. These characteristics of qualitative research justified its use in this study on ICT and HBE 5.0, which values the practical approach and field work in the industrialisation and innovation process. The following section is on research method of the study.

This study adopted the naturalistic, qualitative, embedded, multiple case study approach or method. This was advantageous to the study because the analysis of data from three case sites allowed major gaps in TE to be clearly and easily identified and interrogated.

This study adopted the purposive, non-random probability sampling procedure featuring judgemental and convenience sampling. The QDA, FGD, interviews and observations are the four data collection procedures adopted for this study. The next section focuses on data presentation, analysis, discussion and interpretation.

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Access and Utilisation of Advanced Knowledge and Technologies

LFGD participants reported misalignment or a gap, between the TE curriculum and HBE 5.0 policy framework, around access and utilisation of advanced knowledge and technologies, research and innovation. Case C, OI.4 (Table 4.4) suggested that “Research, Digitalisation and innovation in TE are quite ideal and they should be scaled up.” This was corroborated by Case C. Observation that; “The need for modern equipment that utilises the 4IR era technology was quite evident.” The MHTEISTD observed the need to “Develop disruptive innovative capacities in HTEIs to harness new ideas that translate to high-quality goods and services.” (MHTEISTD, 2021-2025: v). From the RRL, this was a culmination of observation that HTEIs were not fully utilising advanced knowledge and ICT. From observation, entrepreneurship and innovation, in the 21st century TE, should therefore fully utilise advanced knowledge and ICT, in line with the 4IR. However, two of the colleges under this study have shown understanding and willingness to embrace HBE 5.0 by changing and equipping rooms for research and innovation; RI-HUB libraries. Case B, KI acknowledged establishing RI-HUB, saying; “We have already introduced and established our own Research and Innovation Hub.” This was seen as a commendable effort towards aligning with the HBE 5.0 policy.

ICT teacher preparation and ongoing professional development

From the review of related literature (RRL), lecturers do not possess 21st century competences to train teachers (Nabwire, Obondo & Sella, 2015). It appeared equally so, in the Zimbabwean context, that some lecturers lacked the requisite skills and knowledge to train teachers. That made teacher preparation and ongoing professional development, especially with regards to ICT pedagogy, a gap that required urgent attention. From document analysis, Kanokorn, Pongtorn and Sujaya (2013) realized that soft skills were important for teachers and administrators during the 21st century and beyond, yet Alhouli and Al-Khayatt (2020) argued that the teacher development system was providing insufficient opportunities for students to develop those soft skills. It was observed, therefore, that there was need to capacitate lecturers with skills in syllabus development, item writing, and ICT based assessment.

From LFGD, the lecturers exhibited negative attitude towards embracing ICT as a teaching tool and it emerged from the discussion that few lecturers were advancing themselves in the mastery of ICT and other 4IR knowledge and skills.

Developing immersive and interactive educational experiences

From RRL, and according to Kamal et al. (2019), developing immersive and interactive educational experiences is a significant issue for teachers, particularly for those who lack technological expertise and do

not perceive the necessity to spend money on producing technology-based educational content. From research observation, there was need for both teacher and lecturer preparation coupled with ongoing professional development, especially with regards to ICT pedagogy, so that they are capable to develop immersive interactive experiences. However, there are other issues that affect the development and utilisation of immersive and interactive educational experiences like the cost factor and negative attitude coupled with resistance to change.

In the RRL, Mkala and Wanjau (2013), noted the challenge of obsolete equipment or insufficient resources in HTEIs, which negatively impacted on the development of immersive and interactive educational experiences. This was also an issue with Case C. The financing was also observed by the researcher and confirmed by Case C, OI.1 that; *“We do not have enough financial resources. In Mechanical Engineering, we have the equipment but they are now obsolete and we cannot replace them due to financial constraints.”* Case C, OI.2 concurred by stating that; *“Our major challenge is financial and other resources. For us to do serious business, we need capital.”* Case C, KI also pointed out that, *“... the challenge is that the machinery in the workshops has become obsolete so much that there is now no production to talk about.”*

High cost of digital devices, and funding issues

The high cost of digital devices, and funding challenges are some of the issues affecting the development of immersive and interactive educational experiences.

From the review of related literature;

Due to economic constraints and the dominance of the informal entrepreneurship, scarcity of foreign currency and generally negative conditions pertaining in the country (Zimbabwe), there was not much utilisation of technology and technological solutions because these came at a cost (Mangori, 2022).

So, having research and innovation laboratories may not be enough if they are not properly resourced and put to full utilisation. It is that aspect that seemed to be lacking in HTEIs in Zimbabwe. Case C, KI noted that *“We have workshops here but the equipment therein is outdated and obsolete.”* It was also very clear from observation that these workshops and laboratories needed retooling but the challenge was funding. Colleges did not have adequate finances for retooling and so there was need for government to assist. From the document analysis of the MHTEISTD strategic plan (2021-2025), HTEIs were encouraged to enter into Private-Public-Partnerships (PPP) in order improve their financial capabilities.

“HTE, access and utilisation of advanced 4IR knowledge and technologies for economic development” could be a research gap worth exploring.

MOOCs: Opportunities for the pedagogical use of digital technologies in Teacher Education

From the RRL, Ahmad et al. (2022) examined how the technologies of Industry 4.0 could be included in the Massive Open Online Courses (MOOCs). They suggested that MOOCs could improve learner engagement, enhance adaptive learning and collaboration while at the same time offering security, creativity, self-efficacy and growth in learners. Such are the opportunities for the pedagogical use of digital technologies in Teacher Education.

Case B; LFGD suggested that research and innovation hubs, that are equipped with technical/ICT gadgets, are required for research and innovation that should lead to industrialisation. So, HTEIs need resources and systems like High-Performance Computing (HPC) for industrialisation to happen. It is MHTEISTD's strategy to *“Develop and implement a policy on adoption and adaptation of emerging technologies: Big Data Analysis, Artificial Intelligence (AI), Virtual Augmented Reality (VAR) and Nano Technology.”* (MHTEISTD, 2021-2025).

Case A; LFGD observed that MOOCs 5.0, would use Industry 4.0 technologies like the Internet of Things, Cloud computing, Big Data, Artificial intelligence, Machine learning, Blockchain, Gamification Technology,

and the Metaverse to develop better universal access, better learner engagement, adaptive learning, greater collaboration, security, and curiosity. It would also incorporate the zones of ethics and humanism while also giving students access to a variety of learning opportunities.

Challenges in embracing ICT in Entrepreneurial Teacher Education

Hussin and Peredaryenko (2021) express their fear of digital colonisation, concerned that the push-button of the digital colonisation has become the complex social fabric and structure that can easily and directly be manipulated through the use of technology. They however, acknowledge that;

the overarching themes of 4IR such as circularity, self-efficacy, balance and moderation, make it a perfect tool in the hands of every nation to restore its self-sufficiency and sovereignty.

The challenges of ICT use could be a research gap worth exploring especially finding answers to questions like the colonisation effects of ICT.

Addition to Body of knowledge Policy and Practice

Addition to body of knowledge

From the foregone discussions, it can be noted that embracing ICT, innovation, research and retraining programs driven by the adoption and adaptation of emerging 4IR technologies, the programmatic approach, and design thinking have been suggested for Zimbabwe to successfully transition into the future industrialised world economy. The PFEE framework, that is based on the CAT developed by Gibbs (2015) and the UPM by Lackeus (2015), and has a strong ICT component, is an addition to the ICT in TE body of knowledge.

Addition to Policy

This paper suggests ICT policy intervention through making digitalisation and ICT use compulsory aspects of the teacher education curriculum and eventually the whole education curriculum in Zimbabwe, especially given the Education 5.0 context.

Addition to Practice

This paper's addition to practice is the call for teacher education stakeholders to adopt digitalisation (adoption of emerging ICTs, like Big Data, AR, VAR, IoT), research, innovation, programmatic approach, entrepreneurship, and design thinking that can lead HTEIs to innovation, industrialisation, and sustainable development when employed contextually. These practices should be in sync with the trendy, modern and emerging methodologies in the context of each HTEI's capability.

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study focused on embracing ICT as one of the possible strategies for HTEIs to move towards Education 5.0 guided teacher education in Zimbabwe. This qualitative and embedded multiple case study was chosen ahead of many others because of the flexibility in data collection that they allow. This study was informed by the Unified Progression Model by Lackeus (2015) and the constructive alignment theory (CAT) which was developed by Gibbs (2015). This paper interrogated immersive and interactive technology in TE, digital approach (access and inclusion), Massive Open Online Courses (MOOCs), and ICT teacher preparation and continuous professional development. The study also explored high cost of digital devices, funding issues, and opportunities provided by pedagogical ICT use like; adaptive and collaborative learning, curiosity, creativity, passion, self-efficacy and growth of both the student teachers and the lecturers. This paper argued that ICT is a cross-cut theme and vital tool in teacher education in Zimbabwe. This paper also explored challenges faced by HTEIs in embracing ICT. This paper also noted the additions to the body of knowledge, policy and practice that the study generated.

Findings

This study found that there was limited access to and utilisation of advanced knowledge and technologies contrary to demands of HBE 5.0 policy and the 4IR; deficiencies in resource mobilisation and utilisation (Physical and financial infrastructure including ICT and HCR); and the mismatch between TE curriculum and CBC for primary and secondary schools, (showing misalignment and disorientation that was national and beyond tertiary education).

It was research finding of this study that, there is need for lecturer preparation coupled with continuous professional development, especially with regards to embracing ICT and other 21st century methodologies, knowledge and skills. However, challenges such as a lack of technical and programming knowledge, a lack of funding, and time for content development, were found to be having negative impact on program implementation.

Educators should see it necessary to spend time and money on producing technology-based educational content. In fact, it should be mandatory that every learning institution should have a budget for technology based educational equipment, content and programmes. There is need for properly resourced, (modern technology) research and innovation hubs. It was found that ICT is a crosscut theme and key to modern day and future education in general and teacher education in particular.

It was also found that there is need for change of attitude among teacher educators so that they embrace ICT and advance themselves in it. They should appreciate that ICT makes study, community service, research and innovation, industrialisation and commercialisation, (that is Education 5.0), a lot easier, exciting, and manageable. ICT should be viewed as the current and future enabler of well planned, easy but efficient, and effective teaching and learning processes that have desirable outcomes.

Conclusions

The problem that this research paper sought to address was that there was a lack of digitalisation, and use of ICT tools, coupled with inadequate entrepreneurship and innovation theory and practice in TE curriculum in Zimbabwe, contrary to the strategic objectives of the HBE 5.0 policy.

Digitalisation, research, innovation, programmatic approach, entrepreneurship, and design thinking were entrepreneurial TE practices and activities, that could lead HTEIs to innovation and industrialisation in Zimbabwe if employed contextually. Digitalisation (adoption of Emerging ICTs, like Big Data, AR, VAR, IoT (that is sharing economy), design thinking and the programmatic approach could have a great and positive impact on industrialisation. The establishment of RI-HUBs and mainstreaming of Business and Entrepreneurship Studies into teacher education programmes could expedite innovation, industrialisation and sustainable development

In this paper, ICT was generally found to be the answer to the perennial pedagogical shortcomings central to many nations' economic development and industrialisation challenges. Researchers observed with concern that challenges like policy misalignment, conservatism, fragmented resources (including HCR), stiff policy environment, and the general socio-economic and political challenges could be addressed much faster if ICT tools and digitalisation were employed.

Recommendations

Recommendations for Policy Makers

- The mainstreaming of ICT, entrepreneurship and innovation into teacher education was recommended.
- It is recommended that relevant policies giving effect to national alignment should recognise heterogeneous contexts of institutions and should, therefore, be suggestive and not prescriptive.
- The (suggested) HBE 5.0 curriculum framework; the PFETE, was recommended for TE and the whole education fraternity (from ECD to university).

ii) **Recommendations for Teacher Education Principals**

- The following TE practices and approaches were recommended for Principals to adopt in their colleges: digitalisation; research and innovation; entrepreneurship; programmatic approach; design thinking and the establishment of RI-HUBs.
- This study recommended to Principals; the PFETE with its strong ICT component, as ideal teacher development framework that can lead to innovation, industrialisation and sustainable economic development.
- This study recommended that Principals interrogate and implement the provisions of the Manpower Planning and Development (Amendment) Act, 2020, in the context of diversity, capability and heterogeneity of their institutions, to promote innovation, industrialisation and sustainable economic development.

iii) **Recommendations for Lecturers**

- It is recommended that lecturers embrace digitalisation, design thinking, research, innovation and entrepreneurship and appreciate that these are inevitable in modern tertiary education.
- Lecturers should embrace technology as they take a team-based approach; concentrate on artefact, value, and venture creation; connect students and themselves to the outside world; allow student teachers to act on their knowledge; and emphasize active rather than passive learning.

iv) **Recommendations for practising teachers**

- This study recommends to already practising teachers a comprehensive HBE 5.0 In-service Teacher Education Programme (ITEP), with a strong ICT component, to equip themselves with the relevant MBKSA commensurate with the HBE 5.0 philosophy and the HTE 5.0 policy.
- Practising teachers should also have the right attitude towards ICTs and genuine entrepreneurial intention, for them to be able to inculcate the same values in their learners.

v) **Recommendations for Student Teacherpreneurs**

- Student Teacherpreneurs should be aware of the expected learner exit competencies, especially ICT competencies, that are consistent with the emerging outcome and heritage-based education for sustainable development.
- They should embrace and appreciate the place of ICT in their studies so that they remain relevant in the fast-changing world of business and entrepreneurship.
- Student teachers should also have the right attitude towards ICT and genuine entrepreneurial intention for them to be effective teacherpreneurs.

vi) **Recommendations for Further Studies**

- It is suggested that more research be conducted to investigate the harmonisation, alignment, and/or economic impact of Digitalisation. The suggested study gap seemed quite relevant to the alignment of industrialisation and sustainable development discourse but was not covered by this study as it was outside its purview.
- Further studies on the gaps emerging or substantive to this study are also recommended.

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