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Integrating ICTs into the Zimbabwean secondary school pre-service teachers' curriculum

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Abstract

The need for nations to enhance their competitiveness by leveraging the imperatives of the Fourth Industrial Revolution (4IR) has seen major shifts in teaching and learning strategies employed globally by educators. Research in Zimbabwean education has pointed to a gap in teachers' competence in the use of information communication technologies (ICTs) for teaching. Using the UNESCO ICT competency for teachers and Bernstein's (2000) theory of the pedagogic device we propose a conceptual framework for the pre-service ICT curriculum at four Zimbabwean secondary school teachers' colleges in relation, in particular, to the complexities present in the nexus of the curriculum's architecture, pedagogy, and delivery context. The framework suggests strategies on how this curriculum could address the gap in the teachers' competencies through effective integration of content, knowledge, skills, technology, and pedagogy into the salient contextual aspects of the country's education sector, given the constraining shortage of ICT resources.

Keywords: ICT, integration, pre-service, curriculum

Introduction

Globally, ICT continues to advance and have an ubiquitous impact on aspects of everyday life such as the social, economic, and political. Even in the most under-developed countries of the world, many areas of people's lives are, in one way or another, linked to ICT. So huge is the extent to which ICT has become inextricably attached to human life that access to various forms of ICT has become an inescapable human development imperative. ICT refers to "technologies that provide access to information through telecommunication. It is similar

to Information Technology (IT) but focuses primarily on communication technologies. This includes the internet, wireless networks, cell phones, and other communication mediums" (Ratheeswari, 2018: S45). The numerous technology tools, therefore, afford education authorities the opportunity to integrate ICT into teaching and learning.

Among the changes that ICTs have brought to human life are the ways in which business is done, in relation, for example, to issues such as: production, service delivery, and financial transactions; knowledge management; the flow of information globally, along with responses to natural disasters and the empowerment of citizens in times and situations that have seen the disruption of traditional forms of governance. In addition, ICTs have been responsible for the creation of the global village that the world has become since people across the world can now communicate with each other in real time as if they were in the same physical space. This is made possible by applications such as Skype, Zoom, and Microsoft Teams that allow people to hold meetings and connect virtually from different parts of the world.

Education at all levels around the world has been affected by the impact of ICTs on all forms of human enterprise with the major thrust being the integration of technology into teaching and learning. As a developing country, Zimbabwe has embraced the integration of ICTs in education in a bid to both enhance its economic competitiveness and its human development trajectories. Notwithstanding this, research in the use of ICT in Zimbabwean education has identified a gap in its use in teaching and learning with one of the major areas of concern being teacher competence (Majoni & Majoni, 2015; Musarurwa, 2011). This raises questions as to the teachers' capacity for knowledge transfer and, ultimately, the efficacy of their collective contribution to national economic and social development through the use of ICT in education. However, strides have been made towards capacitating teachers with ICT skills through a joint collaboration between the Ministry of Primary and Secondary Education (MoPSE) and the United Nations Educational, Scientific and Cultural Organisation (UNESCO). As of June 2021, the joint collaboration aimed at training 2500 teachers through a rapid teacher training programme carried out via virtual platforms, face-to-face, and instructor-led workshops (MoPSE, 2021). The training of teachers is being carried out as an in-service strategy for teacher capacity development. This leaves a gap in the pre-service area where scant attention is being paid to capacitation in terms of resources as well as skills, thereby making ICT integration difficult.

In this conceptual paper, using the UNESCO ICT framework for teachers and Bernstein's (2000) theory of the pedagogic device, we propose a conceptual framework for the pre-service ICT curriculum at four Zimbabwean secondary school teachers' colleges in relation to the complexities inherent in the nexus of the curriculum's architecture, pedagogy, and delivery context. In the framework, we suggest strategies on how this curriculum could address the teachers' competencies gap through effective integration of content, knowledge, skills, technology, and pedagogy into the salient contextual aspects of the country's education sector such as the constraining shortage of ICT resources arising from the economic challenges that have beset the country for the past two decades.

Currently, the teacher training curriculum structure focuses on the teaching of content knowledge in the main subject area; the pedagogies for teaching and learning are covered through a Professional Studies course and theories of education modules that assist pre-service teachers to understand the theoretical and philosophical underpinnings of teaching. Each pre-service teacher is expected also to complete an ICT module that covers foundational theoretical knowledge and practical skills in the use of ICTs. Pre-service teachers then go into the field to carry out teaching practice during which they use some of the knowledge they will have received from the teacher training institutions and the skills thus acquired before going back to complete the curriculum.

In this paper, we give context to the relationship between ICT and education under such sub-topics as the impact of the ICT revolution on education, 4IR and the need for increased ICT competencies amongst teachers, the UNESCO framework for the integration of ICT into teaching, Zimbabwe's policy response to the ICT revolution, and Bernstein's (2000) theory of the pedagogic device. This is then followed by a conceptual framework that proposes strategies for the integration of ICT into the Zimbabwean pre-service secondary school teachers' curriculum. The conclusion then re-emphasises the need for the unique aspects of the Zimbabwean education context, as highlighted in the proposed conceptual framework, to be taken into consideration in the implementation of recommendations from suggested global best practices, reflected, for example, in the UNESCO framework for the integration of ICT into the pre-service teachers' curriculum.

The ICT revolution-education relationship

As discussed in the introduction, the education sector has been massively transformed by ICTs. The extent to which ICTs have impacted on education has also led to changes in the way education is being perceived and understood as well as how it is being delivered. At the heart of these changes is the teacher who "plays a key role in this transformation process" (Assar, 2015, p. 66). ICT integration into education has led to the creation of alternative forms of teaching and learning such as e-learning. Previously, society progressed largely as a result of capital and labour. However, Fernandez (2017:340) has opined that "a competitive society has emerged that relies on the acquisition, transmission and application of knowledge. It is from these conceptions that, together with the technology edge, school educational processes emerge." In the same vein, Pescador (2014) stated that technology has transformed education by bringing new ways of communicating, interacting, studying, and investigating all of which have had a great impact on it. In the process, the role of the teacher has changed significantly.

Not only have ICTs changed the teacher's role but they have also had a profound effect on the way learners engage with knowledge and how they handle their learning activities. Suarez and Custodio (2014) suggested that as a relevant aspect of human life, education, in combination with ICT, has given rise to a learning environment characterised by students taking responsibility for their own learning. In this environment time and flexibility are key factors. More and more, education is becoming digital as a result of the digital revolution.

New technologies come together and give rise to new paradigms and pedagogies in education. For centuries, education and the way it was delivered remained static, with teachers being the ones to disseminate the knowledge conveniently stored in textbooks.

The importance of ICT integration into teaching and learning has been necessitated by the various advantages that it brings to education. Moorhouse & Wong (2022) assert that ICT integration through blended teaching has facilitated the concept of remote learning which makes it easier for learners and teachers to continue with learning regardless of time or place. This was proven in the Covid-19 era when all learning suddenly came to a halt. Technology was very instrumental in the continuation of learning across the globe. Technology has also improved the quality of education by opening various spaces and pools of information thus allowing learners and teachers to interact with information independently (Ratheeswari, 2018: Starkey, 2020). The emergence of new technologies has seen an expansion in the possibilities for knowledge creation and knowledge transfer (Assar, 2015). Rapid developments in ICT have transformed and shaped the world, particularly in the education domain, into a dynamic space in which curricula are no longer fixed. Learning has therefore shifted from teacher- centred approaches to learner-centred approaches. In addition, learning is no longer fixed in time and space because it can now take place anywhere and anytime (Collins & Halverson, 2009; Moorhouse & Wong, 2022; Oliver, 2002; Ratheeswari, 2018 ;).

While, on one hand, the technological transformations that are taking place in education are positive and make teaching and learning easier, they have placed huge demands on the teacher and on the methods of delivery, on the other. ICT integration into education has thus become a critical area for both teachers and learners with the demand for teacher ICT competencies, in particular, increasing. Assar (2017) asserted that amid all these positive influences of ICT, its innovative and effective integration into education is not a straightforward issue. Rather, it is a multi-faceted and complex problem with far-reaching implications. The complexity characterising the issue lies in the embedding of pedagogy into technology as well as in the parameters that are brought to bear on user application by institutional policies. In all this, it is important to remember that teachers as critical change agents “at the academic floor are the instruments by which changes in education will become true” (Assar, 2017, p. 68). Thus, if teachers lack key skills in ICT integration, these changes may never be implemented across the curriculum. Therefore, “initial teacher education needs to prepare future teachers to deal with this technological implementation from both practical and pedagogical perspectives” (García-Lázaro et al., 2022, p. 342). If this does not happen, traditional methods will continue to hold sway in classrooms and teachers will neither adapt nor evolve. It is therefore critical that ICT integration skills be introduced at the pre-service level to ensure that content knowledge and pedagogical skills are taught simultaneously for the benefit of the students whom the teachers will teach in the schools.

The importance of teachers in the process of integrating technology into teaching and learning cannot be underestimated. Pelgrum (2001) in a survey to assess the barriers to ICT integration in teaching identified the three key barriers of computer insufficiency, teachers’ lack of ICT knowledge and skills, and difficulty in integrating ICT in instruction in a relevant

manner. These points are echoed in studies carried out in Zimbabwe where there is a wide gap in ICT use and its integration in teaching and learning (Majoni & Majoni, 2015; Mandoga et al., 2013; Musarurwa, 2011; Zengeya, 2008 ;). However, Tondeur et al. (2008, p. 2542) pointed out that "integration of computer use in professional competencies implies a more complex approach." Cloke & Sharif (2001) asserted that there is more to ICT integration than mere competencies since factors such as teacher beliefs about teaching and learning with ICTs. Along with technology resource and education management are also critical to the discourse of ICT integration. Changed mind-sets regarding ICT integration have to stem from a constructivist perspective in order to help teachers acquire a broader and deeper understanding of the expectations of ICT integration into teaching and learning. Furthermore, higher self-confidence gained through programs that improve teachers' ICT self-efficacy and awareness of the benefits of ICT are important in ensuring effective and efficient integration of ICT (Kreijns et al., 2013). Thus, ICT integration into teaching and learning requires a more holistic approach than the mere acquisition of ICT competencies.

The ICT revolution has not only introduced educational technologies for teaching and learning but has placed emphasis on the need to acquire the right competencies and the right attitudes and strategies for using the tools. John & Sutherland (2004) pointed out that effectiveness and efficiency in ICT integration is not based on ICT only but on the strategies used in incorporating it into the various teaching and learning activities and the learning content. This assertion is premised on Shulman's (1986) Pedagogical Content Knowledge (PCK) model for ICT integration. Shulman (1987, p. 8) defined PCK as "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented and adapted to the diverse interests and abilities of learners, and presented for instruction." Additionally, Assar (2005, p. 66) noted that "to be used as a lever for pedagogical innovation and institutional transformation, teacher competencies need to go beyond skills in ICT use per se, and to enclose contextual knowledge about technology and, pedagogy and content." This implies a shift from traditional methods of knowledge delivery to technology-based education in which digital pedagogy skills are key to improving the educational experiences of learners as they engage with content. Evolutions in technology have seen major shifts in how technology tools nurture the educational environment and the way in which education is being perceived. Technology has brought with it new forms of content creation and knowledge transfer. UNESCO (2008) stressed that successful ICT integration into education is dependent on the teacher competencies to structure the learning environment in alignment with ICTs. This is also heavily dependent on the knowledge that teachers acquire through training or capacity building programs. Such shifts have had a huge impact on the demands placed on teachers in terms of their pedagogical knowledge. In this paper, therefore, we advance the need for a teacher training framework that capacitates teachers with the requisite competencies for full utilisation and integration of ICT into teaching and learning.

4IR and increased demand for ICT competencies in teachers

The Fourth Industrial Revolution (4IR) is a term coined by Klaus Schwab, founder and executive chairman of the World Economic Forum, to describe a world "where individuals move between digital domains and offline reality with the use of connected technology to enable and manage their lives" Schwab, 2015, p. 3). 41R is driven towards five key targets: reduction of barriers between inventors and marketing due to new technology; increasing trends in artificial intelligence; and innovative technologies that will integrate different scientific and technical disciplines, robotics and the internet of things (IoT) (Xu et al., 2018). Aligned to education are innovative technologies that will integrate different scientific and technical disciplines. Schwab (2015, p. 1) asserted that, in the era of the 4IR, "key forces will come together in a fusion of technologies that is blurring the lines between physical, digital, and biological spheres." Thus, synergies between technologies that will grow opportunities across the various fields, education included, will emerge. Furthermore, the IoT through the "internetworking of physical devices" (Xu et al., 2018, p. 92), is "expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine (M2M) communications and covers a variety of protocols, domains, and applications." Such advancements of technology have brought in new technologies to transform teaching and learning thereby improving education in the form of new pedagogical strategies and content access and creation across learning areas. Essential to these technological advancements and effects on education is a teacher who possesses the requisite competencies and knowledge to integrate technology into teaching and learning. For UNESCO (2018),

> The use of new technologies in education implies new teacher roles, new pedagogies and new approaches to teacher education. The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in new ways, to merge new technology with a new pedagogy, to develop socially active classrooms, encouraging co-operative interaction, collaborative learning and group work. This requires a different set of classroom management skills. The teaching skills of the future will include the ability to develop innovative ways of using technology to enhance the learning environment, and to encourage technology literacy, knowledge deepening and knowledge creation. Teacher professional learning will be a crucial component of this educational improvement. (p. 8)

A shift in teacher training models is therefore crucial if we are to meet the technological shifts and demands of the new technology-based education. However, the models must seek to address the ICT competencies that are required for successful integration of ICT into teaching and learning.

The ICT Competency framework provided by UNESCO (2018) segments the competencies into three main levels beginning with *knowledge acquisition***.** At this level teachers are expected to gain basic knowledge in using technology as well as basic ICT competencies. In addition, they must acquire knowledge of the use of technology in knowledge transfer across

their different disciplines. It is at this level that teachers need to appreciate the benefits of ICT to teaching and learning as well as understand national policies for the betterment of the school and help in making key decisions where ICT investments are being made. It is also at this stage that attitudes and beliefs regarding ICT integration are shaped. UNESCO (2018) provided a list of outcomes that indicate mastery of ICT competencies at the level of knowledge acquisition. Teachers who have fully comprehended this level are able to:

- Articulate how their classroom practices correspond to, and support, institutional and/or national policy;
- Analyse curriculum standards and identify how ICT can be used pedagogically to support attainment of the standards;
- Make appropriate ICT choices to support specific teaching and learning methodologies;
- Identify the functions of hardware components and common productivity software applications, and be able to use them;
- Organize the physical environment to ensure technology supports different learning methodologies in an inclusive manner; and
- Use ICT to support their own professional development (p.9)

At the *knowledge deepening* stage teachers gain ICT competencies for facilitating student centred, collaborative and cooperative learning environments (UNESCO, 2018). Furthermore, at this stage teachers have the ability to "link policy directives with real action in the classroom, have the capacity to build technology plans to maintain the school ICT assets, and forecast future needs. In addition, teachers can study further by linking to national and global teacher networks" (UNESCO, 2018, p.9). The outcomes for measuring competency mastery at this levels are aligned to teachers who are able to:

- Design, modify and implement classroom practices that support institutional and/or national policies, international commitments (for example, UN Conventions), and social priorities;
- Integrate ICT across subject content, teaching and assessment processes, and grade levels, and create a conducive ICT-enhanced learning environment where students, supported by ICT, demonstrate mastery of curriculum standards;
- Design ICT-supported project-based learning activities and use ICT to facilitate students to create, implement and monitor project plans, and solve complex problems;
- Blend varied digital tools and resources to create an integrated digital learning environment to support students' higher-order thinking and problem-solving skills;
- Use digital tools flexibly to facilitate collaborative learning, manage students and other learning partners, and administer the learning process; and
- Use technology to interact with professional networks to support their own professional development (UNESCO, *ibid*).

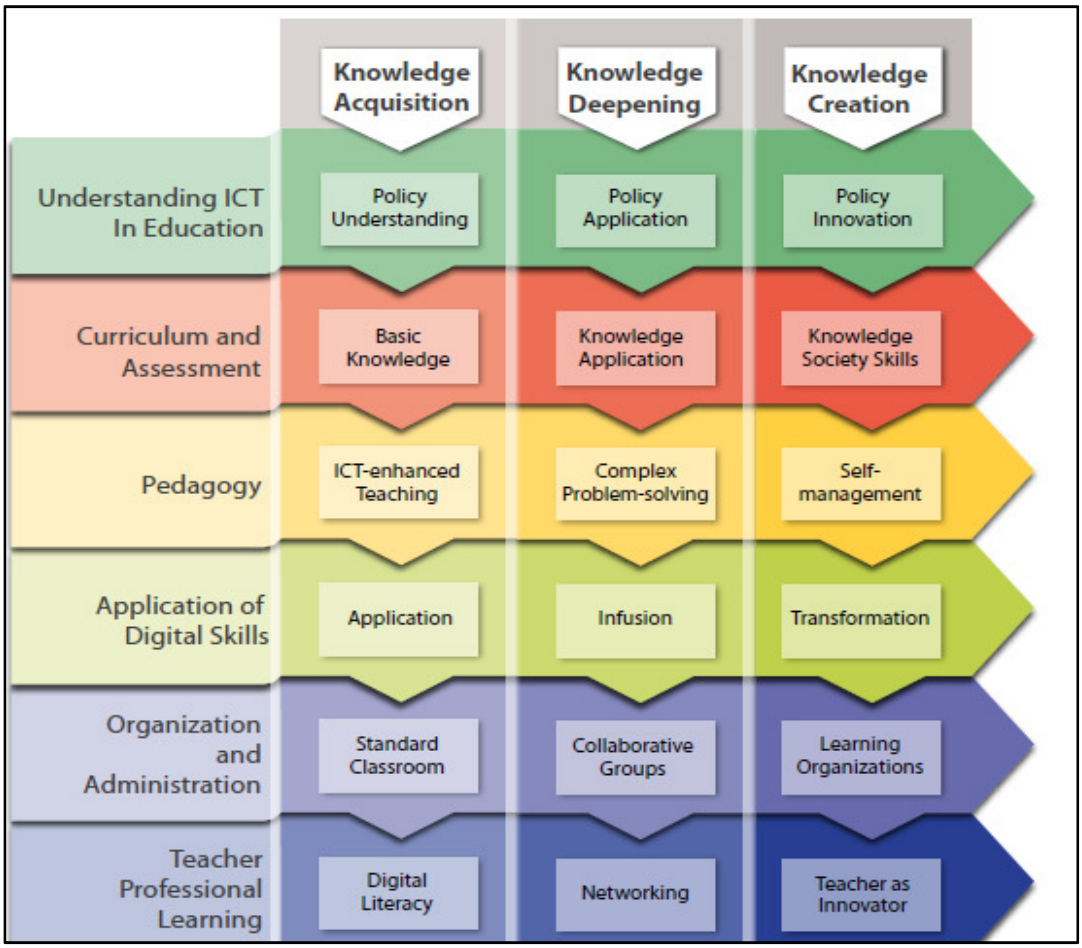
The third and last level that shows understanding and mastery of complex technology skills is that of *knowledge creation.* Teachers develop competencies for modelling good practice and

setting up learning environments in which learners feel encouraged to create novel knowledge of their own (UNESCO, 2018). At this level teachers are able to:

- Critique institutional and national education policies alike, suggest revisions, design improvements and speculate on the impact of these changes;
- Determine how best to incorporate student-centred and collaborative learning to ensure mastery of multidisciplinary curriculum standards;
- Determine learning parameters, encourage student self-management in student-centred and collaborative learning;
- Design knowledge communities and use digital tools to support pervasive learning;
- Play a leadership role in devising a technology strategy for their school to turn it into a learning organization; and
- Continually develop, experiment, coach, innovate, and share best practice to determine how the school can best be served by technology (p.9)

Fig. 1 provides a summarised framework showing the eighteen ICT competencies that teachers are expected to possess for efficient and effective ICT integration. Thus, teacher training colleges need to re-align and redesign training curricula to ensure that they meet the demands of technology-based education.

Figure 1
UNESCO ICT Competency Framework for Teachers (UNESCO, 2018)



Zimbabwe's policy responses to the ICT revolution

The proliferation of ICT has seen a growing demand for its inclusion in education curricula from Early Childhood to Higher Education. Thus, equipping teachers with ICT competencies central to their professional development has become a highly prioritised aspect of education globally. The inclusion of ICT in teacher education in Zimbabwe is founded on global developments in the technology space, the provisions of the National ICT Policy (2015), and the Department of Teacher Education (DTE) ICT policy of 2007 which stipulates that it is mandatory for every student teacher to receive IT education (Musarurwa, 2011).

Policy statement 11.1 in the Zimbabwe National ICT Policy (2015) focuses on ICT Skills Development. (National ICT Policy, 2015, p.28). The Government of Zimbabwe's commitment to the development of ICT skills to improve education shows the importance of integration of ICTs into teaching and learning. This means that education training institutions are expected to provide ICT human capacity skills since these are central to improved teaching and learning. In 2007 the DTE introduced a policy that made IT education compulsory for all teacher education students (Musarurwa, 2011). The policy stipulated that no student would be certified if they failed the ICT course. Therefore, in Zimbabwe every teacher training college offers ICT as a course. There is, however, no specific ICT in Education Policy in Zimbabwe. To ensure development of technology in education institutions, there have been partnerships with international organisations in previous years to enhance ICT skills development in teacher training colleges.

In a bid to enhance ICT usage in teacher training colleges and polytechnics in Zimbabwe, along with global trends in ICTs in education, a non-governmental organisation, Vlaamise Verening voor Ontwikkelingssamenwerking en Technische Bystand (VVOB), after carrying out a needs analysis survey and realising that there was a gap in the use of ICT for teaching and learning, rolled out the College Information Technology (CITEP) programme. This program was meant to improve skills training, access, and use of ICTs in the higher education space. The CITEP program ran from January 2003 to December 2008, training selected lecturers from three secondary teacher training colleges and ten polytechnics (Musarurwa, 2011). CITEP managed to advance ICT capacitation and training in teacher training colleges by developing infrastructure, providing ICT support, and support development. Such moves and developments show a dedication and commitment to ICT advancements in Zimbabwe. Despite efforts made from the beginning of 2003 to 2008, very little has been done to increase technology infrastructure in teacher training colleges. The Zimbabwe Ministry of Higher and Tertiary Education, Innovation, Science and Technology Development (MoHTEISTD, 2022) that is the overseeing ministry for teacher education colleges in Zimbabwe, acknowledges the limited and inadequate technology resources and is undertaking discussions with local and international investors to improve infrastructure in the various institutions of higher education. This makes it difficult for teacher training institutions to then provide adequate training and skilling of pre-service teachers in ICT integration strategies.

The challenge of integrating ICTs into teaching

Research findings in the area of ICT integration into teaching and learning show that teachers have the right attitudes and beliefs regarding ICTs. The problem, however, is that they lack the requisite skills to integrate ICTs into the teaching of various subjects. This has the capacity to derail the national ambition to leverage ICTs (Ganyani, 2016; Majoni & Majoni, 2015; Mandoga et al., 2013; Musarurwa, 2011; Zengeya, 2008 ;). The lack of skills regarding ICT integration into teaching and learning could possibly suggest a deficiency in ICT resources and teacher training models which is, in essence, the curriculum that is used in the training of the teachers. It therefore becomes necessary to reflect on this curriculum in the search for the possible source of the problem of teachers' post-training inability to integrate ICTs into their teaching of different subjects. Left unattended, this problem could derail the national bid to leverage ICTs for the realisation of socio-economic development which is exemplified by the government's promise that by 2030 Zimbabwe should be an upper-middle-class country. Chitiyo and Harmon (2009, p. 807) discovered that integration of ICT in teacher education institutions is hampered by "lecturers' computer proficiency and competencies which are at the basic level in Internet usage, with little confidence shown in basic productivity software skills and in IT integration tasks and processes." Further complicating the challenge is the lack of institutional support evident in the lack of access, the absence of an IT integration policy, and the absence of appropriate initial and continuous staff development. Bhukuvhani et al., (2010), in a study evaluating pre-service teachers' use of improvised and virtual laboratory experimentation in the teaching of Science, in which pre-service teachers from Bindura University, Zimbabwe, were the participants, discovered that despite knowing the value and advantages of virtual experimentation, the pre-service teachers did not employ technology in teaching. The researchers discovered that the pedagogies used to teach the pre-service teachers merely focused on familiarisation with technology without paying much attention to specific instructional uses of technology and technical skills. There is, however, limited research on ICT integration in the pre-service teacher training curriculum, so this paper could assist in adding to the scope of knowledge in the area of ICT integration at pre-service teacher training level in Zimbabwe

Bernstein's theory of the pedagogic device: Implications for the ICT curriculum

Over the years various theories have been put forward in an attempt to explain the processes that are involved in the design and implementation of curricula and the implications that this has for effective teaching and learning, and, ultimately, the realisation of the multi-faceted goals of education. One theory that could be applied to the ICT curriculum in Zimbabwe is Bernstein's (2000) theory of the pedagogic device. According to Bertram (2012) the theory envisages the re-contextualisation of knowledge produced at one site when it is transferred and reproduced at different sites. Bernstein (2000) identified three fields in which different processes involved in curriculum formulation take place. These are the field of production, the field of re-contextualisation, and the field of re-production. Constituting the field of

production are the processes whereby new knowledge that should be in the curriculum is generated, for example, by university and industry experts (Singh, 2002). In the case of ICTs, ICT experts could be found at any of the institutions of higher learning that offer ICT programmes in their various faculties. Industry experts in ICT could be found in both the government and private sectors. These experts could separately or collectively generate new ICT knowledge that should go into the secondary school pre-service teachers' ICT curriculum. In this regard, insights could be drawn from global trends, for example, in terms of the infusion of elements of 4IR into the curriculum.

In the field of re-contextualisation pedagogic discourse on what constitutes knowledge is produced from the knowledge generated in the field of production (Ensor, 2004). In terms of the ICT curriculum for pre-service secondary school teachers, in the field of re-contextualisation, pedagogic discourse related to the ICT knowledge that should be imparted to pre-service teachers is produced from the field of re-contextualisation. The field of reproduction is the site at which selection is made of what counts as legitimate knowledge to be delivered to learners. Included in the selection are elements such as content knowledge and assessment practices (Betram, 2012). In the context of ICTs for pre-service secondary school teachers, in the field of re-production choices would be made, for example, by the college ICT lecturers of which skills, knowledge, and competencies the pre-service teachers should have imparted to them in order for them to be able to transfer these to secondary school learners.

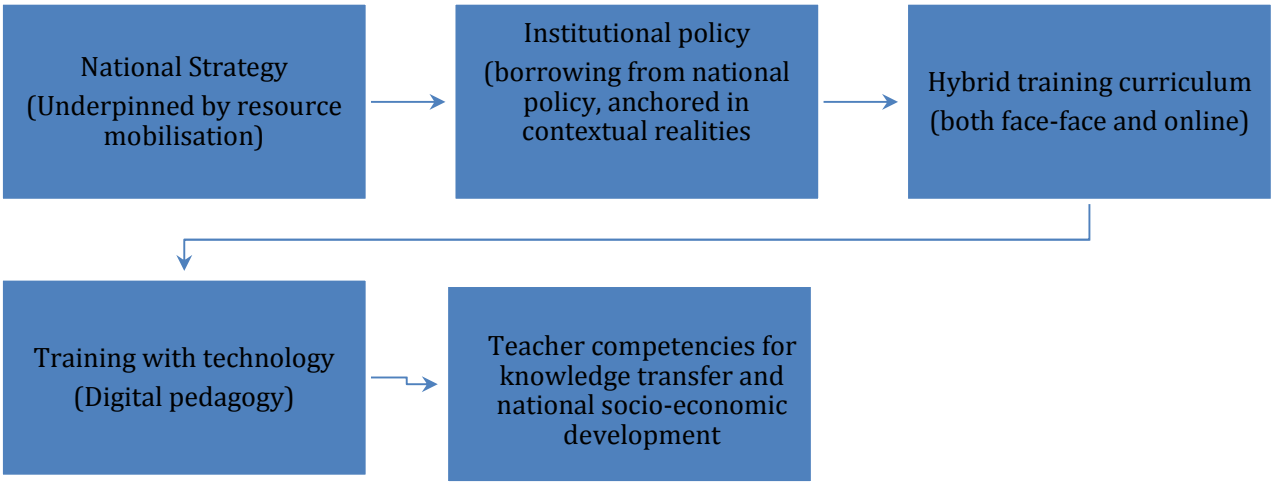
According to Betram (2020), Bernstein made a distinction between the official recontextualising field and the pedagogic recontextualising one. Usually found in the former are state and ministry of education agents who come up with the official curriculum after selecting from the knowledge produced by experts in a specific field. Operating in the latter, usually, are practitioners such as teacher trainers and textbook writers who select from the official curriculum what is to be taught in schools and indicate how it will be taught. Bernstein & Solomon (2000) also highlighted the importance of agency in the theory of the pedagogic device when they suggested that in each of the fields identified in the theory, there are agents who use their positions to seek domination of other role players. Thus, in the training of teachers, curriculum developers decide on what should be taught and how it should be taught, without any awareness of the needs of the pre-service teachers in relation to knowledge and skills. We propose, in this paper, that pre-service teachers must be consulted in the process of curriculum development.

Towards a conceptual framework for pre-service secondary school teachers' ICT curriculum

Drawing insights from both the UNESCO (2018) ICT competency framework for teachers and Bernstein's (2000) theory of the pedagogic device, we suggest a conceptual framework from which insights can be drawn for the formulation of an ICT curriculum that could contribute effectively to pre-service teachers' ability after graduation to integrate ICTs into the teaching of various secondary school subjects. Figure 2 above is a representation of our

proposed conceptual framework. As shown in the figure, in coming up with the curriculum for pre-service teachers, the first step should be to come up with a national ICT strategy. This needs to be predicated on the country's socio-economic development goals. However, in order for the plan to stand any chance of being implemented, it also needs to be underpinned right from the beginning by the intention to mobilise resources needed for its implementation. For example, greater internet penetration at national level is possible only in cases where the requisite infrastructure has been put into place. This implies the need for teacher training colleges to consider up- scaling their ICT infrastructure or finding strategies to ensure that each student has the necessary resources that enable effective and efficient implementation and utilisation of ICT. Otherwise, the national ICT policy will remain an abstract proposition.

Figure 2
Proposed conceptual framework for the Zimbabwean pre-service secondary school teachers' ICT curriculum



Individual institutions, as shown in the diagram, should borrow from the national strategy in coming up with the curricula for pre-service secondary school teachers' curricula. Drawing insights from Bernstein's (2000) theory of the pedagogic device, the colleges need to determine what constitutes knowledge that enables pre-service teachers to effectively integrate ICTs into their curricula. This should take place in their fields of production. On the basis of the UNESCO ICT Competency Framework for Teachers (2018), we propose that it is at this level that the colleges need to formulate strategies for the pre-service teachers to acquire both content and pedagogic knowledge for the effective use of ICT in teaching when they graduate.

Constituting Bernstein's (2000) field of recontextualisation would be the production of discourse on what constitutes pre-service secondary school teachers' knowledge for the integration of ICT into teaching and learning. This would entail the acquisition of the relevant knowledge by the preservice teachers in terms of what they need to know. However, in doing so, in the field of reproduction, the teachers' colleges need to take cognisance of their own realities, for example, the number of departments which they have as well as the infrastructure already in place for the implementation of the policy. Based on the UNESCO (2018) competency framework for teachers, the teachers' colleges need to enable the

preservice teachers to create new knowledge and also transfer such skills to their own learners. For greater effectiveness, drawing from the institutional strategy, the secondary school teachers' colleges could, for example, also come up with hybrid curricula, whereby the pre-service teachers could be trained using both online and face-to-face methods. While some of the content to be learnt could be posted online, certain skills and pedagogic strategies could be imparted in face-to-face sessions with lecturers. The integration of technology into the curricula used for the training of pre-service teachers should, however, be privileged over training which is purely theoretical. Then, in the light of the concerns raised over Zimbabwean teachers' inability to integrate ICTs into their teaching, as the curriculum design process goes through different sites as propounded by Bernstein (2000), emphasis should be put on equipping them with the capacity to transfer knowledge and competencies to their learners through the use of ICT when they are deployed to schools upon graduation. In the long term, as suggested in the proposed conceptual framework (Figure 1) this will contribute to improved socio-economic development since learners leave school with the requisite ICT skills for their participation in 4IR.

Conclusion

In this paper, we have brought to the fore the general consensus on the need for training Zimbabwean secondary school teachers to integrate ICTs into the teaching of various subjects. In light of the inseparability of education from ICT in the 21st Century and taking cognisance of Zimbabwe's socio-economic development aspirations, we have argued that the need for this gap to be closed is evident. Relying on the UNESCO ICT competency framework that suggests the different types of ICT knowledge that teachers should possess and Bernstein's (2000) theory of the pedagogic device, we have suggested a conceptual framework that would develop Zimbabwean secondary school pre-service teachers' capacity for integration of ICTs in teaching. This is an inescapable imperative in the light of the desperate need there is in the country for accelerated socio-economic development that can only be realised through ICT competences, especially those that are formally imparted at school level where teachers are a vital cog.

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