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THE RELEVANCE OF TEACHER EDUCATION AS A TRAJECTORY IN DEVELOPING AND SUSTAINING INCLUSIVITY IN THE DIGITAL CLASSROOM

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Abstract:
All human developmental requirements are cultivated by an effective education system, adapting and embracing technological invention and advancement. Education and teachers are cornerstones to all human development. This research seek to find out, the role teacher education (TE) can play in promoting and cultivating a culture of technology designing, invention, digital utilisation as a necessity for African socio-economic transformation. However, not possible without an inclusive science oriented education system embracing contemporary techno-digital teaching-learning approaches. Also, seek to examine possible suggestions on how TE curriculum can improve grooming digitalised products, historically not achieved and in some cases still not achieved. Literature reviewed indicated effective TE as one of the most crucial basics for cultivating digital inclusivity, a techno-oriented education culture, yet current TE in most African countries has been criticised for not producing innovative, competent teachers with adequately relevant techno-digital skills to inculcate students' 21st century and future science diverse needs. Data analysis indicated that TE face challenges in embracing techno-digital teaching approaches remaining traditional, focusing on chalk-talk-approaches and setting an incorrect precedent. The qualitative 'analytical model of constant comparison' was used in gathering and analysing data. The major conclusion to this research was based on the argument that, if TE institutes include techno-digital courses its product are likely to pursue, follow and cultivate a sustainable scientific culture in schools for both immediate and future ends. The research recommended introduction of sciences for all, at all learning levels, inclusion of compulsory technology, media and design innovative pedagogies course in TE.

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1. Introduction

It has been noted by several educationists (Avalos, 2011; Geoff, 2009; Sarason, 2011) that human development especially socio-economic growth depends on access to quality education, the effectiveness, sustainability of its basic education system, the skills and knowledge developed within that particular education system and the kind of teachers (Ojose, 2011; Silva et al., 2006; Tella, 2008) found within that particular education system. Developing countries, like Zimbabwe, have noted a need to invest in education (Zvobgo, 1998; Fafunwa & Aisiku, 1982; Nyagura & Reece, 1990; Maravanyika et al., 1990; Gray, 1999), knowledge-based, high-tech global trends developments, especially to achieve inclusive educational goals in the dynamic rate of change taking place in the digital era to improve commercialisation of knowledge, invention of technology and knowledge creation to meet 21st century digital dynamics especially socio-economic needs like functional literacy. Functional literacy is seen as a necessity to advance human standards of living, improve invention and productivity, expecting in return for that productivity to bring forth necessary economic growth (Watkins, 2000; Cockcroft, 1982; Dean, 1982).Even though the need for changing the current science underdeveloped most African education curriculum systems is generally agreed on, as necessary for much needed socio-economic transformation and correcting colonial non-inclusive education system, there are however disputes on how to effectively go about it in reality, due to a number of educational challenges (UNESCO, 2014; Moon, 2014; Adler & Reed, 2002). Challenges, such as lack of adequate funding, politicization of education access, facilities and equipment, teaching materials, libraries, electricity, computers, laboratories and scientific apparatus.

But of much deeper concern is the challenge of most African teachers failing to recognise differences between students' learning characteristics, choosing appropriate teaching methods, combining and integrating contemporary innovative pedagogies (Ericsson, 1993; Feuerstein, 1980; Smith, 2002; Schultz, 2013; Petty, 2009). These challenges in the classroom raise questions about the role of education in postcolonial Africa in as far as preparing students for an inventive/digital future is concerned. Other related questions could also be asked, why most African teachers are unable to employ innovative, techno-oriented, hands-on-learner pedagogies?, but rely and hammer on chalk-talk-approaches, at a time when critical literacy for problem solving, decision making, goal setting and life-long learning is a prerequisite. Consequently, African schools produce learners who appreciate, instead of being able to invent technologies and be active participants of the information and the space age. Thus, the focus of education in the digital era must shift (Johnson & Beinart, 2010; Bransford & Darling-Hammond, 2005; Kincheloe, 2008) from the tradition of teaching students what to think, to teach students how to think and reason. This approach of teaching will also require a paradigm shift in how teachers are trained (Petty, 2006). Given Africa's knowledge

power-politics Africa today need an education system which can produce, if not at least, make new scientific discoveries, students who can find adequate solutions to impelling world problems and who can adapt to change and maintain sanity in the space age. This is the creative African education challenge today.

Failure by most African teachers to meet contemporary and future African learning needs may be blamed on their educational experiences, during their primary, secondary schooling and how they were trained in teachers' colleges-dominated by transmission teaching that lacked learner-activities and innovation foundations but focused on textbook-driven, teacher-centred, paper and pencil, theory schooling. Twenty-first century curriculum is different from the traditional chalk-talk-pedagogies, it is interdisciplinary, project-based, research-driven, it cooperates higher order thinking skills, multiple-intelligences, technology and multimedia, thematic, project-based and integrated (McAninch, 1991; Lawton, 1987; Guskey, 2002).The contemporary challenge in most African schools especially observed in Zimbabwe Classrooms is lack of twenty-first century inclusive and diverse teaching and learning activities within a given lesson. Many teachers, both student and qualified teachers in general have assumed that all children learn in a uniformic manner, through lectures assigned readings and listening to the teacher. This has led in the productivity of non-curious, unanalytical pupils. Africa is in need of improving teacher preparation and in sharpening the skills of teachers currently employed. Poor training of teachers affects their creativity in the classroom and broader analysis of contemporary digital era learning needs. As a result of poor training (Makoelle, 2016; Nkabinde, 1997; Petty, 2009), many teachers cannot employ a wide range of active learning approaches, techniques and strategies, device techno-digital teaching aids, and materials in the digital era to fit the conditions found in their schools. Consequently, they rely heavily on prescribed textbooks and traditional media (charts, word/work cards, still pictures) that does not support and cater inclusive pedagogy which encompasses aspects of inclusive teaching and learning, teacher's beliefs and attitudes on and about deliberate promotion of technological literacy for individual learning differences, intellectual capabilities, and needs.

Considering the above teacher education and teaching challenges there is a need for an educational paradigm shift. However effective paradigm shift and sustainable curriculum change involves wide and wise consultations, planning and above all a systematised approach as to how to fund needed change, what ought to be changed and for what purposes? Today the most driving force in the world for curriculum change is the consideration of education being techno-digital-invention oriented and accessible by all. The broad implication of this perception of education being techno-oriented also implies education systems preparing adequate supply of human resources capable and appreciating their role, to bring into reality the contemporary world educational vision. In other words there are two major opinions about implementing curriculum change, where the change should be initially effected, start by training human resources or human resource grooming will be gradually implemented. Each of

these approaches have their advantages and disadvantages, however not the focus of this study but relevant to the arguments of the study's focus. This study argues that teacher education and the teacher is a pinnacle of all sustainable development, therefore all developmental and curriculum changes should be initiated in teacher training programmes, this line of thought will be justified later. Of relevance now is to appreciate that there is an intertwined relationship between curriculum changes and preparing the people who will implement that change effectively, and that there is also a complex relation between education and curriculum and how to make both bring forth much needed transformation.

2. Conceptual Framework

Educationists general agree that all development and involvement of almost all people in sustainable development could be brought forth by schooling, effective and skilful teaching (Karras et al., 2015; Geoff, 2009; Burkill & Eaton, 2011). The quality of teachers in schools and quality of teacher education are inseparable. The objectives of teacher education in Zimbabwe involves the training and development of the right type of a teacher who is competent in pedagogies, reflective to contemporary and future socio-economic needs, dedicated and capable to apply, extending and synthesize various forms of knowledge, developing attitudes, values, and dispositions that create an inclusive learning environment for quality teaching and learning for individual learners to fully realise their potential (Perraton, Creed & Robinson, 2002; Lawton, 1987; Stephen, 1995; Avalos, 2011). Under normal circumstances, teacher education programmes in relation to 21st century needs should emphasize sound knowledge of subject matter and create avenues for developing practical epistemologies about teaching.

In reality, teacher education framework should adequately set up learning situations where trainees can develop contextualised understanding of today's and future teaching needs. Teacher education generally includes four elements: improving the general educational background of the trainee teachers; increase their knowledge and understanding of the subjects they are to teach; pedagogy and understanding of children; and the development of contemporary and future skills and competences. True in theory. Teacher education in Zimbabwe has a major challenge to fulfil its theoretical expectations. From general observations, most programs in Zimbabwe teacher education are conventional in approach, focusing on teaching at a time when they have to focus on learning. They hammer theories of education content (not that they are irrelevant) rather than skills building. Teacher education should be an aggressive force for technological invention, 21st century socio-economic dynamics and for change and not a reflection of the status quo.

In its diverse educational challenges Zimbabwe, if not most African countries, has currently been criticized for not channelling sufficient resources to invest in improving its teacher and general education system to meet 21st century world

standards (UNESCO, 2000-2016). The expected standards being provision of quality and equal education for all (adequate and competent teachers, adequate learning and teaching resources, curriculum materials, equipment, and supplies, sufficient schools for all children within a reasonable walking distance, affordability, access to a relevant curriculum in terms of promoting real-life-skills based learning, sufficient and up-to-date reading materials and access to digital information and technology). Of much concern here is not to dive into greater detail in what consist of quality education but to question how that quality education can be obtained? And who can be perceived as a key person to bring about the achievement of quality education? Also, to question what is involved in the process of grooming that person who is expected to deliver quality education? Also of significant concern is to question if material resources, high-tech teaching and learning media and access to adequate information and communication technologies has a direct impact on effective learning? Because their impact depends on how they are used. One can fairly argue that, investment in teacher effectiveness is more relevant than investing in resources for instruction. However, one cannot deny the significant impact of material resources on student expenditures and their importance in the organisational context of teaching.

Even when resources are allocated toward instructional needs, however their benefits depend on how they are applied. Underutilisation of instructional materials is caused by teacher education and trainees' failure to emphasize and appreciate that, knowledge of teaching represents 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. In other words, effective teaching is consequential (Schon, 1991; Kincheloe, 2008; Schultz, 20013), it embraces many and diverse teaching approaches and critical pedagogies including a demonstration of a commitment to every learner's success, making them feel included, valued and secure. It also involves creating secure foundations for subsequent learning, make schooling relevant to the learner's wider life goals and concerns, consider the learner's cognitive capabilities and address the learner's learning challenges and strengths, all these expectations can only be met through use of diverse teaching and learning approaches by a well-trained, environ-techno-reflective teacher. However, in Zimbabwe most teachers do not have control over material resources. Because the impact of resources depends on how the resources are availed and used, control over material resources is also an important consideration. Teachers are supposed to have a close psychological contact with students; they know best what resources are needed to meet the student's needs. This perspective sees teachers as knowledgeable professionals and suggests that the greater teachers' control over the allocation of teaching and learning resources, the more effective the resources will be used. However, research to date has found little evidence for effects of teacher control over technologies on skilful teaching or learning.

The major concern in this study is classroom teaching and learning quality. The key factor in providing quality and inclusive classroom activities is the teacher and the

pedagogies that the teacher applies in conducting learning activities, particularly in an environment of scarce digital resources. Schooling without a skilful teacher becomes irrelevant in producing reflective and contributive students, aware of solving socio-economic challenges (Avalos, 2011; Guskey, 2002; Adler & Reed, 2002).In addition to competent teaching seen as quality education, the above cited scholars not only concern themselves about reflective and adaptive teaching, as part of an equation to enhance quality schooling, they also argue that quality teaching is connected to how the classroom practitioner is trained. They see teacher education as the backbone to all human development schemes and progress (Bransford & Darling-Hammond, 2005; Silva et al., 2006; Sefa Dei, 2010). The main argument in support of that perception is that, effective teacher education should be reflective and conscious of the needed teacher calibre. The perception also follows an opinion that sees effective teacher training promoting and training teachers who will in turn pursue multi-intellectual, personal, social and physical all-round development of each learner, value contemporary dynamics and even future needs.

If the system that produces teachers is efficiently organised, its products are likely to be reflective and above all the end users to the teacher education product will highly benefit. But easier said than done, producing a creative, reflective and competent teacher, requires a number of considerations. The process is inter-influenced by many curriculum forces underpinning ideas about the nature of knowledge and promotion of full utilisation of information, technologies and cultivating a science culture. Teacher training and effective inclusive teaching is linked to other considerable factors such as curriculum constraints, administrative policies or resource availability may have more significant influence on teaching approaches. One also has to consider the entire national curriculum where prospectus teachers should be exposed to science subjects and scientific research culture from tender ages, qualification requirements for teacher education entry, organisation of beneficiary teaching practice duration, curriculum issues and what sort of product is intended to be produced. A sustainable future is in the hands of skilful teachers, the quality of tomorrow's inventors will be no better than the quality of today's teacher. Teacher skills and knowledge have to be raised if Africa is to substantially contribute technological inventions to the levels needed for an information economy and general development. African teachers' colleges are facing the challenge of producing the digital-era quality teacher, groomed with the best teaching approaches suitable for today's social dynamics.

3. Methodology

To this end, a qualitative research was conducted, attempting to determine the relevance of teacher education as a trajectory in sustaining an inclusive education curriculum in a digital era for socio-economic transformation, with a focus on two major teacher education aspects: how teacher training institutes can produce techno-digital literate teachers, not only literate but reflective and active agents and promoters

of 21st century learning and developmental needs, the role a reflective teacher can play to effect a techno-digital culture in the classroom socio-economic transformation and the role teacher training institutes system can perfectly produce socio-economic a reflective teacher who is also an agent of influence and agent of change.

Literature reviewed was selected through purposive sampling, specifically the 'maximum variation technique' (Glaser & Strauss in Lincoln & Guba, 1985; Creswell, 2007; Krefting, 1991). The sampling technique required the researcher to examine library catalogues and selecting a list of sources based on the judgement of their relevance to the research problem at hand. This initial sample helped identifying other potential information in a snowball fashion. Data was collected through note taking and coding to come with themes and sub-themes relevant to the research question and objectives at hand from published documentary sources (Jesson, Matheson & Lacey, 2012). Data collection and analysis as true to the canons of qualitative research took place simultaneously using the 'constant comparative method' of Corbin and Strauss (2008). In reality, the model described above involves the researcher reading relevant sections of sources of literature and take-down notes to record for identifying and summarising major ideas and the researchers comments about the recorded ideas to answer the research question(s). The process of note-taking and finding key issues also involves the process of triangulation where the researcher consulted key issues from different sources so as to verify the authenticity of a fact.

4. Research findings

Relevant and inclusive education depends on the teacher and applied pedagogies in the teaching. According to analysis of gathered data, teachers play a central role in the delivery of quality education, cultivating the science and philosophy of contemporary developmental dynamics at all levels of the education system. Therefore, it is essential that they receive quality training and their conditions of service are improved so that they work in a motivating environment. Even though the relevance of a teacher in the promotion of inclusive learning and promotion of digital literacy is not doubted, there are however many questions on the way teachers are trained and their adequacy in meeting 21st century and future teaching and learning requirements. This research discovered that, even though several factors influence student learning (socio-economic status, minority status, per-pupil spending, pupil-teacher ratios, class sizes, pedagogies applied and forms of assessment used) teacher quality is the most highly correlated with student learning, inclusive education and techno-digital-based education promotion and sustainability. Most Zimbabwe teachers face a challenge of using a wide range of critical thinking skills and attitudes which in turn help learners to think more logically, to develop, analyse and critically evaluate judgements, above all meet today Africa's greatest educational requirement-technological invention and consistent utilisation.

In Zimbabwe, technology, design and invention, need to be taught and used in the teaching and learning processes through the various curriculum subjects at all levels of schooling, so as to cultivate the technological culture and meet world standard developmental expectations. But teachers have neither the skills, nor the knowledge to do so. It is for this reason that teacher education and national curriculum should be revisited to include technology and design as a compulsory subject to fulfil 21st century digital era dynamics.

If Africa is to provide students with 21st century relevant education, Africa should not overlook adequate investment in teacher education. Despite agreed need to invest in teacher training, most, if not all African teacher training institutions face a number of challenges to fulfil expected teacher quality production. Some of these noted teacher education challenges include decline in quality, specifically the mismatch between teacher education focus and expectations of the teacher in the schools after training; inadequate exposure to contemporary technologies and media forms during teacher training; limited exposure and access to information, communication and technologies during training; most teacher education curriculum in Zimbabwe focuses more on the theories of education and limited time on the practicum of teaching, how to actively involve learners in the classroom and how to effectively utilise media and technology in the classroom. These qualitative challenges are not the only challenges hindering skilful teaching. Teacher training institutes are also haunted by a plethora of quantitative digital-instructional-materials and teacher education curriculum challenges to fulfil their digital era expectations like, lack of adequate media and technology infrastructure, outdated reading materials, limited access to interactive boards, computers and computer-aid learning equipment, digital-audio-visual aids.

Other issues related to teacher education and its role in the digital era sufficed. Zimbabwe teacher education is still based on the traditional methods and ways of grooming teachers. The main purpose of teacher education in the traditional sense is to transfer teaching theoretical knowledge and desired behaviour. Perennial teaching ideologies are relevant to a limited extent; however, there is also the need to prepare the teacher for new developments and contemporary and future digital pedagogies like practical problem-solving, active experimentation techniques based on technology invention as compared to usage and appreciation of technology.

Contemporary teacher education should place more emphasis on more practice; hands-on-learner centred participatory, environmentally responsive behaviour approaches rather than theoretical transfer. If today's teachers are to integrate digital-era teaching and learning expectations into their instruction they have to be trained and exposed to diverse technologies and even on how to design these technologies. Above all the digital era teacher has to accept and appreciate the notion of the requirement of consistent and efficient educational technology use in the classroom environment. Teacher training institutes also have to play their significant role in drafting teacher education curriculum that allows trainee teachers to accept and perceive technology as the future of all learning and come up with solutions that address the lack of

technological utilisation in the classroom. Digital usage and technology appreciation in the classroom is related to four main factors: developing a culture of embracing, appreciating and using technologies; attitude towards the relevance of technologies to involve teaching and learning; the perceived usefulness of technologies and observing the learning benefits technologies yield; the frequency of use of technologies.

Literature review also brought to light that even though some students may be exposed to and access technology and digital instructional materials they may however due to vast reasons not fully utilise available technologies. Two major challenges hindering usage of available technologies by most Zimbabwe student and qualified teachers are: the current Zimbabwe education system at all levels is examination-theory oriented and most teaching approaches used are lecture-drill pedagogies; most teachers think the chalk-talk-pedagogy works and therefore do not see the need to diverse and be flexible. But research evidence has proven that not all learners learn through listening to the teacher, digital approaches appeal to diverse individualised learning needs and ways.

5. Discussion

This study has indicated that there is a relation between teacher education and attitude towards use and the perceived usefulness of media and technologies in the digital era depending on how the teacher training institutes emphasis on the necessity of technology based pedagogies. How technologies are perceived, understood, and embraced by teachers is a culture that is cultivated from early levels of schooling and polished during initial teacher training and continues to be developed in life-long learning. However technology education or digital-literacy, or access during pre-service and in-service teacher education is not adequate to escalate the frequency and cultivation of a wide spread culture of using educational technologies if they focus only on the theories of education or on how to use technologies in the classroom, rather than including the instructional teaching on how technologies are invented and emphasizing the practical utility of technologies in the learning process.

Technology-based pedagogies follow the focal point of the classroom moving from the teacher, the giver of answers and the fountain of knowledge, to the learner, who is required more and more to accept responsibility of learning and to develop practical technological habits in keeping with the atmosphere of information co-operation in the classroom not only how things function but also what makes those things under study function the way they so do. African education systems and teacher education for Africa to contribute positively to the digital era, technological and information advancement should make its curriculum focus on how technologies are invented instead of learning how technologies function and repaired. The social and economic benefits of such teaching perceptions such as invention based learning are clear for national development and children learn to be self-reliant and co-operative rather than rely on guidance or dictation. Above all hands-on learner activities create

opportunities for each learner to express their creativity and thoughts. Technology-based pedagogies are not only inclusive and appeal to all human sensations they also promote active learning, student-centred pedagogies and learning essentials for sustainable development.

Teacher education in Zimbabwe is provided by private and government colleges/universities. Even though provided by different institutions student enrolment for entry into teacher education is less or more similar and so are teacher education challenges in Zimbabwe. The challenges faced by most teacher education institutions could be divided into two categories; internal and external categories summarised on the table below. Some challenges can be addressed and solved within the given college or university of education, other challenges require national and inter-ministerial approaches and solutions.

In addition to mentioned challenges, most teacher training institutions have limited consideration for the introduction of compulsory contemporary subjects that increase critical, creative thinking, and consciousness on socio-economic matters and development. These include philosophy, logic, philosophy of science disciplines, history and development of technology and design, introduction to economics and developmental studies, innovative pedagogies and global politics. The major reason to teach these subjects to teacher trainees is to open their minds on topical contemporary needs in the hope that in turn they will motivate learners to be literate in these contemporary issues and understand that education in Africa is not only to pass examinations and improve individual social status but to also address historical and contemporary dynamics, add value to African development and intellectual contribution to the digital era.

The other critical issue to be considered by teacher training institutions in order to be relevant to current socio-economic needs is the reality that, currently in Zimbabwe the issue of access to education is no longer a complex challenge; the current challenge is the increasing number of highly qualified unemployed school/college/university leavers. Given the case of increasing number of trained teachers not employed, the concern of teacher training institutes today therefore is to sustain current and future teacher demand especially considering and focusing on producing a quality teacher reflective to 21st century demands. Producing a quality teacher may also require extending the duration of training and increasing pedagogy courses relevant to contemporary issues instead of focusing on mainstream theories of teaching and learning.

In addition to failure in the productivity of competent teachers, teacher training institutions have also faced challenges to be trend setters in academic digital and technology related researches which are essential in laying a foundation to discuss or address socio-economic digital and technology related challenges. As a result teacher education institutions instead of being preparatory foundations for producing socio-economic transformers they become places to nurture people who fill-in teacher-shortage gaps for the sack of securing employment opportunity attached to the teaching

profession as compared to other economic sectors, at a time Africa is in need of reflective teachers who are capable of changing and decolonisation the future generation to see themselves as deciders of their destiny.

According to human rights and labour theorists education is considered critical for economic development because in general, it can give people the skills and knowledge to compete in markets and because it can help bring about a more equitable distribution of wealth and power which in turn contributes to long-term economic growth (World Bank, 1988; UNESCO, 2014, Ornstein, et al., 2011), however disputed by Marxism. The human rights and labour theorists approach can be applicable when there is an effective education system, equity, social justice, under a normal performing economy where there are no political challenges affecting economic performance. The challenge in Zimbabwe concerning teacher education to be utilised as a critical economic developmental tool are educational challenges hindering education to become a human right due to limited government funding, poverty, corruption in teacher education enrolment, unrealistic lecturer-trainee, teacher-pupil ratios, high tuition charges, precarious conditions and resources, poor management of teacher education institutions, low salaries, congested time-tables not allowing consistent tutorials (Nyagura & Reece, 1990; Shumba, 1993; Calderhead, 1987; Nziramasanga, 1999; World Bank, 1988; Shaw, 1995). These challenges, in addition to ineffective teaching and teacher training, hinder improvement of teacher education systems, resulting in the production of non-performing teachers.

In addition to the above challenges the number of teacher graduates has increased in Zimbabwe yet the demand and employment opportunities for these graduates is not on the rise. School graduates also don't see themselves as much needed contributors to socio-economic solutions with no well–paying jobs available in the country worsened by static governance structures not absorbing the young, ambitious and energetic. Some well-trained teachers immigrate to wealthier countries with better employment opportunities and end up making intellectual contributions to the socio-economic development of foreign countries.

At the apex of diverse challenges is that teacher education has remained traditional in its training approaches which may not be highly relevant to contemporary socio-economic needs Traditional approaches to education have focused, on the teaching of "course content" material which is to say, on imparting factual knowledge (Daner, 1989; Schon, 1987; Levine, 2006; Moon, 2010; Perraton, et al., 2002). By comparison relatively little attention has been given to the teaching of thinking skills or higher order activities such as reasoning, creative thinking and problem solving essential for socio-economic transformation or general ability to apply taught or learnt knowledge effectively in all spheres of life. The question then is how teacher education institutions should inculcate these much needed critical skills. Despite these challenges, teacher education institutions have the potential to bring socio-economic changes within Zimbabwe that will shape the knowledge and skills of future generations

needed for socio-economic transformation. Teacher education institutions serve as key change agents in transforming education and society.

6. Conclusions

Despite Zimbabwe's current teacher education limitations, it was discovered that teacher education institutions have the potential to bring changes within educational systems that will shape the knowledge and skills of contemporary and future generations. Some of its relevance includes grooming trainees to appreciate the integrated nature of media and technology to inclusive learner-centred pedagogies as 21st century cornerstone teaching and learning approaches. However, developing countries like Zimbabwe lag behind in investing adequate funds and attention for the continuing professional development of teacher education, though the importance of teachers is emphasised in many educational forums. As a result of underfunding current Zimbabwe teacher education has vast quantitative and qualitative challenges hindering its fulfilment of 21st century teaching and learning expectations. Despite its diverse challenges teacher education institutions and effective teaching serve as key change agents in transforming educational and societal needs. The main argument throughout this research was the opinion that effective teaching can come as a result of sensitive and dynamic teacher education and after training continued research on teaching and educational matters, is the key essential force in bringing about digital and technological utilisation, appreciation and invention in the Zimbabwe education system at all schooling levels. However, effective teaching can only be achieved if the process of training teachers in itself is rigorous and considerate of contemporary digital socio-economic needs and expectations. There is also the need to align teacher education curricula to suit or support digital and technological oriented education.

This research also argued that teachers' colleges initially mandated by government to focus on liberal arts need to reconsider their traditional curricula to meet 21st century socio-economic needs like technical and digital focus by including compulsory high-tech digital courses in their curricula. This research also acknowledged other challenges in addition to ineffective teaching and gave examples of quantitative challenges like unavailability of special laboratories for the study of media and technology pedagogies in teachers' colleges, in secondary schools especially in rural schools. Therefore affecting quality teacher education and improving all aspects of education and ensuring excellence of all so that recognised and measurable learning outcomes are achieved by all. Above all this research made an observation that socio-economic transformation in Zimbabwe can only be achieved through a sound education system with reflective teachers who teach for critical thinking as the cornerstone for further education and contributory factor to economic participation and development by all.

Literature reviewed reveals that effective teaching practice and professional preparation are very necessary to enhance teacher development but not the only

solutions to teacher performance. Other key factors that may not be taught in teachers' colleges are necessary for a dedicated teacher to be effective, such characteristics include personal commitment and attitude toward the significance of teaching children to be inventors of technologies instead of being consumers of technologies, utilisation of technologies in an inclusive classroom and understanding African power-political epistemological needs and predicaments, appreciate the need to address Africa's dependence on foreign technologies, self-driven cultivation of a personal philosophy of science and broader perception and appreciation of teaching as a foundation for national and economic development. The 21st century teacher education therefore is not only teaching content and pedagogies but also to make trainees to understand Africa's contemporary and future needs, embrace current global technological and socio-economic advancement and how these have become part of the education policy and priority all over the world. Zimbabwe as a developing country is no exception in the digital era direction. The teacher, the pivot on which education is foundationed, is therefore indispensable.

7. Recommendations

- There is need for a shift from traditional chalk-talk-pedagogies to hands-on-learner centred active participation, experiment and invention based pedagogies.
- There is a need for the introduction of a compulsory media, technology and design course in teacher education curriculum.
- Contemporary teacher training should focus on quality productivity of teachers instead of quantity since there is an increase in the number of unemployed teachers in Zimbabwe.
- Introduction of stringent recruitment strategies should be considered by teacher training institutes to reduce 'deadwood' and ineffective products.
- Adequate funding and supportive infrastructure for digital pedagogies learning needed in teacher education.
- Training of effective science teachers equipped with both science subject content and 21st contemporary pedagogies should be prioritized in all teachers' colleges.

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