FUTURE DIRECTIONS FOR TECHNOLOGY EDUCATION IN BOTSWANA: CHALLENGES AND IMPLICATIONS

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ABSTRACT
There is some ongoing debate about the extent to which more education, and with it the production of the workforce for 'new' economies, actually contributes to the economic development that it is intended for. It is, however, a significant part of the official policy rhetoric almost everywhere – education as part of national development strategy. Botswana as a developing country and a member of the global community, needs to examine how it will respond to the future challenges of sustainable economic development.
As the country shifts rapidly from its rural and mining legacy towards a more educated and informed nation, attempts to integrate itself in the world-economy poses new challenges on the education system to provide highly skilled professionals for the future if the country is to compete both regionally and internationally.
This paper seeks to generate discussions amongst the relevant stakeholders in terms of the future directions for national efforts towards devising a technology education curriculum that is relevant, contemporary and responsive to the socio-economic needs of the country. The paper will initially examine the current technology education trends in Botswana, based on international perspectives and some comparative analysis of these. Finally, the paper will put forward some principles for developing a more broad based technology education and gender inclusive curriculum model that could serve as the framework for creating career opportunities for the future generation.
The paper will employ qualitative research paradigm and desk study approaches.

Keywords: Globalization, Technology, Technology Education, Knowledge economy, Curriculum Integration

1   INTRODUCTION
In technology education, teaching about technology and society has usually been embedded in the notion of technological impacts on society. References to the impacts of technology on society are pertinent to the study of technology education so that students will be able to understand the nature of technology, appropriately use technological devices and processes, and make a meaningful contribution to society's decisions on technological issues. This article will interrogate the current research literature on technological developments from an international perspective so as to generate some meaningful discussions around strategies for implementing technology

education that is relevant, contemporary and responsive to the socio-economic needs of the Botswana as a developing country.

2   THE HISTORICAL PERSPECTIVE OF THE SUBJECT

Design and Technology is a relatively new subject in Botswana. It evolved from the traditional subjects of Woodwork and Metalwork, formerly offered under the banner of Industrial Arts (though in Botswana it was known as Arts and Crafts) which is a similar trend to what obtained in countries like England, Australia and the United States of America. In Botswana, the development of technology education dates as far back as 1987 [1] but the actual introduction into junior secondary schools (14-16 year olds), was done in 1988. In its first inception around 1990, the subject was first piloted in sixteen (16) junior secondary schools and five (5) senior secondary schools (17-19 year olds). At this early stage, the subject placed more emphasis on the study of materials and technology and the development of problem solving skills leading to project work based on technological design process and product development. It was not until 1998 that a joint project between the University of Cambridge Local Examination Syndicate (UCLES) and the Ministry of Education (Botswana) led to the introduction of the long awaited Botswana General Certificate of Secondary Education (BGCSE). The new BGCSE design and technology curriculum was officially introduced into all senior secondary schools in the year 2000.

Central to the development of this curriculum was the government's wish to prepare Botswana citizens for participation in an increasingly inter-dependent global economy particularly in this era of widespread and rapid technological change, as well as to move the country away from the traditional agro-based economy to the more broadly based industrial economy the country is aspiring towards. [2]

2.1   The current status

Much of the literature in this paper will share with the reader the current teaching practice that obtains in a typical design and technology offering Junior and Senior Secondary school in Botswana. Before delving into issues of how the curriculum is being implemented it is worth noting that the underlying assumptions pertaining to the delivery of the Botswana design and technology curriculum are that it is designed to;

● build on the knowledge and skills already acquired from the junior secondary school.
● provide learners with broader design and technology concepts that will develop their capacity to tackle real-life problems in the community.
● expose learners to a range of manufacturing knowledge, skills and processes, through making their designed products.
● be delivered through problem solving approach, which should result in learners that are resourceful, dynamic, creative and multi-skilled.
● prepare learners for the world of work, further training and life-long learning.
● develop the learners' understanding of the environmental, social and economic implications of a variety of technologies [2]

However, as was experienced in the UK (England and Wales) in the early 1990s when the design and technology curriculum was introduced into the British education system the implementation of the new curriculum in Botswana remains polarised between those who are still trying to "protect what they preserve to be their individual subject

boundaries (the old woodwork and metalwork teachers) and those who believe in the need for hard technology and a sound knowledge base (the newly trained teachers)" [3]. It is still very much content and skills driven, it is still being provided for less academically able students, many of whom are boys, with little or no alteration to what was delivered in the old JC and COSC syllabuses. It can be best described simply as a merger of the more resistant materials (wood, metal, and plastics) with some element of designing. The subject, at least at senior secondary school level, has recently undergone a review though the depth and breadth of this review could not be established due to lack of such information.

2.2 Organisation of the syllabus

The syllabus is organised into the following components and content areas as outlined in table 1 below). Each content area has general and specific objectives. The objectives are the learning outcomes or benchmarks against which students' performance will be assessed or measured.

Table 1 (Botswana Design and Technology Teaching Syllabus, 2000)

Syllabus Component	Content Area(s)
Health and safety	*Safety Precautions and First Aid.*
Materials	*Timber, Manufactured boards, Metals, Plastics, Optional materials, Adhesives, Abrasives, Fixings, Fittings and Finishes.*
Communication	*Graphics and Information Technology*
Design	*Design Process, Marketing, Promotion, Costing and Pricing.*
Technology	*Energy, Structures, Mechanisms, Electronics and Pneumatics.*
Tools and Processes	*Measuring and Marking out, Chisels and Chiselling, Shears and shearing, Forming, Moulding and Casting, Turning and Milling, Joining and Fabricating, Holding and Assembling tools, and Finishing materials.*

3   INTERNATIONAL TRENDS

In the study by Rasinen [4] it was found that different countries tend to use different terms such as *technics, design and technology, technology education,* and *technological education* to describe technology education. Within the context of this article these titles are considered to be synonymous after all in the words of Rasinen "regardless of the term used; the universal goal is to help students to become technologically literate" (p.31). Therefore, in the acceptance of the different definitions and interpretations of technology education, the following definition has been provided so as to establish a common ground and facilitate some meaningful discussions about the philosophy of technology education. Technology education has been defined as;

> *"a study of technology which provides an opportunity for students to learn about the processes and knowledge related to technology that are needed to solve problems and extend human potential"* [5].

The overall goal countries share in common is the need to respond to the current and emerging economic and social needs of the nation and to provide those skills which will allow our children who are the future workforce maximum flexibility and adaptability in their future employment and to live in a rapidly changing technological world [4].

3.1 Global issues and development of technology education in Botswana

The discussion of global issues with respect to the development of technology education in Botswana is pertinent because the forces of globalisation have made us one world and one economy. No country exists in isolation from the rest of the world and we see a trend developing such that as countries advance into the future, the entire society is changing in a global context. New opportunities for industry are emerging as a result of these driving forces. Therefore, it is imperative for developing countries such as Botswana to be thinking in terms of how they need respond to the opportunities and challenges determined by this new international order. The current design and technology curriculum in Botswana presents a fundamental challenge in terms of how it should be tailored to meet the socio-economic context of Botswana whilst at the same time ensuring that the country embraces opportunities brought about by global trends such as the impact of technology and globalisation in our lives. This confirms our argument for a drive towards an enhanced curriculum content that is strongly related to concerns about national economic competitiveness in rapidly changing world markets rather than merely content or skills driven.

3.2 Technology as an agent for change

According to Rasinen [3], technology involves "the development and application of ideas and principles from other areas of learning such as the applied sciences, engineering, and business and commerce". Technology along with globalisation, multinational corporations and world brands, currency and financial markets have been identified as the driving forces for change. New opportunities for industry are emerging as a result of these key forces for change. It has been predicted that success in business will depend to a large extent on using these forces to advantage. Lewis [6] asserts that technology the school subject can clearly be a vehicle for social transformation in the third world if the subject is introduced in such way as to help children intelligently resolve tensions between the competing pulls of the traditional and the modern. For example, in Botswana design and technology education was seen as an important component in the transformation of the country from a predominately agrarian to an industrial based society.

3.3 Information communications technology

It has to be acknowledged that in the twenty-first century, understanding and using technology will be an integral part of virtually every aspect of daily life. It is the school system's responsibility to prepare students for this future. According to Hafkin and Taggart [7] ICT has become a powerful force in transforming social, economic, and political life globally and contesting further that if access to and use of these technologies is directly linked to social and economic development, then it is imperative to ensure that developing countries understand the significance of these technologies and use them. If not, they will become further marginalized from the mainstream of other countries and of the world (p.4). Therefore, this has implication for our educators to be thinking in terms of how we need to respond to the opportunities and challenges determined by this new international order. For example, with respect to the Design

and technology syllabus, ICT falls under the *Communication* focus area referred to as *Information technology*. The coverage of this content area seems to be limited in scope as it only states that students should "understand the application of information technology in engineering" (p.9).

3.4 Knowledge Economy

The world now is entering a new phase beyond the industrial revolution and information revolution. Knowledge has become a valuable commodity. Though currently limited in its geographical extent, there is an emerging consensus that the knowledge economy is widening the use and value of knowledge or information while dependence on material resources is becoming less important. In the context of a knowledge economy, Kay [8] argues that the raw material content of a product and its physical characteristics have become less significant in terms of their contribution to overall value. In his view, the competitive advantage in a knowledge economy is derived from the management of knowledge, and the addition of this of knowledge to what companies produce. Kimbell and Perry [9] suggest that the deliberate and actively inter-disciplinary nature of design and technology places it at the vanguard of those preparing for employment in the knowledge economy.

4 Challenges and implications for technology education in Botswana

4.1 The need for a systemic change

When the new curriculum was first introduced into schools, the understanding was that whilst efforts were being made to provide resources (both human and material) for the teaching of these new content areas, they would be regarded as optional. Perhaps this was an oversight on the part of curriculum developers as they seem to have been totally neglected by some schools. The position taken in view of this is that, the first step should have been to establish the resource capacity required to deliver the new curriculum instead of designing the curriculum and trying to make make-shift arrangements in retrospect. It will be necessary to determine the capabilities needed by schools and this should lead to the development of a mechanism for assessing the capabilities (skills audit) present in the current members of the teaching force so as to determine a common starting point. There will be a need to ascertain teachers' credentials to determine their skill level and competency in this area. The need for teachers to be adequately prepared for its implementation cannot be over-emphasized. The implication for training of teachers will be tremendous. Essentially this would require a Systemic change in which the impact of change on all parts of the whole and their relationships to one another will be taken into consideration.

4.2 The need for curriculum integration

Norton and Wiburg [10] have argued that "Today's world is one of rapidly expanding knowledge with concurrent demands to integrate the knowledge with new skills and new jobs. Technology integrated into the ongoing educational process, can play a significant role in creating environments that reflect the way people interact with the real world" (p.32). Studies into integrated model of teaching have revealed that teachers have been able to cover their usual curriculum faster and as a consequence have extra time to experiment with restructuring ideas like problem-based learning. When technology becomes integrated into the teaching and learning, it encourages teachers to view learning as a creative and interactive process and ultimately this leads them to

coming up with more innovative approaches to teaching such as team teaching, team curriculum development, student collaboration, and interdisciplinary projects [10].

5   CONCLUSION

There have been suggestions from some quarters that Africa must join the runaway global knowledge revolution and be able to compete in the global economy or face a future of increasing exclusion. This is perhaps a wake up call for Botswana to also consider through education reforms ways that could address the social ills that delay the road to economic prosperity. Therefore, as a move towards responding to this challenge, this paper strongly argues for a curriculum review that would create a framework that will offer this country the opportunity to participate in the technology-driven global economy. The focus should now shift towards producing a future workforce that is innovative and creative, technologically literate, socially responsible with some element of entrepreneurship skills embedded.

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