An Investigation of the Process of Local Curriculum Development and Implementation:
A pilot Study Based on the Transition from a British to the Botswana Model of Design and Technology Education.

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Abstract

In 2000, Botswana introduced a locally developed programme for senior secondary schools (17-19 year olds) known as the Botswana General Certificate of Secondary Education (BGCSE). This included a new Design and Technology (D&T) curriculum. Prior to this, schools had followed D&T through collaboration between the Ministry of Education (Botswana) and the University of Cambridge Local Examinations Syndicate (UCLES, England). However, since the transition, very little research has been done to assess how the new D&T curriculum was being implemented in schools. It is against this background that a small-scale pilot study was designed. The goals were *to explore a range of issues regarding the implementation the new D&T curriculum:* Ultimately the findings would enable the researcher to determine the focus for the main research study. Baseline data were captured from teachers, curriculum developers and administrators. Methods included a questionnaire, a group interview and individual interviews. Participants reported many factors affecting the implementation effort: inadequate communication with teachers regarding the change; limited capacity to implement; limited resources and lack of support for teachers, especially in the new technology content areas. This paper draws together significant factors and challenges identified.

Key words

BGCSE, Cambridge, design and technology, curriculum change, implementation process, transition, new technology content, professional development

Word count = 3295

Background

This article begins by providing a background to the D&T curriculum in Botswana. This is followed by a description of the change process, its principles and challenges. The methodology used in the study will be presented; findings will also be presented and discussed. Finally, conclusions will be drawn from the findings with implications for the main study.

The development of the BGCSE programme was driven by the need to align the education system to the socio-economic needs of the Botswana (Revised National Policy on Education, 1994). In the years since the adoption of the Cambridge curriculum, there has been a realisation that it was not fully relevant to the socio-economic needs of the country (Commission on Education, 1992; Revised National Policy on Education, 1994). Ndaba (1994) also noted that a philosophy developed in one country cannot be transposed unchanged to meet a different context. D&T was identified as one of the key subjects needed for the country "to move away from the traditional agro-based economy to the more broadly based industrial economy the country" (Permanent Secretary, Ministry of Education, 2000).

There has not been any research activity on senior secondary school D&T since the introduction of the BGCSE. Early research by Ndaba (1994) and Molwane (1993) focused more on the historical perspective of the subject and implementation challenges. Moalosi and Molwane (2008) have looked at problems and challenges of the implementation of D&T in primary schools. Gaotlhobogwe (2010) investigated attitudes to and perceptions of students towards D&T at junior secondary level.

This research forms part of a PhD study by the author. The paper refers to the specific objectives of the pilot which were to *determine the impact of the transition on teaching and learning in schools;* and *to identify and consider strategies needed to promote effective implementation and management of the curriculum.* The paper will report on data which addressed the following research questions:

1) *What factors have necessitated change from the Cambridge to the BGCSE model of D&T?*
2) *What views and perceptions are held by various stakeholders regarding the change and transition?*
3) *What organisational factors have facilitated or inhibited change?*

The study used the Northern and South central regions as representatives of the six (6) regions. Figure 1 summarises the basic structure of the PhD study as a whole and the specific focus of the pilot.

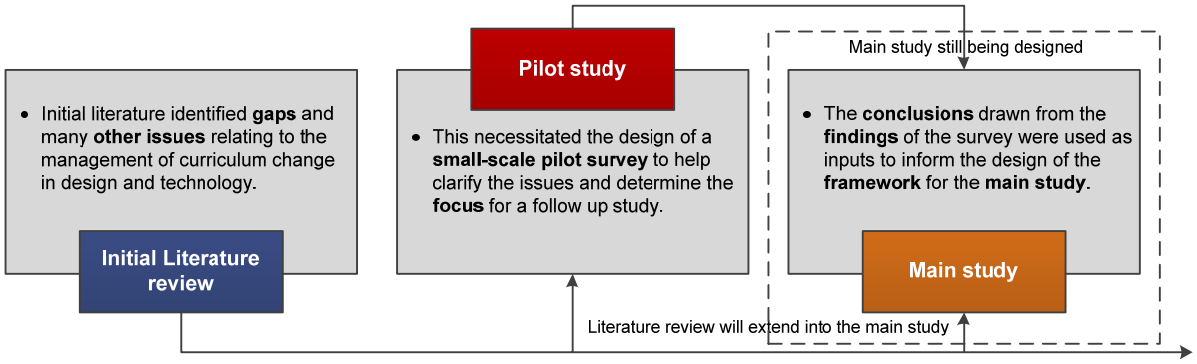

Figure 1: Author's basic structure for the PhD study

Change processes and challenges

The literature review familiarised the author with the processes and challenges of implementing curriculum change and helped to focus the research questions. Factors and issues affecting implementation of curriculum change (Fullan, 1993; Fullan, 2001; Kotter, 1996; Hughes, 2005; Stacey, 1993) have been summarised in table 1 below.

Table 1: Factors affecting change

Key factors	Explanation
❖ **The driving forces for change**	❖ Fullan (2001) and Stacey (1993) observed that the need for change within organisations is driven largely by **external factors** such as the **economic, technological**, **social**, **political** and **cultural** environment. However, change may also be driven by **internal factors** such as; employee demands, organisational politics and top management changes.
❖ **Commitment to change**	❖ Major change can only be successful if head of the organisation is an active supporter (Kotter, 1996).
❖ **Clear and shared vision for change**	❖ The need for change must be clearly articulated at all levels and embedded in the culture of the organization. Effective communication is critical to implementation from the outset (Kotter, 1996; Harvard Business Essentials, 2003).
❖ **Visionary and supportive leadership**	❖ Leadership sets the new direction or vision for the organisation. The leadership must take responsibility for the success or failure.
❖ **Stakeholder participation**	❖ Effective change demands collaboration between willing and motivated parties. Everyone must be taken on board.
❖ **Capacity to manage change**	❖ Capacity is the resources that the organisation needs to implement the change effectively (Harvard Business Essentials, 2003). The organisation's capability in terms of human, financial and physical resources needs to be assessed beforehand including. ❖ Commitment to change is evidenced by provision of resources including time and incentives.
❖ **Implementation strategy**	❖ Implementation is "the means to achieving certain outcomes" (Fullan (2001, p.52). Implementation strategy is a plan for the change and operationalising the strategy. A good implementation plan should be flexible and open to revision (Kotter, 1996).

The literature showed that organisations emphasise straightforward, technical aspects of the change process, but tend to ignore the complex and unpredictable concerns of people affected by the change (Bridges, 2009; Fullan, 1993; Fullan, 2001; Kotter, 1996; Harvard Business Essentials, 2003). Ignoring the human dimension is short-sighted and a symptom of ineffective management (Harvard Business Essentials, 2003). Bridges (2009) argues that getting people through the transition is essential if the change is to work.

Methodology

The sampling frame for the pilot survey is summarised in figure 2. The survey provided a forum through which various stakeholders involved with the implementation process could reflect and share their experiences (Cohen et al, (2011). The survey used three instruments for data collection: a self-completion questionnaire for teachers, followed up with a group interview for those teachers and parallel individual interviews with senior officers. This reflects the mixed method approach (Creswell and Clark, 2011; Bryman, 2001). In justifying the use of the mixed method approach, Creswell argued that audiences such as policy makers, practitioners, and other stakeholders need multiple forms of evidence to document and inform the research problems. The approach was driven by the research questions to be answered (see background), the research context and for triangulation purposes (Strauss and Corbin, 1998; Thomas, 2009). A grounded theory approach was used to guide procedures for data collection and analysis (see Corbin and Strauss, 2008). Grounded theory was found appropriate because all the issues pertaining to curriculum change had not yet been identified thus necessitating further exploration to increase understanding (Corbin and Strauss, 2008; Bryman, 2008).

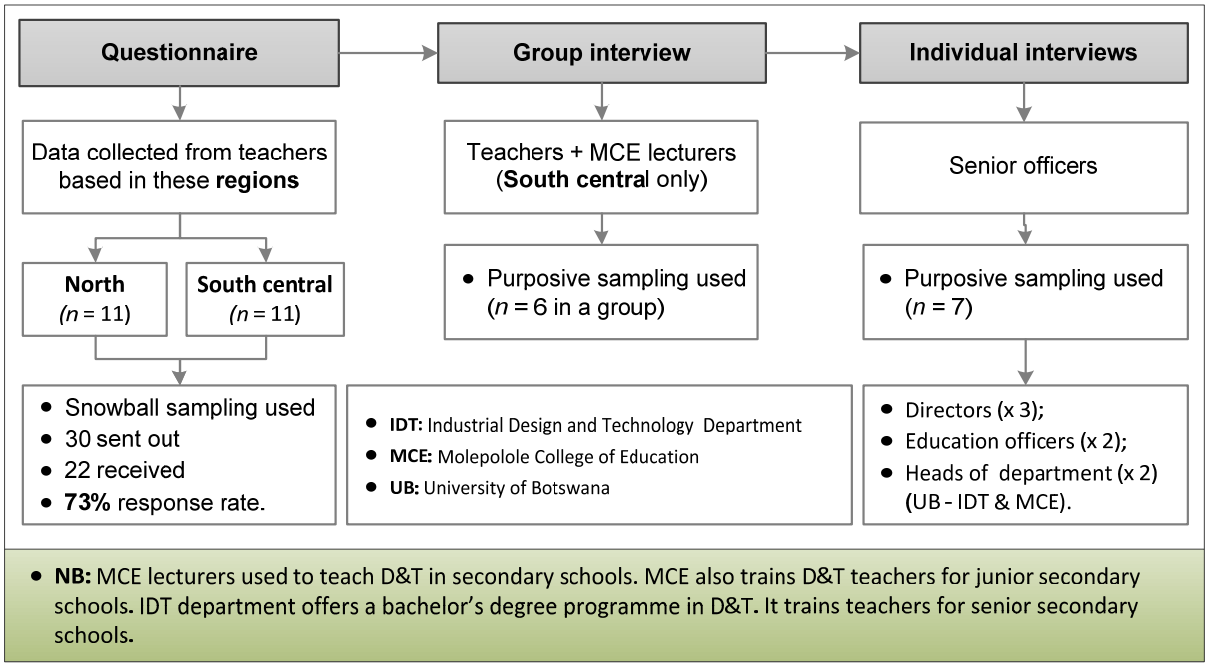

Figure 2: The sampling frame

Questionnaire

The Questionnaire enabled the researcher to gather data on a one-shot basis and was economical (Bryman, 2008; Cohen et al, 2011). The questionnaire was chosen for teachers because they are curriculum implementers and they represented a larger number of the respondents. The protocols and data types are summarised in Figure 3, below.

Group interview

Participants for the group interview were chosen following procedures recommended by Berg (2007, p.146). The composition and sample size for the group interview are given in figure 2. The participants had taken part in the questionnaire. So the interview provided a forum for the researcher to follow-up on issues emerging from the questionnaire.

Individual interviews

The interviews were semi- structured and were organised around conceptual issues which had emerged from the literature. Figure 3 summarises protocols for the questionnaire, group interview and individual interviews.

	Procedures followed	Types of data collected	How the data were recorded
Questionnaire	• Contact was made with initial participants by email and phone. • Once accepted to participate a formal letter was emailed to them. The letter included details of the study and ethical procedures to be observed by the researcher. • Then snowball sampling procedures were used to invite other participants (Berg, 2007; Bryman, 2008).	• Mainly qualitative; however, some quantitative data were collected. • The questionnaire consisted of both closed and open questions. The responses from closed questions yielded quantitative data whilst the open ended questions yielded qualitative data.	• For qualitative data, a table was created to allow each respondent's responses to each question to be entered manually. • For analysis purposes, quantitative data were recorded using both IBM SPSS Statistical software and Microsoft Excel.
Group interview	• The participants had taken part in the questionnaire. There was a provision for them to indicate their willingness to participate in the group interview. • Purposive sampling was used (Cohen et al, 2011; Berg, 2007). A copy of an ethics protocol was made available to them prior to the interview.	• Qualitative data. • The data captured ensured a broad and balanced view of opinions and attitudes (see Hughes, 2005; Berg, 2007).	• The interviews were audio recorded with some minimal recording. Memoing technique was also during data collection and analysis (As in Groenewald, 2008) • In order to obtain a consensus, a summary of their responses was made to converge their opinions as a whole (Creswell, 1998).
Individual interviews	• Purposeful sampling was used to select the participants (as in Miles and Huberman, 1994). • Initial contact was made by phone through their Secretaries. • Once accepted the invitation, a formal letter was written to them. The correspondence included an Informed participant form ; an interview schedule; and an ethical clearance form.	• Qualitative data. • The interviews captured data based on respondents' opinions, experiences and feelings on a topic under investigation. • Throughout the interviews the researcher adopted a neutral friendly, purposeful stance.	• The interviews were audio recorded. However, the researcher also did some minimal recording. • An interview schedule was prepared. The schedule included a list of questions and the order in which they will be asked (see Bell, 2009; Creswell, 1998). • All the interviewees were asked the same questions to enable their responses to be validated against each other.

Figure 3: Protocols used for data collection

The findings

This section will present summaries of combined data sets. Due to the small samples used in the study, the results have limited reliability. However, the information obtained was found useful to illuminate the discussions in this paper. The data were analysed using open coding technique (Corbin and Strauss, 2008). The findings will be presented as follows:

- Study context;
- Communication regarding the change;
- The effects of the transition on the teaching and learning;
- The capacity for the change; and
- Teachers' professional development support.

Study context

The schools covered represented urban and semi-urban areas, funded by the government. Four (4) of twenty-two (22) teachers had a Master's degree in Education whilst the remainder held Bachelor's degrees. Four universities have been involved in the training of Botswana D&T teachers: University of Botswana, Exeter (England), Newcastle (Australia) and Edith Cowan (Australia). Many teachers were trained in the Craft, Design and Technology (CDT) model of D&T described by de Vries (1995). The teachers with the highest teaching experience ranged between 11-20 years. The least experienced were 5 years and below.

Communication regarding the need for change

This answered the first research question *"what factors have necessitated change from the Cambridge to the BGCSE model of D&T?"* This was addressed by data from the questionnaire, group interview and senior officers. The participants were required to share their views regarding their awareness about the change; the level of communication by the authorities; and their role in decision-making related to the change process. The following question was asked:

Do you think the change from Cambridge to the BGCSE D&T curriculum was necessary?

For the teachers this question required a **"Yes** or **No"** response. However, it had a provision for respondents to justify their answers. Those who answered with a "NO" moved to the next question. Figure 4 below summaries of the teachers' responses.

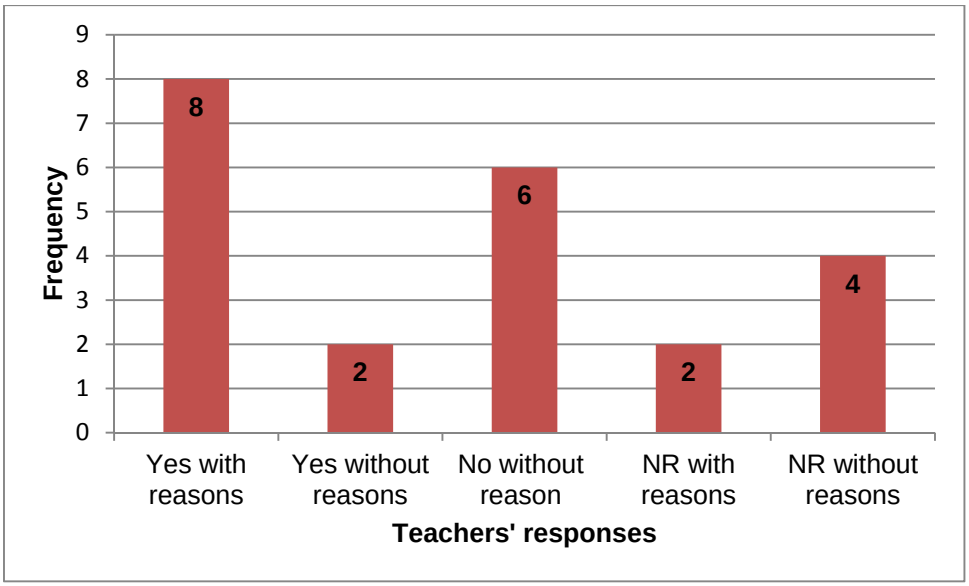

Figure 4: Teachers' perceptions about curriculum change

N = 22

Key: NR (No Response)

Eight (8) respondents answered **"Yes"** and also justified their answers. Two (2) answered **"Yes"** without justification. Six (6) answered **"No"** without justification. Four (4) did not respond at all to the question whilst two (2) did not answer because they had just joined the field

The reasons for the change

Open coding technique recommended by Corbin and Strauss (2008) was used to identify common themes or keywords emerging from the data. Figure 5 below presents keywords identified from the responses.

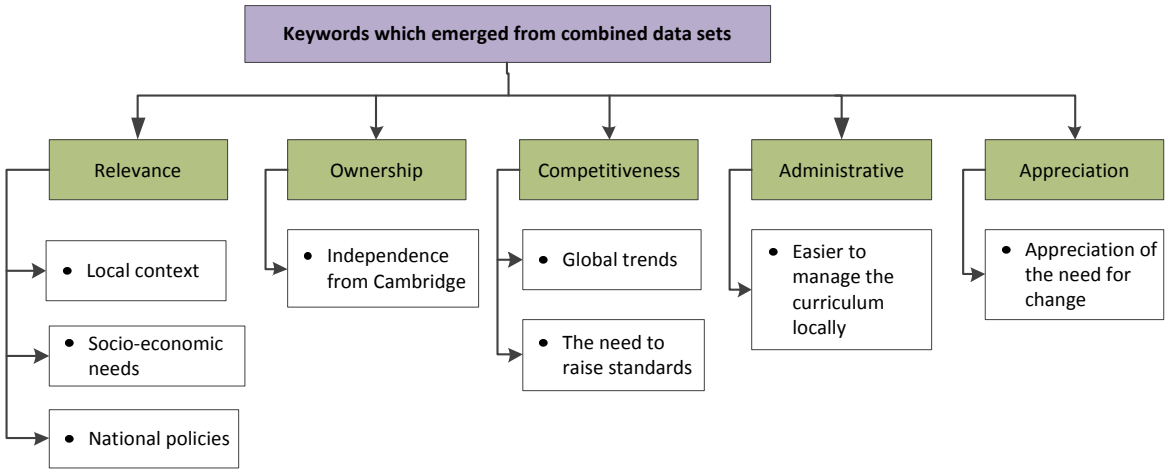

Figure 5: Open coding of the data

In order to answer the second research question *"what views and perceptions are held by various stakeholders regarding the change and transition?"* the data collected from the questionnaire, group interview and the individual interviews were analysed. The next question required participants to share their views regarding the level of communication regarding the change based on the questionnaire responses.

Was the need for change clearly communicated to the D&T teachers?

The responses were measured using a rating scale as shown below.

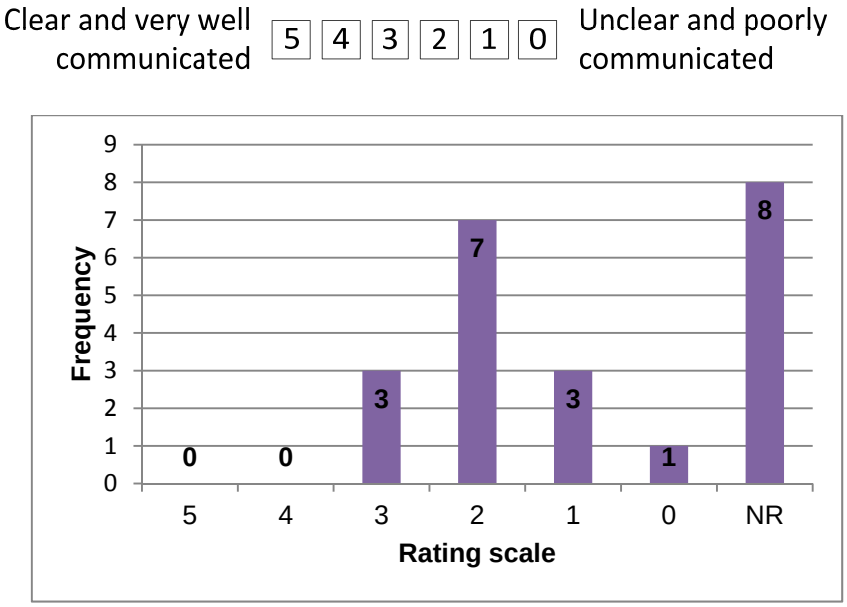

Figure 6 - Teachers' perceptions about the level of communication

Three (3) rated the level of communication 3, suggesting that the communication was somewhat clear and fairly communicated; eleven (11) rated between 0-2, suggesting that it was unclear and poorly communicated; eight (8) left it blank. While two (2) did not respond to the question because they were not in the field at the time. The most obvious result was the absence of 5 or 4 responses. This indicates nobody felt fully clear.

The effects of the transition

The following questions addressed the third research question "*what organisational factors have facilitated or inhibited change?"* The participants were asked to share their experiences regarding any changes in practice and new requirements that were brought about the new curriculum.

What new content do you teach as a result of the introduction of the BGCSE D&T curriculum?

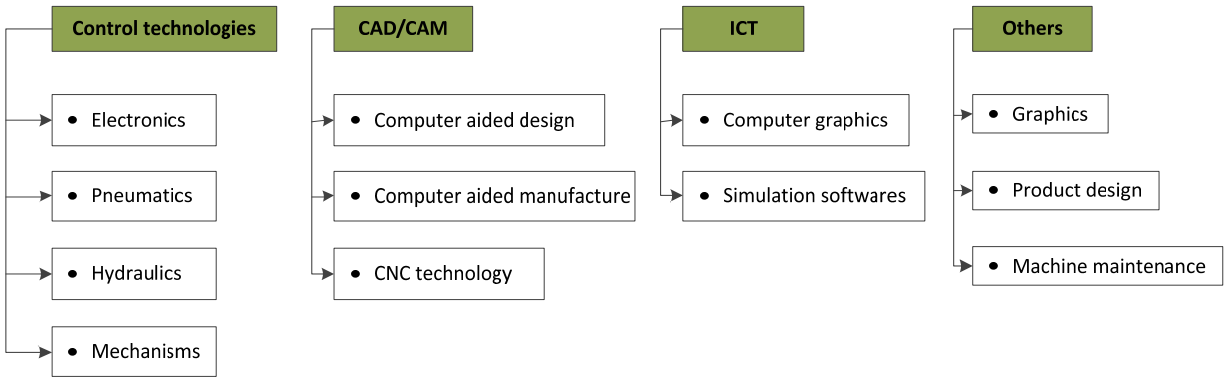

Figure 7: Initial themes used to classify responses

The data reported new content areas such as electronics; pneumatics and computer aided design and manufacture (CAD/CAM).

The next question required teachers to indicate their most critical need for in-service training. Descriptive quantities were used to help with the ranking.

List aspects of the BGCSE D&T curriculum which you feel you need training in.

Figure 8 summarises teachers' responses to the above-mentioned question. However, these findings were also validated by the data obtained from the group and individual interviews.

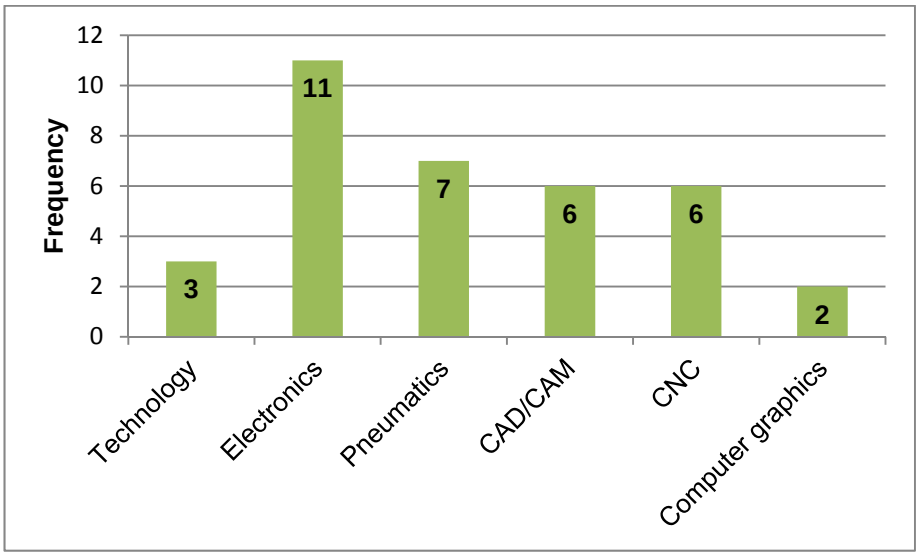

Figure 8: Teachers' preference for in-service training

Electronics was ranked the highest (11), followed by pneumatics (7); CAD/CAM and CNC (6) and computer graphics (2). As seen in figure 8, the aspects for teachers' training needs are organised into large categories. A follow-up study will be needed to get more detailed information on where such training should focus.

The capacity for change

The capacity for change was assessed in terms of leadership at all levels, administrative support, provision of resources and teachers' profesional development. A five-point Likert

type scale was enabled particpants to indicate their judgement regarding the support offered by the service providers.

How would you rate the level of support you have received from the providers.

Key: **5**: Very high; **4**: High; **3**: Average; **2**: Fairly low; **1**: Low; **0**: Very low

The highest rating was fairly low, followed by very low and low. The data showed a general dissatisfaction with the support provided by School heads.

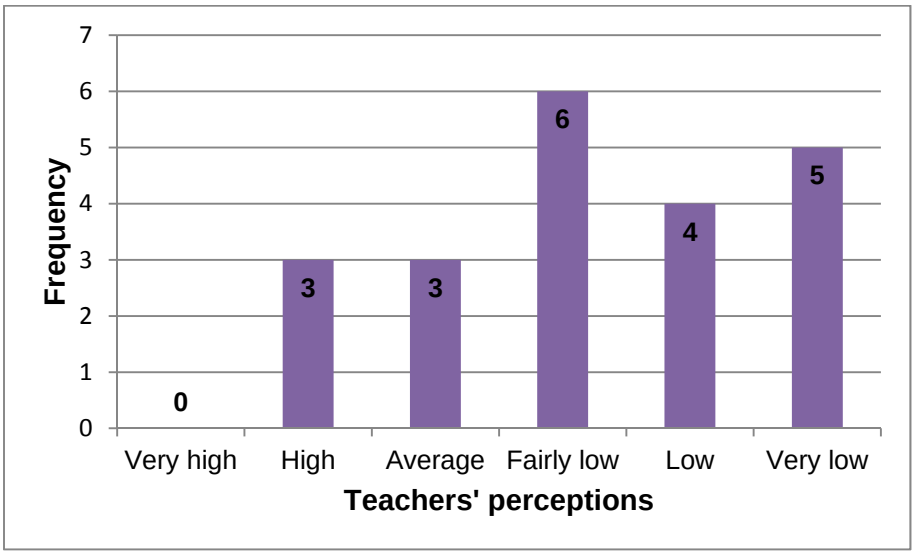

Figure 9: Level of support offered by School head

The highest rating was very low, followed by low. The data showed that teachers (86%) were dissatisfied with the level of support received from Education officers. In responding to the same question, the Education officers felt they were incapacitated because they were few on the ground and also lacked financial support to deliver in-service training.

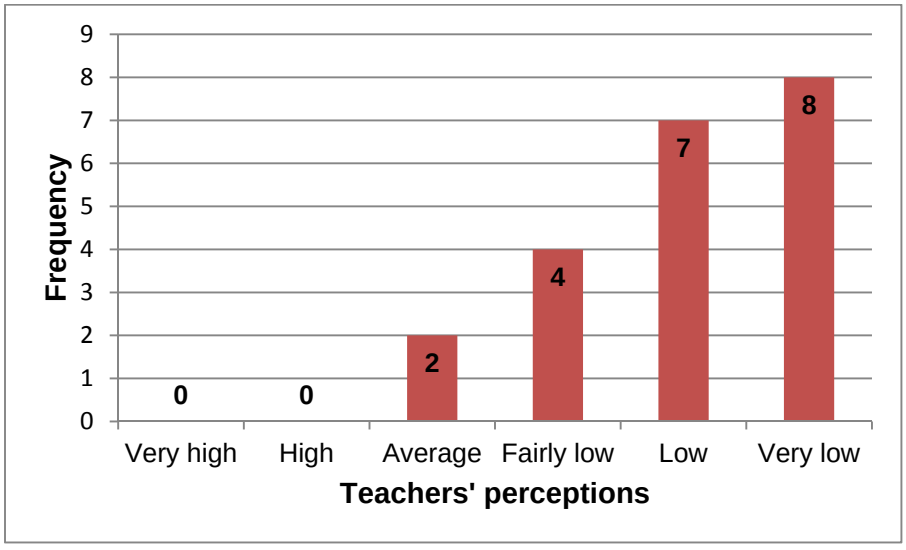

Figure 10: Level of support offered Education officer (D&T)

The highest ratings were fairly low and low. The data showed that teachers (54%) were dissatisfied with the level of professional development offered to them. Teachers' views were also supported by senior education officers for D&T. It was reported that some regions did not have D&T officers which undermined efforts to provide in-service training.

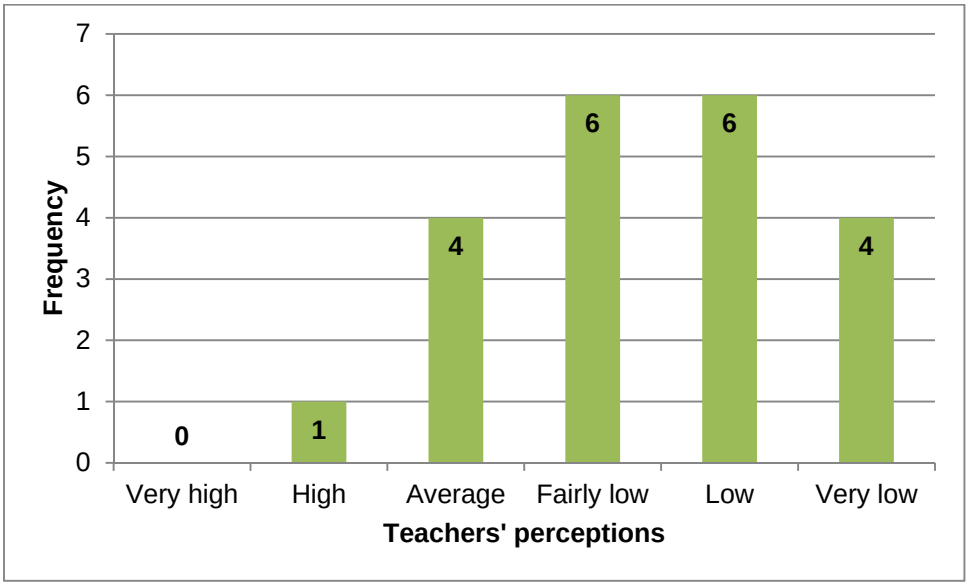

Figure 11: Teachers' perceptions of professional development

List the main factors/issues which you feel have contributed to the current state of the BGCSE D&T curriculum. The responses to this question were obtained from combined data sets. The responses have been organised into broad categories as seen in Figure 12 below.

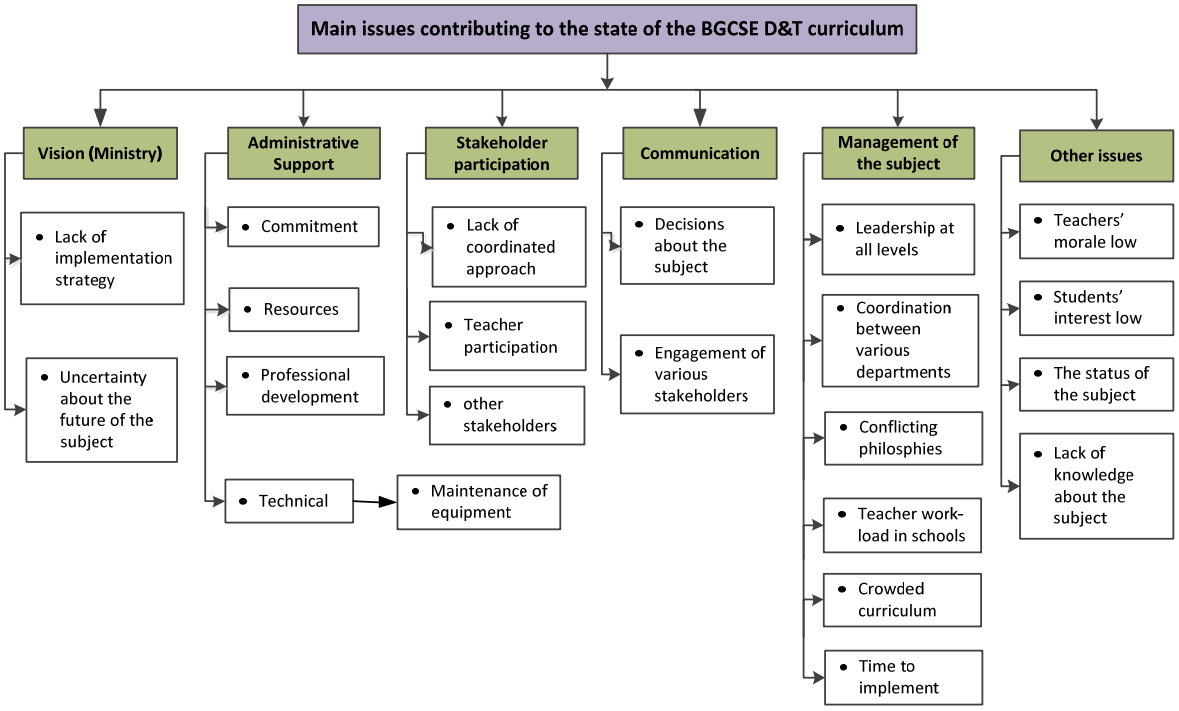

Figure 12: Broad categories of responses

Selected findings and discursive commentary

This discussion is based on findings from the questionnaire and the two interview sets. For the purpose of this paper, the discussions will focus on the following:

- Communication regarding the change;
- Stakeholder participation;
- Implementation strategy;
- Capacity to implement change;
- Teachers' professional development.

Communication regarding the change

The majority of participants (50% teachers and 100% senior officers) recognised the need for change and welcomed the localisation of the D&T curriculum. However, in terms of the level of communication about the change, evidence across the data sets suggests that it was not effectively articulated or clearly understood, especially by the teachers. Many officers interviewed were new in their positions; as such they could not ascertain the effectiveness of communication by prior post holders. They also did not have the records of correspondence to schools. Lack of access to original documents and correspondence limits the efficiency of any curriculum review process. In a hierarchical operational structure such as that of the Ministry of Education, decisions are made at the top and passed down through the senior and middle management. This affects the information flow to the people at the bottom, mostly the teachers. Appropriate communication channels must be put in place to ensure the message get to individual teachers and is effective at that level.

Stakeholder participation

The curriculum process followed in Botswana involves teachers, non-governmental organisations and other government agencies. Although most teachers in the sample embraced the change, they felt that their role in decisions about curriculum change was minimal. This view was also acknowledged by senior officers: *"everybody is realising that when you introduce something new you need to go back to the teachers because they are the ones who are going to teach"* (Field data, 2011). Also found to have played a minor role in the development of the curriculum were teacher training institutions. The need for collaborative partnership between tertiary institutions and stakeholders was highlighted by Keogh et al (2009). For example, a linkage between the university and practising teachers could be developed through collaboration and in-service programs to meet the needs of the new curriculum (Boser and Daugherty, 1994). However, Keogh et al (2009) noted that "collaboration between service providers and educational institutions is not an easy task"

(p.38). Therefore, for future implementation, there will be a need to think carefully about the roles of all stakeholders and their organisational relationships (Fullan, 2001; Schutt, 2006).

Implementation strategy

Implementation involves planning for the change and operationalizing the strategy (Harvard Business Essentials, 2003). A good plan should be flexible and open to revision (Kotter, 1996). The Cambridge curriculum was piloted in five senior secondary schools for three years before full implementation in the rest of the schools (Ndaba, 1994). However, the author could not establish whether there was any review of the implementation effort prior to transition to the BGCSE. Such a review would have helped to identify gaps and issues before full implementation.

The capacity to implement change

Capacity refers to the resources that the organisation needs to implement the change effectively (Harvard Business Essentials, 2003). In terms of the physical infrastructure, in 1999 the Ministry undertook a major upgrade of all senior secondary schools. New workshops were built and new equipment for specialist areas such as electronics, pneumatics and CAD/CAM were supplied. However, the survey showed equipment was not being used because the teachers were not trained in its use. It was also reported that some departments at higher levels were still undergoing restructuring. This has been evidenced by lack of education officers in some regions. All these factors undermined the capacity to deliver the curriculum effectively.

Teachers' professional development

Teachers' professional development (TPD) is defined as "the growth that occurs as the teacher moves through the professional career" (Glatthorn, 1995, cited in Villegas-Reimers, 2003, p.11). Responsibility for providing TPD support is vested in the department of Teacher Training and Development (TT&D). The data observed inadequate support for TPD (*"don't talk about administrative support; I'm burning inside"; "you make a request, plan workshops on a certain area; you're told there is no money"* (Field data, 2011, Set 6). New technology content areas were identified as the most affected.

Barnes (2005) highlighted that "a supportive school environment is fundamental for the successful implementation of new curriculum" (p.11). The contributors to this environment are education officers and school heads by offering administrative and financial support to teachers. However, addressing this issue through in-service training is not straight-forward. For example, in the UK, Atkinson (1990) observed that there were those who resisted change by trying to "protect what they preserved to be their individual boundaries and those who believe in the need for hard technology and a sound knowledge base" (p.10). A great

deal of encouraging will be needed to help people move out of their 'comfort zones' (Kotter, 1996; Bridges, 2009). So the challenge is to demonstrate that the new 'zone' is even more comfortable and secure.

Conclusion

This paper set out to share the findings of a pilot study which was conducted in Botswana to explore a range of issues relating to the processes and challenges of implementing the BGCSE D&T curriculum. The pilot study has helped to illuminate many factors affecting the implementation of the D&T curriculum. A number of key concerns about the state of D&T were identified which include: limited participation by teachers in curriculum development process; lack of implementation policy; limited capacity to implement; lack of administrative support; and lack of support for in-service training of teachers.

Teacher participation in decisions about curriculum development looms large across the data sets. Teacher participation is an important matter in any education system (Fullan, 2001). Teachers occupy a central position in curriculum decision making. As implementers they have the closest relationship with the curriculum (Fitzpatrick, Sanders and Worthens, 2004 as cited in Saracaloglu et al, 2010). In terms of communication, a two-way communication system should be developed to enhance teacher representation at each level.

Due to the on-going restructuring exercise by the Ministry of Education, some departments especially TT&D have not been able to recruit and deploy D&T officers in some regions. This situation undermines the capacity to deliver the new curriculum. Also noted was that the BGCSE was implemented without a well thought out strategy. This paper proposes that prior to transition to new curriculum, studies should be carried out to inform the feasibility and the implementation strategies of such a curriculum.

D&T is a relatively new subject in Botswana. The following statements drive the message home: *"The BGCSE programme is fairly new people want to stick to the old system. We're still in a transition"* (Field data, 2011, Set 4). By implication the *"teachers continued to work along traditional lines"* (Field data, 2011, Set 3). So the need for teachers to be adequately prepared for its implementation cannot be over-emphasized.

The next stage in the research will be to prioritise the findings, determine the direction, and design the methodology for the main study.

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