

# Developmentally Appropriate Technology in Early Childhood (DATEC) in Botswana: In-Service Teachers' Perspectives

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## Abstract

*Developmentally Appropriate Technology in Early Childhood (DATEC) aims to identify the most appropriate applications of Information and Communication Technology to support the development of children under eight years of age. Botswana has a unique spread of population density and deep-rooted socio-cultural values. There is a need to address the compatibility of these aspects with the application of Information and Communication Technology in the proposed Early Childhood Education programmes throughout Botswana. The researcher felt that the views of the in-service teachers, (who are now students of the Bachelor of Education Programme) in the University of Botswana and have specialized in Early Childhood Education, would be a valuable input towards an appropriate Early Childhood Education curriculum. Hence, a study was proposed to assess the views of the teachers, regarding DATEC in Botswana. Forty (40) fourth year students (Level 400) of Bachelor of Education (Primary) Programme of University of Botswana, who specialised in early years and have a good exposure to Information and Communication Technology constituted the sample. Their views were obtained from a semi-structured questionnaire. Both quantitative and qualitative approaches were used for analysis of data. The findings of the study showed that the respondents strongly believed that an integration of Information and Communication Technology with the Early Childhood Education curriculum is necessary to enhance an overall development of young children. Computers with relevant resources were thought to be the best Information and Communication Technology applications in Early Childhood Education for a developmentally appropriate programme that would provide educational concepts, problem solving skills and creativity. However, they emphasised the need to make the technology socio-culturally compatible to citizens of Botswana (Batswana) to facilitate developmentally appropriate education of young children. The study concluded with a few recommendations.*

**Keywords:** *Early Childhood Education, Information and Communication Technology, Developmentally Appropriate Technology in Early Childhood, Botswana, Socio-Cultural values.*

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## **Developmentally Appropriate Technology in Early Childhood education (DATEC)**

Early Childhood Education requires rich learning experiences to facilitate development in cognitive, social, emotional, language, physical and motor aspects. During the important years of Early Childhood Education that span the human life from birth to age of eight years, children need to be provided with Developmentally Appropriate Practices that can ensure age appropriate, individual appropriate and culturally appropriate educational material (eduware) for an overall development. The Early Childhood Education environment is changing today and Information and Communication Technology is used carefully in developmentally appropriate ways for children. The integration of Information and Communication Technology as the modern technology that can store, retrieve, manipulate, process, transmit and receive different kinds of electronic and digital information i.e. voice, video, text, data and different forms of communications (Tutor2U, 2008) needs to be used carefully in developmentally appropriate ways for Early Childhood Education. This would in return benefit both the young children and the community as a whole. This would have a positive effect on children's learning and development leading to safe integration of the technology into pre-school curriculum.

Information and Communication Technology that is applied to Early Childhood Education worldwide are computers with suitable software, video films and games, the Internet, video conferencing, programmable toys, interactive white board, digital images, television, radios, satellite communication terminals, electro-mechanical learning kits and many more. For an optimum utilisation of Information and Communication Technology into Early Childhood Education there is a need to identify the most appropriate applications of Information and Communication Technology to support the development of children under eight years of age. The concept of Developmentally Appropriate Technology in Early Childhood education (DATEC) thus emerged.

In the European context (UK, Sweden & Portugal), the Developmentally Appropriate Technology for Early Childhood (DATEC) was a two year research project and development initiative funded by the European Union in association with the European Network of Excellence for Intelligent Information Interfaces (i3). DATEC aimed to identify the most appropriate applications of Information and Communication Technology to support the development of children under eight years of age, and published exemplars and guidance material for parents and early childhood educators at the end of 2001. (IOE, London, 2002, <http://www.ioe.ac.uk/cdl/datec/datecfrm1.htm>). DATEC found that the best applications of Information and Communication Technology in Early Childhood Education in European countries were (Iram & John Siraj-Blatchford, 2007) educational that encourage collaboration, integration and play, that is under

a child's control, and something that is transparent, intuitive and do not contain violence or stereotyping, but provide awareness of health and safety issues while facilitating educational involvement of parents.

### *DATEC in Botswana*

Botswana achieved a primary school enrolment ratio of 92% as early as 2000 (Republic of Botswana, 2003). However, the multiple indicators survey in 2000 estimated that only 9% of children have had access to preschool education. Significant improvement in these figures has not taken place. The need to strengthen the Early Childhood Education in Botswana has now been recognised. It is reliably learnt that the MOE has recently proposed to introduce pre-primary schools, attached to primary schools, and wishes to post some of the primary school teachers who specialized in Early Childhood Education to the Pre-Primary (4-6 years) and Lower-Primary (6-9 years) classes. The curriculum development is in progress and therefore it is most appropriate time to introduce the concept of DATEC in the Botswana context.

The researcher, a faculty member of UB, closely involved in the Bachelor of Education programme in primary education had access to these in-service teachers. The researcher proposed the present study, as it was felt that the views of these teachers from all over Botswana, who have specialized in Early Childhood Education and have a good exposure to Information and Communication Technology, would be valuable input towards the constitution of an appropriate Early Childhood Education curriculum. The insight of these teachers regarding the most appropriate application of Information and Communication Technology in Early Childhood Education (pre-primary and lower primary children in Botswana) would strengthen the curriculum.

### *Objectives*

The main aim of the study was to assess the views of the respondents, who were from all over Botswana and have practical experience of handling children up to the age of eight. It was essential to gauge their confidence and experience on the introduction of Information and Communication Technology in Early Childhood Education. The researcher needed to understand (a) the nature of edeware that would be required; and what is currently available in Botswana; (b) gauge the extent to which the Early Childhood Education community are ready to understand and accept Information and Communication Technology; and if so, (c) do they have enough infrastructures to support it. Hence, the researcher identified the following objectives:

- To assess the use of Information and Communication Technology in Early Childhood Education
- To gauge the E-Readiness of Early Childhood Education Stakeholders (Teachers)

- To find out the most Appropriate Technology in all facets of Early Childhood Education
- To evaluate the introduction of the best Information and Communication Technology application in Early Childhood Education

### **Methodology**

A survey research design was adopted for the study. A purposive sampling technique was used. The population used was the participants of Bachelor of Education programme (Departments of Primary Education and Home Economics Education) who were recently teaching in primary schools spread across the country, and were undergoing in-service training at the UB. Level 400 students were chosen as they were completing and getting ready to go back to the fields. Forty (40) Level 400 in-service teachers who specialised in Early Childhood Education, constituted the sample. Taking cues from Gay and Airasian (2003) the most appropriate instrument to use was a questionnaire and not a detailed interview as that was the best option on the ground at that moment. Their views were obtained from a semi-structured questionnaire, which had both open and close-ended questions. The questionnaire was designed covering the important areas that could address the issues regarding the use of Information and Communication Technology in Early Childhood Education, the most appropriate technology in Early Childhood Education, the E-Readiness of the Early Childhood Education teachers and the best application of Information and Communication Technology in Early Childhood Education. The researcher used both the quantitative and qualitative approaches to analyse the data. Tables and graphs were used to present the quantitative data and their recorded responses were quoted verbatim wherever necessary.

### *Results and Discussions*

The findings lead to introspection on a number of issues on developmentally appropriate technology applicable to Early Childhood Education in Botswana.

### *Demographic Data*

In the total sample of 40, 35(87.5%) were female. This is a true reflection of the reality as most teachers at the Early Childhood Education level are female. There is a gender bias in the teaching profession in schools and particularly in Early Childhood Education. As far as there age is concerned, a majority of them clustered between the age group of 30 and 45 years; 21 (52.5%) had a Primary Teachers Certificate (PTC); a few (10%) were even holding the very basic secondary education qualification. This is a challenge to the very Early Childhood Education programme of Botswana. The findings revealed that majority of the sample (90%) had acquired teaching experience in primary education; only 11 (27.5%) had any experience in the Early Childhood Education sector (0 to 8 year olds). This demonstrates the infancy of the Early Childhood Education programmes in Botswana.

### *Use of Information and Communication Technology in Early Childhood Education*

Before dwelling into developmentally most appropriate technology in Early Childhood Education, it was necessary to assess whether the Early Childhood Education teachers feel the necessity of using Information and Communication Technology in Early Childhood Education in the Botswana context. Therefore, pertaining questions were asked and the entire sample (100%) felt that there is a need to use Information and Communication Technology in Early Childhood Education curriculum. They reaffirmed the need to approach the higher authorities to instil Information and Communication Technology in schools, as Information and Communication Technology helps in an effective teaching/learning process. They indicated that an exposure to Information and Communication Technology in early years would lead to (a) brain stimulation, (b) good foundation, and (c) technology empowerment. A sizable number of them envisaged Information and Communication Technology for facilitating an overall development of a child (Table 1):

**Table 1** Overall Development of Young Children through Information and Communication Technology

Cognitive Development	Social Development	Creativity	Physical Development	Emotional Development
37(92.5%)	35 (87.5%)	33 (82.5%)	28 (70%)	27(67.5%)

The respondents felt that Information and Communication Technology would help in:

1. Development of cognitive skills like problem solving skills through computer games and video games; and the use of the Internet for information processing for young children (92.5%).
2. Enhancement of social aspects such as communication, cooperation and sharing experiences in learning though more turn taking behaviour, which form attachments with others and show participation in educational & cooperative play activities (87.5%)
3. Enhancement of creative aspects by computers tools like drawing tool and the technology that could facilitate creative activities like story telling, songs and the use of Internet (82.5%)
4. Facilitation of physical development by video films (displaying exercises), computer programmes that can enhance Eye-Hand Coordination and Finer-motor Coordination, and by teaching them various postures while handling the Information and Communication Technology tools (70%).

Inculcation of emotional affective skills like patience, temper, stress with cartoons, films, computer and video games, interactive software, stimulating pictures, stories etc.(67.5%).

A majority (80%) of them advocated for infusion of Information and Communication Technology in Early Childhood Education programme very much like Carr & Claxton (2002) who stated that the Information and Communication Technology should be integrated in Early Childhood Education to support the development of positive dispositions towards learning. Utilising computer for an overall development and integrating it into Early Childhood Education curriculum physically, functionally, and philosophically with clear goals and objectives (NAYEC, 1996) is necessary. Such integration and infusion for an overall development would benefit young children and increase the quality of the teaching/learning process in Botswana.

#### *E-Readiness of Early Childhood Education Stakeholders (Teachers)*

It was inspiring to see the response of the subjects who showed a positive interest towards the use of Information and Communication Technology in Early Childhood Education. The next question that automatically follows is 'are we ready in Botswana to call for a situation like this where we can use Information and Communication Technology in Early Childhood Education'?

Around 14(35%) of them felt that Botswana as a country is not ready for this venture due to scarcity of funds and infrastructures in terms of Early Childhood Education centres, classrooms, Information and Communication Technology equipments that Early Childhood Education professionals need to use for teaching/learning purposes. They expressed as:

"We are not ready to use Information and Communication Technology in Early Childhood Education in Botswana due to lack of funds and shortage of resources"

They also faced problem of follow-up at home, and argued as Crook (2003) that it is necessary to develop more applications that provide a continuity of educational experience between the home and the pre-school environment.

In addition, most of them 37 (92.5%) indicated a lack of appropriate Information and Communication Technology edeware that are developmentally appropriate in terms of socio-cultural aspects. They felt the need for the Early Childhood Education professionals to make special efforts for using Information and Communication Technology in Early Childhood Education by designing developmentally appropriate materials for mixed ability groups of children as Botswana has a multi-cultural context.

However, around 36(90%) felt that as far as professional readiness is concerned, they could go ahead with this exercise of using Information and Communication Technology in Early Childhood Education, as they have acquired both Early Childhood Education and Information and

Communication Technology skills and know how to handle tools like computers, video games, video films etc. and infuse them in Early Childhood Education. It could well be emphasised here that it is of utmost importance to make a suitable atmosphere that could offer resources both in terms of infrastructure and eduware.

*Most Appropriate Technology in all facets of Early Childhood Education*

It was necessary to assess the Early Childhood Education professional's views regarding the most appropriate technology to be used with young children in the Botswana context.

According to Grant (2003):

A Is not for Apple Anymore, A is for Assistive Technology, B is for Babies and C is for Computer. (p.1)

The respondents of the present study too aligned themselves mainly towards computers (Table 2). One of them said:

“Computer is the most appropriate tool as children can see moving pictures, hear songs, and also communicate with it.”

**Table 2** Appropriate Technology for Early Childhood Education

Computer	Programmable Toys	Video Games	Video Films
37(92.5%)	34(85%)	34(85%)	28(70%)

Table-2 shows that the majority (92.5%) of them responded that the computer is the most appropriate application of Information and Communication Technology in Early Childhood Education because computer programmes provide interactive, flexible, diverse, and user-centred learning. It allows the users to actively participate at their pace and perform a task repeatedly. They emphasized that the use of Multi Media packages is very important in Early Childhood Education as it provides video-audio clippings, animation, simulation, sound, graphics, which evokes a child's sensory perception to make a child's learning more effective at early childhood years. They rated multimedia better than posters, static photographic material and limited video clippings, which they felt were rigid, passive and non-interactive.

The respondents (Table 2) also rated the Internet as very important. As (Lisa Janicke, 2004) puts it:

Teacher educators in the early childhood education (Early Childhood Education) and child development fields can use the technological capabilities of the Internet to expand the boundaries of the classroom and enrich the learning experiences of their students. The Internet is a vast system of computer networks that exchange electronic data, thereby facilitating communication and access to information. (p.1)

Probably knowledge of how to integrate the Internet resources into Early Childhood Education is ideal for any Early Childhood Education professional.

They further indicated video games and films, and programmable toys as appropriate technology for Early Childhood Education. Around 85% felt that programmable toys and video games are appropriate technology, whereas only 70% considered video films as an appropriate application in Early Childhood Education (Table 2).

Technology, both conventional like radio, television, tape-recorders, electronic and electro-mechanical construction kits, scientific models and unconventional like interactive white boards, video conferencing, satellite TV and radio broadcast sets that can run easily on batteries and generators, High Frequency (HF) radio, Internet connections using very small aperture satellite or HF Communications were not mentioned at all. It perhaps indicates that there is a limited exposure to the wider spectrum of technology for learning. In addition, their confidence and in the area of computer and multimedia is perhaps greater than that in other tools.

*Introduction of the best Information and Communication Technology application in Early Childhood Education*

For any application of Information and Communication Technology to be successful, proper practices and procedures, are necessary. Therefore, it was necessary to gauge the views and experiences of the respondents regarding the best Information and Communication Technology application in Early Childhood Education in Botswana's context.

We have seen that the majority recommended that computer is the best technology for Early Childhood Education. To address the issue of best Information and Communication Technology application in Early Childhood Education, questions pertaining to 'how they would use Information and Communication Technology' were asked. The findings showed that they wanted to use computer to provide educational concepts (82.5%), problem solving skills (80%), communication and collaborative skills (75%) through appropriate eduware (Table 3).

**Table 3** Information and Communication Technology and its Use in Early Childhood

Educational Concepts	Problem Solving Skills	Communication & Collaborative Skills	Secure Use of Information and Communication Technology Tools
33(82.5%)	32(80.0%)	30(75%)	24(60%)

Computers engage children in responsive interactions, high-level of spoken communication and cooperation and initiate interactions more frequently and in different ways than when engaged with traditional activities (NAEYC, 96) and encourages longer, more complex speech and development of fluency (Davidson & Wright, 1994). A child can learn about an



educational concept with the help of a developmentally appropriate multimedia package (Bose, 2005). The potential gains for Information and Communication Technology in Early Childhood Education are tremendous. Children can gain improved critical thinking, problem solving skills, enhanced mathematical thinking, increased creativity, and a higher level of language development (Nastasi & Clements, 1994).

Children should protect and take care of their computers. Around 24(60%) felt it was necessary to provide computer and Internet security skills in young children. This would not only enable them to use Information and Communication Technology tools and devices efficiently but would also teach them a healthy habit of using it in a secure manner. The respondents felt that there is a need to use security codes, display safety use, give instructions, and monitor computer related activities constantly so that children's access to watching pornography and other negative elements could be blocked.

While dwelling upon the forte, that is computers, they expressed a strong need for using developmentally appropriate edware, computer software in this case. The findings of the present study related to the National Association for Education of Young Children (NAEYC)'s Position Statement (1996) which states as:

... in any given situation, a professional judgment by the teacher is required to determine if a specific use of technology is age appropriate, individually appropriate, and culturally appropriate. (p.1)

The respondents wanted to use an age-specific edware and one stated as:

"I will use age-specific technology like computer games, multi-media programmes for teaching young children in my class".

They strongly recommended the use of small size Early Childhood Education classrooms so that the teacher could cater to the individual differences between different children. They felt that no amount of innovative technology could be effective if the teacher student ratio is not reduced.

They further raised a concern regarding the socio-culturally appropriate edware. They observed that most of the available edware like multi-media programmes, computer games, video games, video films etc. are relevant to western cultures and not applicable to the Botswana context at all. Some expressed:

"Botswana is multi-cultural and children need to understand where they come from".

The respondents insisted the use of stories, pictures, games, dramas, language, music, dance, food, vegetables, animals, clothes, beliefs, celebrations, myths, customs, national days etc. related to Botswana.

The respondents volunteered to contribute towards this effort utilizing their multi-cultural background and experience in Early Childhood

Education & Information and Communication Technology. They further emphasized that Early Childhood Education trained teachers who are part of the society, can play a very important role in development of socio-culturally appropriate eduware as they have an in-depth knowledge of Early Childhood Education and have the basic knowledge of Information and Communication Technology too. Some expressed as:

“Now I am competent and can contribute to the development of software for Early Childhood Education as I had training in Early Childhood Education and Information and Communication Technology skills”.

Therefore, to exploit the computer capabilities fully both by the teachers as well as the students, an effort to develop Botswana’s own socio-culturally compatible material needs to be developed with the help of trained Early Childhood Education teachers. The Early Childhood Education teachers, who are the best agents for this exercise, can work hand in hand with the computer software developers and bring out the best possible eduware that is relevant to the young Botswana. This confirms Hosein’s (2007) study on Educational Software design with young children with reference to Trinidad as follows:

A study using questionnaires and observation was conducted to review existing software and suggest improvements that could be made to them. The results show that many packages still need a lot of improvements before the software can be extremely beneficial to students. The results of the survey also show that although general “all-country” packages are useful, local developers in each country should attempt to write packages that explore the cultural heritage, geography and history of the country and also customize certain parts of the software that are related to curriculum content. (p. 870).

#### *Discussions on crosscutting issues*

Upon careful reflection on these findings, the researcher felt the need to examine the following crosscutting issues that cover more than one aspect of the study. It is well known that the foundation of a child’s development is at the Early Childhood Education level and this is where the basic socio-cultural values of the nation need to be inculcated in the child.

Before moving on to further discussions, it is necessary here to understand the unique characteristics of the land and the people of Botswana.

#### *Land, People and Culture of Botswana*

Botswana, a land locked country sharing its borders with South Africa, Namibia, Zambia and Zimbabwe is sparsely populated with just over 1.7 million people living in an area of 582,000 square kilometres. Since gaining independence in 1966, Botswana has performed exceptionally well economically, scoring one of the world’s highest growth rates. It is now a middle-income country with a per capita GDP of \$11,200 (2006). Botswana

is populated by no less than 20 different tribes with some originating from the neighbouring countries of South Africa, Zimbabwe, Zambia, Angola and Namibia, giving the country a rich diversity of cultures.

The foundations of the cultural values are Botho (Humanity), Morero (Consultation and Consensus Building) and Tumelo (Religion). Botho refers to the possession of the good attributes associated with a good human being, with good manners, helpfulness, politeness, humility and consideration for others, respect for older people. Morero refers to consultation and consensus building within society, at inter-personal, family, and community levels; is an invaluable asset in the ability to reach and sustain agreements.

Tumelo refers to the wide-ranging religious practices because of the diversity of tribes and their origins. Today Christianity accounts for around 80% of the religions practised in Botswana, although many people still maintain dual religious practices, between Christianity and traditional religious worship. Key features of Botswana's culture have, survived negative influences of change and modernisation (Beliefs, Values and Practices, 2008).

Observing the unique spread of population density and deep rooted socio-cultural values in Botswana, two crosscutting issues emerge that are unique to this country as follows:

- Alignment of the available eduware to the basic Batswana values: The respondents asserted the need to ensure that DATEC in Botswana does align to the values of Botho, Morero and Tumelo. The respondents reacted actively and expressed strong views in support of these needs. They confirmed that the currently available computer software addresses the western culture and values and does not meet the local needs. They felt that best application of Information and Communication Technology in the Early Childhood Education programmes calls for production of socio-culturally appropriate computer software to Batswana. They emphasised the eduware to be compatible with the deep-rooted socio-cultural values of Botho, Morero and Tumelo. These, they felt, would help the children to acquire good attributes and make them humble, polite and respectful; encourage them to build consensus and sustain agreement; and understand the traditional values. They have further gone ahead to volunteer their services to assist software development professionals and companies to develop such programmes for the Early Childhood Education community of Botswana.
- Exposure to a wider spectrum of technology: Botswana is a very sparsely populated country with a population density as low as three people per square kilometre. This poses severe challenges to infrastructure necessary for Information and Communication Technology in Early Childhood Education to reach every settlement

where necessary. To meet this challenge, there is a need to consider, in addition to conventional methods, unconventional methods for the delivery of Information and Communication Technology. The researcher is referring here to unconventional technologies like satellite TV and radio broadcast sets (that can run easily on batteries and generators), High Frequency (HF) radio, Internet connections using very small aperture satellite or HF Communications, other technologies that are portable and can run on batteries. The findings showed that the respondents have not made any remarks on these unconventional methods, which is rather interesting as this would mean that either Information and Communication Technology reaches all the locations and settlements that they are aware of or that they have had no exposure to the fact those unique and unconventional methods exist for addressing the outreach problems in remote areas.

### **Conclusion**

Information and Communication Technology is changing young children's world in profound ways. A careful integration of Information and Communication Technology into the Early Childhood Education curriculum virtually enhances every aspect of development, i.e., cognitive, social, emotional, language and fine motor skills (Bose, 2005). Botswana is no exception. From the findings of the present study it is understood that an integration of Information and Communication Technology with the Early Childhood Education curriculum is necessary for DATEC in Botswana. Amongst a wide spectrum of technology that could be used in Early Childhood Education, the computer programmes and the Internet could perhaps be the most appropriate technology for Botswana. The findings of the study emphasised on the production of developmentally appropriate eduware that is specifically socio-culturally compatible with the deep-rooted socio-cultural values of Botswana. Western educational material not aligned with Botswana cultural aspects of Botho, Morero and Tumelo were not accepted by the Early Childhood Education teachers of Botswana. A collaborative effort was proposed by the study, both for the Early Childhood Education professionals and the software developer, to produce an amicable computer based educational software for young children of Botswana. It was also highlighted that the respondents did not have much awareness regarding unconventional technology that could be used to reach the remote areas. Thus, efforts must be made to provide socio-culturally appropriate educational software for young children of Botswana, before they are infused in Early Childhood Education, so that they are acquainted with Botswana's rich culture, rather than aping cultures that do not belong to Botswana. And provision of a relevant course covering wider spectrum of technology would perhaps meet the challenges of reaching the sparsely populated country, as the teachers need to be exposed to unique and

unconventional methods that exist for addressing the outreach problems in remote areas.

To conclude, it can be stated as 'DATEC in Botswana calls for development of socio-culturally appropriate computer software to Botswana'.

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### **Biographic statement**

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