

Gumbo, M.T. (2008). **Exploring the development of indigenous technologies: A survey of databases.** *Africa Update*, XV(4). (ISSN: 1526-7822).

VOL XV (4) 2008

**Exploring the Development of Indigenous Technologies:
A Survey of Databases**

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Introduction

Indigenous technologies, as part of Indigenous Knowledge Systems (IKS), and the call to protect the rights of indigenous people have become part of the development agenda that has a bearing on the school curriculum. This happens against certain historical orientations that have brushed aside the thriving of IKS. For instance, there exists a skewed orientation that technology is not known to indigenous cultures. But Serote (1998) alerts us that technology is not the exclusive property of industrialised societies as indigenous cultures are also inventors and custodians of technology. Indigenous technologies are described in terms of looms, textile, jewellery and brass-work, agriculture, fishing, forestry, resource exploitation, architecture, medicine and pharmacy, etc. (Odora Hoppers, 1998). The contributions of indigenous cultures to this world's technological development can thus not be overemphasised. The general approach to technology attempts to deface this contribution. The colonial practices have contributed to this especially in developing and/or underdeveloped nations. Gloria Emeagwali (1999), Odora Hoppers (1993; 1998) and Seepe (1999) concur that colonialism has played a role to subjugate indigenous technologies.

It follows that colonialism has stifled and overshadowed the developmental efforts of indigenous technologies. What is colonialism? According to Gloria Emeagwali (1999:1), "colonialism is a system of administration; a process of exploitation and a production system that is often geared towards the creation of capitalist relations and the economic and socio-cultural aggrandisement of the coloniser". Implied in this system of administration is the role that technology plays. Technology is a tool that is used to manipulate the economic and socio-cultural environments to meet man's needs and wants or solve problems using available knowledge, skills and resources. All are engaging in some form of technology every time. But the colonial approach has advanced Western perspectives of technology at the expense of indigenous ones. Resultantly, the world is busy re-orientating itself towards the democratic and equal treatment of humanity entrenched in human rights. Intellectual property rights of indigenous cultures have become the subject of research and debate alongside this development. Efforts are also being made to acknowledge and promote IKS in general. In South Africa in particular, IKS has lately become a researched field for obvious reasons that it was sidelined prior to the democratic era. The South African National Research Foundation, for instance, is commissioned to support and promote research in the field. The IKS Programme, established in collaboration with the now transformed CSIR, under the auspices of the Parliamentary Portfolio Committee on Arts, Culture, Science and Technology (Serote, 1998) is also engaged in this research mission. As a result South Africans are increasingly becoming aware of the importance and the benefits of IKS, particularly indigenous technologies, against a previously lost opportunity to celebrate their richness.

In the light of this orientation, it should be established as to what extent, on the international front, is effort being made to promote and advance indigenous technologies. Does this effort focus on the school curriculum or outside? This enquiry is inspired by the crucial implication that indigenous technologies have on the school curriculum, particularly the technology education curriculum. As a result, we address the following research questions about indigenous technologies:

- What are the focus areas regarding international research on indigenous technologies?
- What is the extent of research on indigenous technologies per level of educational institutions?
- What is the extent of research on indigenous technologies per country per educational institution?
- Where are the focuses on indigenous technologies taking place?
- How do the research trends on indigenous technologies develop over time?

Method of study

To answer the questions stated above, we followed an Educational Resources Information Centre (ERIC) electronic database. Electronic databases available on the Internet were searched for this purpose. The researcher used the Internet resources available at the University of South Africa and University of Pretoria's incorporated Mamelodi Campus (of the former Vista University). The electronic databases housed by the libraries of these universities, and the University of Pretoria (main campus), University of Witwatersrand, Rand Afrikaans University, Potchefstroom University and the Human Sciences Research Council (HSRC) were accessed and searched. This is a random sampling of more than 20 South African universities (excluding the HSRC) just before the merger and incorporation.

A random choice was informed by convenience because the author planned to visit the said libraries if need arose. The need could have been triggered by limited resources in some of these institutions in the process of database search. So, distance was possibly going to impact on data-gathering plan. Other factors taken into account included the capacity of the University of South Africa's and University of Pretoria's libraries, and free access of the author to the computer facilities of the then Vista University as an employee. To give an indication, the University of South Africa and Northwest University (Potchefstroom Campus) libraries housed over 1, 807, 000 and 659, 480 collections respectively, at the time of this research. These were however, not the updated records (confirmed by the librarians). The other libraries were not ready to give their records at the time of the research. The HSRC was basically included because the institution keeps the record of completed dissertations and theses, and records of research projects, which are either still in process or have already been completed. Thus, it was envisaged that either completed or ongoing research within the field of IKS and/or indigenous technologies would yield the required data.

The author printed records obtained from the Internet and filed them for analysis later. Data were presented according to the categories of the searched databases. This entailed the database name, the areas it covered and in some cases even the period in years that the database search covered.

2.1 Categories of database search method

2.1.1 CD-ROM search

In this category the CD-ROM database search was confined only to the libraries of the University of South Africa and former Vista University, as the other libraries mentioned above could not be accessed. The following databases were searched:

a) ERIC

This is an educational database that includes both original and secondary academic materials, as well as related fields from library science to numerous social science topics (Katz, 1997). The academic materials covered in this category include journal articles, conference papers, microfiches, seminar speeches, books, handbooks, etc. The search covered the period from 1982 to June 2000.

b) Humanities Index

Humanities Index covers all of the areas of the humanities and it offers literature criticism, philosophy, journalism and many other areas (Katz, 1997). It also covers academic materials like journal articles, conference papers, microfiches, seminar speeches, books, handbooks, etc. The search covered the period from February 1984 to August 2000.

c) Social Sciences

This category covers areas like administration, urban studies, and criminology (Katz, 1997). The database search was in this case done on the sociological abstracts. These sociological abstracts covered only journal articles and conference papers. The period of this search ranged between 1983 and August 2000.

d) Science and Technology

This category analyses English language periodicals by subject (Katz, 1997). The search was done on the GEOBASE. It covers books, reports, journal articles and microfiches. The search covered the period ranging from January 1990 to August 2000.

e) NISC (National Information Sciences Corporation)

DISCover is a CD-ROM full-text and bibliographic database publishing company and it covers a wide range of topics in the sciences, arts and humanities (NISC, 1993). Database search in this category was done on African Studies, and covered books, journal articles and conference papers, from 19th Century to August 2000. It was also done on the South African Studies, which cover only journal articles and paper reports from 1987 to May 2000.

f) British and Australian Education Indexes

These databases were searched by using WinSPIRS, which allows the search both on full-text and bibliographic databases (SilverPlatter, 1999). The British Education Index covers only journal articles from 1976 to June 2000, whereas the Australian Education Index covers books, conference papers, Masters theses and Doctoral dissertations, speeches and journal articles from 1978 to June 2000.

g) NEXUS

NEXUS is a database that is provided by National Research Foundation (NRF). NRF supports and promotes research through funding, human resource development and provision of the necessary research facilities in the fields of science and technology. The search in this case covered both current and completed research projects.

2.1.2 Book Search and Other Publications

In this category, in addition to the libraries of the University of South Africa and former Vista University, the libraries of the University of Pretoria, University of Witwatersrand, the then Rand Afrikaans University, University of Northwest (Potchefstroom Campus) and Human Sciences Research Council were also accessed. This research exercise was affordable by searching the listed institutions' libraries electronically from the same working station at the Mamelodi Campus. The database search covered academic books, handbooks, encyclopaedias, journals, monographs, conference papers, etc. Also, the *International Journal of Technology* volume collection was searched. It covered the period ranging from 1989 to 1999. It was accessed from the article collection downloaded from Internet at the Education Library of Indiana University, USA, during the 1999 Summer Institute that the author participated in.

2.1.3 How the database search was Done

A key concept, *indigenous technology*, was used to guide the search of all databases. For a thorough search, synonymous adjectives or words that are close in meaning to indigenous were used. Each was used to qualify the term technology, just like *indigenous* qualifies technology in the concept "*indigenous technology*." These synonymous adjectives are:

- *traditional (relating to knowledge, doctrines, customs, practices, etc. transmitted from,*
- *generation to generation),*
- *native (produced, originated, or grown in a particular region or country; indigenous),*
- *cultural (relating to the sum total of the attainments and learned behaviour patterns of any specific race or people),*
- *ethnic (of, belonging to, or distinctive of a particular racial, cultural, or language division of mankind), and*
- *local (of or pertaining to a particular place by environmental, etc. influence).*

Hence, specific database search concepts were arrived at: *traditional technology, native technology, cultural technology, ethnic technology and local technology*. The CD-ROM database search was done on different databases, which covered different reading materials and disciplines. The relevant database menu was opened. Then the key concept and the related concepts given above were typed in to obtain printouts of materials covered under each of them. The book database search was not necessarily restricted by discipline. That was due to the keyword search technique (by typing in each of the above database search concepts), which resulted in obtaining the printouts covered by each concept.

A file was developed with all the printouts arranged according to the institution, key search concepts and database categories above. They were analyzed. We grouped all the databases according to the electronic database types, period covered in years (1980-2000), author(s) and year of publication, and the research focus either by key aspects in the material or its exact title. The authors' column was listed in terms of the earliest year of publication down to the latest. This was done with each database category. The reason was to clearly reflect the column of the period. The period 1982 to June 2000 covers records from 1990, the earliest publication year down to 1999, the latest publication year. A repetition of common records between the libraries was avoided, i.e. a material that appeared more than once between records of different libraries was not recounted for obvious mathematical reasons. This task ended up with the development of a table bearing the database information arranged

according to the columns of electronic database, period covered, author(s) and year, and research focus and brief description of key aspects or title. The purpose of developing this table was to provide a practically manageable strategy to address the questions at hand.

3. Answers to the research questions from the database search

After the outlined database search method was set and the search done, the author was able to answer the stated research questions.

- What are the focus areas regarding international research trends on indigenous technologies?

TABLE 1: International focus areas of research on indigenous technologies

FOCUS AREAS	NUMBER
Curriculum	83
Industry	54
Social Development	46
Indigenous versus Western technology	60
Development of Indigenous technologies	40
Agriculture	20
Policy	8
Gender	10
Culture	48
Medicine	7
Law	12
Religion	4

Table 1 shows the focus areas of research on indigenous technologies. The right-hand column gives researches done in each area. It seems that the bulk of the research focuses on curriculum, industry, social development, the comparison between indigenous technologies and Western technologies, culture, the development of indigenous technologies, and agriculture. Comparatively speaking, the highest research interest seems to lie in the area of curriculum. However, it is important to note that this priority is only about research on school curriculum. It is not about indigenous technologies being included in curriculum offering in schools. Rather, researchers do raise questions about the marginalization of indigenous technologies in the school curriculum. The other focus areas in Table 1 represent other sectors besides the school curriculum where indigenous technologies appear not to be offered a recognizable platform that they deserve. Thus, it appears that many of the researchers call for their inclusion in what seems to be the domineering Western technologies.

- What is the extent of research on indigenous technologies per level of educational institutions?

TABLE 2: The extent of research on indigenous technologies per level of educational institutions

LEVEL OF EDUCATION	NUMBER
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University level	52
Secondary School level	40
Primary School level	35

Table 2 offers an indication of where curricular research on indigenous technologies are more concentrated according to the level of educational institutions, i.e. university level, secondary school level and primary school level. The numbers in the table indicate how many researches were counted from the record list at the time of the database search. The focus is more at universities than secondary and primary schools. This is most probably due to the fact that the universities' basic function is teaching and research. In addition, some Universities are directly involved with research in the broader field of indigenous knowledge systems, which includes indigenous technologies. In South Africa, for instance, some universities were commissioned to nationally audit Indigenous Knowledge Systems in collaboration with the CSIR.

Table 2 does not imply that universities offer indigenous technologies in their curricula, but only that they conduct research in the field. The exception lies with the Australian Catholic University which, according to data searched, offers programmes in indigenous technologies to accommodate the Australian Aborigines. Secondary and primary schools are also represented in research on indigenous technologies, even though, as indicated in Table 1 above, this does not really mean the inclusion of indigenous technologies in the school curriculum but the confinement of efforts to research only.

- What is the extent of focus areas of research on indigenous technologies per country per educational institution?

TABLE 3: The extent of research focus areas on indigenous technologies per country per educational institution

COUNTRY	UNIVERSITY LEVEL	SECONDARY SCHOOL LEVEL	PRIMARY SCHOOL LEVEL
Alaska	1	1	1
Australia	9	6	5
Caribbean	1	1	1
Ghana	2	2	2
Nigeria	1	1	1
Sierra Leone	1	1	1
South Africa	2	1	1
United States	3	4	2

The numerical information in Table 3 is not expected to tally with that in Table 2 because Table 2 includes cases that are not country-specific. In Table 3, Australia takes the lead in addressing the need for the inclusion of Aboriginal technologies in the curriculum of the educational institutions. The South African cases only refer to the research initiatives conducted by CSIR in collaboration with some universities in the country, and secondary and primary schools cases are only about investigation regarding the development of African indigenous languages in the school curriculum. The generally low representation of research in the countries and educational

institutions in Table 3 could well mean the very low status offered to the development and promotion of indigenous technologies particularly in the school curriculum.

- Where are focuses of research trends on indigenous technologies taking place?

TABLE 4: Countries where focuses of research trends on indigenous technologies take place

COUNTRY	TOTAL NUMBER	COUNTRY	TOTAL NUMBER
Australia	11	Sierra Leone	2
Kenya	3	Ghana	3
Bangladesh	2	Singapore	1
Korea	6	Guinea	1
Brazil	1	South Africa	22
Mozambique	1	Sri Lanka	1
China	3	Indonesia	1
Nigeria	22	Sudan	1
Caribbean Islands	1	Japan	1
Puerto Rico	1	United States	9
Ethiopia	1	Zimbabwe	1
		India	8

It may be observed from Table 4 that research in the field seems to be concentrated more in Africa than elsewhere in the world. In Table 4 Africa rates high where research focuses have and are taking place. There are 57 researches from African countries (Table 4). In Africa alone, Nigeria and South Africa appear to be countries where a remarkable initiative is shown. However, the author realized that it appears many of these initiatives did not target the school curriculum. This could be a good move towards building up content for indigenous technologies from other sector. It would also be worth it to draw indigenous technologies into the school curriculum.

- How do research trends on indigenous technologies develop over time?
This question seeks to find the growth in research on indigenous technologies over the years. Is there any increase in the graph; if so, in which year period? The databases revealed that many researches have been conducted between 1990 and 2000. This could imply an increased interest from the researchers in the field of indigenous technologies as reflected in table 4. In Africa alone, the development of concepts like African Renaissance, Indigenous Knowledge Systems and a call for the Africanization of curriculum has most probably inspired this growing interest. What do the answers to these research questions tell us?

The author appreciates and acknowledges the research efforts in favour of indigenous technologies. The relevant role-players in education need to take advantage of this research base to advocate the extension of these research efforts to the school curriculum. Crucially implied here are the education front-liners like policy makers, curriculum developers and other officials who need to embrace an indigenous sensitive approach to curriculum engagements. They need to reflect from time to time as to whether their curriculum design, development, implementation and practice are informed by voices of the indigenous masses rather than the universalization of the West only. Teachers need to be exposed to curriculum

principles that suggest the embracing of indigenous technologies through workshops and other forms of training. When this happens, they can take advantage of the available wealth of indigenous technologies out there, which informs the lived-world of many of the learners from such backgrounds, to plan their teaching activities to accommodate this wealth. The ideal is therefore for the front-liners to reorientate their attitudes towards indigenous people by showing respect and interest to want to mine from their worldview to enrich the school curriculum.

Engagements in indigenous technologies and their custodians raise cultural issues as well. They are more about the need to accommodate indigenous cultures, that were previously marginalized in the school curriculum. In his "Multicultural education and its politics" (2001), the author accounted for how attempts to accommodate other cultures in the American school curriculum do spark a resistant attitude by those who are opposed to it. As according to Table 1, much research raises questions in support of an indigenous sensitive curriculum. The challenge is then to be accommodative of indigenous technologies in the school curriculum to restore the indigenous people's pride and celebrate our diversified make-up for unity through education. We can learn much from the Australian attempts (e.g. Australian Catholic University) which went an extra mile beyond research, to literally introduce these research efforts in the school curriculum.

The author notes, with much interest, the curriculum developments taking place particularly in his country, South Africa which came along with transformation since the change from apartheid to democratic governance. The current curriculum principles run in opposition to West-loaded curriculum that is characterized by the following practices:

- Learners are educated to be miseducated as they miss the real purpose of education in their lives - that of being a perfect fit in their society.
- Learners are included to be excluded, that is, they are literally admitted in school but the curriculum design and practice excludes them in terms of being unaccommodative of the package of knowledge and skills they bring from home.
- Learners; interest is being coerced into the foreign school curriculum rather than stirred by their own willingness.
- This disinterested attitude translates into all forms of misbehaviour at school as an attempt to express the close to meaningless school activity.
- Teachers do not absorb the curricular materials that they find difficult to fall in step with, which leaves them with no option but to do a lot of cram work.
- Parents take their children to school to learn English more so than the subject matter and their own indigenous languages, therefore equating education and competitiveness with the ability to converse in English.
- As a result, parents boast about English as a tool; for learning rather than a medium of instruction, and look down on parents and children who are not from schools that equipped them with English.
- Social classes are thus determined as such, and pride in knowing your own mother-tongue is lacking. Learners get assimilated into a culturally born - again society that strives to operate fully in the Western mode.

The principles of National Curriculum Statement (NCS) include, amongst others, social justice, a healthy environment, human rights and inclusivity (Department of Education, 2003:5). In line with indigenous technologies, the author chooses to confine himself to how principles such as these inform the nature of the learning

outcomes of the Technology Learning Area. The three (Grades R-9) and learning outcomes (LO's) of the Technology Learning Area in the RNCS, according to Department of Education (2003:21-22) are:

- LO 1: The learner will be able to apply technological processes and skills ethically and responsibly using appropriate Information and Communication Technologies.
- LO 2: The learner is able to understand and apply relevant technological knowledge ethically and responsibly.
- LO 3: The learner will be able to demonstrate an understanding of the inter-relationship between science, technology, society and the environment.

When one considers the third LO it is realized that its Assessment Standards are organized under the headings: indigenous technology and culture, impacts of technology, and bias in technology (Department of Education, 2003:22). This implies that teachers should integrate indigenous technologies in their teaching for this learning outcome. Teachers' training should empower them to engage their learners in learning activities that will address the impact and bias against indigenous cultures and the contribution of indigenous technology to culture.

4. Conclusion

Nothing about us without us (Semali & Kincheloe, 1999:37), is the conclusion that one can derive from the context of this chapter and the issues addressed. The school curriculum is about learners – to teach them. However, to a great extent it fails to teach indigenous learners about themselves. Rather, it tends to teach them about other cultures with the hidden mission to assimilate them. They hardly read about themselves in the learning support materials for instance, and this misrepresents or even under-represents them.

This article has explored international trends on research regarding attempts to accommodate indigenous technologies in the school curriculum. The answers to the research questions reveal that efforts to develop indigenous technologies are concentrated more outside the school curriculum. Thus, much still needs to be done to translate the research efforts into something practically realizable and integrating indigenous technologies in the school curriculum.

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