

Science Education in a Developing Country:

The Sudan

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Science education is extremely important if a country is to successfully compete and survive in today's world. Countries all over the world are comparing, ranking one another and scrutinizing their curricula to ensure that their students are being taught the necessary material in order to remain scientifically competitive. The most important variables for good science education include a strong and focused curriculum, qualified teachers and good educational facilities and resources. However, all these things require an investment of a substantial amount of money. How are these variables dealt with in a developing country such as Sudan, which is not only economically strained, but has also been suffering civil strife for nearly a half century? How is science education affected in a country that has difficulty satisfactorily meeting these variables? This essay seeks to provide an answer to these questions by looking at how science is represented and taught in the Sudanese science curriculum, the barriers to science education that are present as a result of the economic and civil contexts and the ways in which both Sudan and the world community (through aid agencies) are seeking ways of solving some of these problems and helping Sudan to move forward.

Sudan is the largest country in Africa; it shares its borders with Egypt and the Red Sea. Sudan's environment is a mixture of desert in the north and tropical forest in the south. Politically, Sudan is divided into 26 states, although the major political and civil divisions separate the country into northern and southern regions. Most of the urban centers, including the capital city of Khartoum, are located in the north while the south is predominantly rural. Sudan's population of approximately 39,000,000 is made up of "70% Sunni Muslim Arabs...25% indigenous African tribes and 5% African Christian [converts]."¹ Sudan's most important economic sector is agriculture, which employs about 60% of its workforce. Oil has recently

¹ CIA The World Factbook (n.d.). Retrieved March 18, 2005 from:
<http://www.odci.gov/cia/publications/factbook/geos/su.html>

become an important trading resource; however, the management of this extremely beneficial resource is still under dispute, as is the distribution of the new-found wealth resulting from it.²

According to a 2005 estimate by the CIA World Factbook, Sudan's gross domestic product (GDP) is approximately 85 billion³. The World Factbook records the average adult literacy rate in Sudan at 61.1% (71.8% for males and 50.5% for females).⁴

The civil war that has been going on in southern Sudan has seen recent peace efforts, although stability is still not completely certain, and in the western region of Darfur indigenous tribal villages are under continued siege from militias and terrorists. Over 4 million Sudanese people are currently living in refugee camps in neighbouring countries, and another estimated 4 million are displaced within Sudan itself.⁵ Thus, great differences in education accessibility exist between the different populations of Sudan, ranging from those receiving little or no education to those who have access to universities. Although the Sudanese government guarantees basic education to all children from age six to 13, the southern states are still suffering from the effects of the civil war and are currently in the process of developing a formal curriculum. The national average for enrollment in Basic Education hovers at around 60%, with Darfur being the lowest at 5%.⁶

² Salman, S.A., Al-Dasees, I.S., Ibrahim, A.G., El-Haj, A.Q.M., Al-Araki, M.A., Bashir, A.-T.A., Ghafour, H.A. et al. (2003, December 03). Country Case Study-Sudan: Sudanese Experience in the Development and Evaluation of the Basic Education Curriculums, p.3. *Association for the Development of Education in Africa*. Grand Baie, Maurice.

³ CIA The World Factbook (n.d.). Retrieved May 25, 2006 from:
<http://www.odci.gov/cia/publications/factbook/geos/su.html>

⁴ CIA The World Factbook (n.d.). Retrieved March 18, 2005 from:
<http://www.odci.gov/cia/publications/factbook/geos/su.html>

⁵ EFA Global Monitoring Report (n.d.). Retrieved March 18, 2005 from:
http://portal.unesco.org/education/en/ev.php-URL_ID=15626&URL_DO=DO_TOPIC&URL_SECTION=201.html

⁶ Whittle, P.A. (2001). *Sudan Basic Education Sub-Sector Analysis*. Khartoum:UNESCO.

SCIENCE EDUCATION IN THE CURRICULUM

The Education System and the Basic Education Certificate

In Northern Sudan, education is divided into 3 main categories:^{7,8}

- | | | |
|-------------------------|------------------|------------|
| 1. Preschool Education: | 2 years duration | ages 4-5 |
| 2. Basic Education: | 8 years duration | ages 6-13 |
| 3. Secondary Education: | 3 years duration | ages 14-16 |
| (academic or technical) | | |

As stated above, all children in Sudan are officially guaranteed education at the Basic level. The goals of education at the Basic level are as follows:⁹

- Strengthening of religions spirit among children
- Acquisition of language skills by children
- Complete development of the child
- Development of sense of belongingness to the mother country
- Protection and conservation of environment

Scientific knowledge or attitudes are not prominently stated in these goals, in fact, science may be said to be relevant to only the last of the five goals, Protection and Conservation of Environment. The lack of official importance attached to such knowledge is further reflected in the criteria that are used in determining qualification for the Basic Education Certificate, which signifies the end of Basic Education for individuals, and which is necessary for enrollment in secondary education.¹⁰ A student is eligible for receiving the Certificate upon obtaining a passing mark on an exam that is written at the end of the eighth grade, and is based solely on the eighth grade curriculum. The exam is out of 280 points, and a student is considered to have

⁷ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p. 8. *Sudan Basic Education Sub-Sector Study*. UNESCO.

⁸ Salman, S.A., Al-Dasees, I.S., Ibrahim, A.G., El-Haj, A.Q.M., Al-Araki, M.A., Bashir, A.-T.A., Ghafour, H.A. et al. (2003, December 03). Country Case Study-Sudan: Sudanese Experience in the Development and Evaluation of the Basic Education Curriculums, p.6. *Association for the Development of Education in Africa*. Grand Baie, Maurice.

⁹ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p.10. *Sudan Basic Education Sub-Sector Study*. UNESCO.

¹⁰ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p.12. *Sudan Basic Education Sub-Sector Study*. UNESCO.

passed upon receiving at least 140 *total* points. This system does not enforce scientific knowledge as a requirement for certificate obtainment. In fact, compared to other subjects the weighing of science on this exam is quite low. Out of the 280 total points, religious studies are worth 60 points (21%), Arabic is worth 50 points (18%), English and math are each worth 40 points (14%). Science is worth only 30 points (11%) which makes it one of the lowest core subjects in terms of weight on the exam. Because this system does not test the student's knowledge in each individual subject, but only considers total points across all subjects, a student who excelled in religion, Arabic and English would receive a passing mark even if he or she had very limited or no knowledge of science or math.¹¹

Science in the Curriculum

The Basic Education curriculum reflects the subject weighing of the final exam and does not feature science as a prominent subject until grade seven. Throughout the Basic curriculum, scientifically related material is taught approximately 20% of the time in each year and in accordance with the educational goal of “strengthening of religious spirit among children” all the material is taught in a religious context. This means that science is taught equally as often as religion and 5-10% less often than Arabic (see Table 1). Science is completely absent in the first and second grades, and is not taught as an independent core subject until seventh grade.

As mentioned above, scientifically related material is taught through integrated subjects in grades three through six. The two integrated subjects in these grades are called “Expressive and Applied Arts” and “Man and the Universe”. Expressive and Applied Arts is a course that includes traditional art (such as drawing and craft making), as well as some scientifically

¹¹ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p.12. *Sudan Basic Education Sub-Sector Study*. UNESCO.

grounded and practical material on agriculture, reproduction and hygiene as well as technology.¹² Man and the Universe encompasses science, history, geography and the social sciences.¹³ The specific topics that are taught each year in these integrative subjects are outlined in Table 2.

In grades one, two, and three, Expressive and Applied Arts focuses solely on craft making and drawing, to the exclusion of any science. In the upper grades (six to eight), emphasis is placed on materials that relate to agriculture, and in grades seven and eight, additional topics include nutrition and sexual health. Agriculture is extremely relevant to the students, many of whom live in agricultural areas and are likely to grow up to be employed within the agricultural sector. Nutrition and health have great personal relevance. However, it is important to realize that even though these subjects are outlined in the curriculum, they may not be taught equally across Sudan, due to poor teacher training, lack of resources and political barriers, which are the focus of the following section.

BARRIERS TO SCIENCE EDUCATION

Economic

In Sudan, economic provision for schools is the responsibility of a political entity called the “mahalyas”. A mahalyas is an elected council of 24-48 people that exists for roughly every 50,000 citizens and oversees several departments including education. The mahalyas obtains money through taxation of the population living within its political territory.¹⁴ Approximately 16% of the mahalyas’ income is dedicated to education, 45-55% of which is reserved for Basic Education.¹⁵ Because the money is collected through income taxation on a region rather than

¹² Salman, S.A., Al-Dasees, I.S., Ibrahim, A.G., El-Haj, A.Q.M., Al-Araki, M.A., Bashir, A.-T.A., Ghafour, H.A. et al. (2003, December 03). Country Case Study-Sudan: Sudanese Experience in the Development and Evaluation of the Basic Education Curriculums, p. 26. *Association for the Development of Education in Africa*. Grand Baie, Maurice.

¹³ Whittle, P.A. (2001). *Sudan Basic Education Sub-Sector Analysis*, p.9. Khartoum: UNESCO.

¹⁴ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 10. UNESCO.

¹⁵ (2002). Chapter 3: Planning for Education for All, pp. 109-116. *EFA Global Monitoring Report*. UNESCO.

centrally redistributed, regional disparities exist between the mahalyas, with rural regions and regions affected by civil unrest faring the worst. In order to make up for lacking monetary resources, many schools rely on funding from non-governmental organizations (NGOs) and parents. In some regions, parents may provide a greater ratio of the funds than the mahalyas. This provision is on top of what the parents already pay to the mahalyas in income taxes.¹⁶ The money from these different sources is used primarily for the construction and maintenance of the schools, for teacher salaries and some educational resources.¹⁷

Regional disparities are reflected in the physical structure of the schools and the resources that are available, such as text books and labs. In terms of the physical school environment, a UN study¹⁸ states that approximately 88% of the schools in Sudan are in good or acceptable shape, but many of these are in the northern half of the country. The study states that there is an average of 54.5 students per acceptable classroom in the north, while the average rises to 76.0 students in the south. Furthermore, only 57.7% of the student population is in a classroom with chairs and tables, and textbooks must often be shared between students.¹⁹ Since many schools are lacking basic educational facilities, it is not surprising that facilities and resources for scientific education, such as laboratory materials, are scarce if not entirely absent, especially in the south.²⁰ Furthermore, in surveys conducted about their work conditions, teachers voiced concerns about lack of audio visual equipment and material, absence of educational technology tools and basic educational materials, and no resources for after school clubs or activities.²¹

¹⁶ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 19. UNESCO.

¹⁷ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 20. UNESCO.

¹⁸ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 62. UNESCO.

¹⁹ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 22. UNESCO.

²⁰ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p. 16. *Sudan Basic Education Sub-Sector Study*. UNESCO.

²¹ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 38. UNESCO.

Qualified Teachers and Teacher Concerns

Another major barrier to science education in Sudan is the lack of qualified teachers and the lack of good teacher support systems. This is an issue that affects the entire country, although, once again, the rural and war-affected regions fare worst.

Until only recently, a teacher at the Basic Education level needed only a high school education; however, the current standard is a university level Bachelor of Education.²² In Sudan, approximately 84% of teachers are female, and of these, only 47% are trained. In total, approximately 62% of teachers at the Basic Education level are trained.²³ As a result, a large number of current teachers must be re-trained to meet the new standards, and considering current enrollment capacities of the universities that offer Bachelor of Education degrees, this goal will not be achieved for a number of years.²⁴

For individuals currently planning to go into education, several universities offer Bachelor of Education degrees, as well as degrees in science and technology teaching. However, most of the graduates of these programs teach at the secondary Education level, or leave Sudan for other countries where opportunities and work conditions tend to exist. Thus the teacher problem at the Basic Education level is not resolved. Furthermore, teachers consider the rewards of their profession in Sudan low, compared to neighbouring countries. This is especially true in the southern rural regions where, in some cases, teachers work on a volunteer basis or are paid only a subsistence wage by the parents.²⁵ It is not surprising that under such conditions, many trained teachers opt to work outside of Sudan.

²² Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p. 15. *Sudan Basic Education Sub-Sector Study*. UNESCO.

²³ (2002). Annex. *EFA Global Monitoring Report*, pp. 254-255. UNESCO.

²⁴ Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, p. 15. *Sudan Basic Education Sub-Sector Study*. UNESCO.

²⁵ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 20. UNESCO.

In addition to low economic rewards, teachers who teach at the Basic Education level also face challenges such as lack of teacher support and poor teacher rewards. Few teacher guides exist for the integrated subjects of Expressive and Applied Arts and Man and the Universe. The two guides that are available for Man and the Universe, one for the four-to-six and one for the seven and eight grade levels, do contain statements about goals and objectives of the topics, as well as some lesson plan ideas, but “do not provide much practical advice for the teacher who would like to make his or her science lessons more activity oriented and experiential.”²⁶ Rural educators have little opportunity to hold idea-sharing meetings or participate in continuing education due to their relative geographic isolation and few possibilities to travel between regions. As a result, these teachers, who are already working in resource-poor schools for very little money, also lack guidance in effectively implementing the science curriculum. A combination of poor training, lack of resources and low-confidence of the teachers in their own abilities, results in an over-reliance on a lecture-style teaching method.²⁷ Such a teaching style may not lend itself well to the motivating student learning of certain scientific concepts because it prevents student involvement in the classroom.

MOVING FORWARD

The barriers to science education in Sudan are being addressed both within Sudan and by the global community through the work of non-governmental organizations, such as the UN and USAID.

One of the ways that the global community is helping is through the foundation of literacy programs. One such literacy program is called University Students for Literacy (UNILIT). UNILIT is a UNESCO sponsored program that exists throughout the Arab countries

²⁶ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 36. UNESCO.

²⁷ AlSayed, A.A.A. et al. (2001). Sudan Basic Education Sub-sector Study 2000-01, p. 39. UNESCO.

in northern Africa.²⁸ This program is implemented through local universities, and involves university students running literacy workshops throughout their country of residence. In return, students receive either a university credit for participating for 40 hours or fulfill their community service graduation requirement.²⁹ Although this program is not directly tied to science education, literacy is an important first step towards making science education in the schools more effective. Parents who can read and write may be more likely to help a child with their homework and thus ensure that the child stays in school where he or she can receive more science education. Furthermore, this program may be a model for the development of other outreach programs in the future, one of which may be for science education.

Another organization that is currently funding education programs in Sudan is USAID. In 2001, USAID pledged 20 million dollars to fund a program that will focus on improving teacher education programs, increasing the quality of Basic education and improving informal education programs. The USAID program will focus on repairing existing teacher training facilities and schools, training new teachers, supplying materials to the schools and increasing distance learning programs.³⁰

In 2003, an outreach program called The Sudan Radio Service was implemented. This service was developed by the Education Development Center, a non-profit organization that receives funding from USAID. The programs of the Sudan Radio Service focus on “news, civic

²⁸ Salamé R and Dajani N. (2004, September). University Students Tackle Illiteracy. *UNESCO Education Today*. Retrieved from:
http://portal.unesco.org/education/admin/ev.php?URL_ID=1449&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1106238584

²⁹ Salamé R and Dajani N. (2004, September). University Students Tackle Illiteracy. *UNESCO Education Today*. Retrieved from:
http://portal.unesco.org/education/admin/ev.php?URL_ID=1449&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1106238584

³⁰ USAID Sudan. (n.d.). Sudan Basic Education Program. Retrieved March 18, 2005 from:
http://www.usaid.gov/locations/sub-saharan_africa/sudan/education.html

education, health, agriculture and education”³¹ and are broadcasted in several indigenous languages in addition to Arabic and English, thus making the programs more accessible to the non-Arabic speaking communities within Sudan.

CONCLUSIONS

It appears that the most important area of development in Sudanese science education is related to teacher training and support, especially in rural areas. A lecture style of teaching may not be the most effective technique for creating understanding of scientific concepts, especially in the lower grades; teachers must be trained to develop effective lesson plans that will interest and inspire their students. A focus on the local environment, which is already present in the curriculum, provides relevant study material while keeping costs to a minimum, however, without confident, empowered and appreciated teachers, even the best of curricula may not be effective in drawing students into the world of science.

As one of the world’s least developed countries, Sudan certainly still has a long way to go in terms of economic and social development. A strong commitment to a peace agreement is a vital first step to this process because without peace, education will continue to face severe challenges and possibly even destruction, not only in terms of physical structures but also in terms of being able to reach students. Education is an important tool to maintaining peace and helping countries grow because education can give both children and adults a sense of hope for the future. The field of science is full of information, of knowledge yet to be discovered and of means of affecting the world in a positive manner, and if properly implemented, attracts children’s natural curiosity.

³¹ The Sudan Radio Service. (n.d.). Retrieved March 18, 2005 from: <http://www.sudanradio.org/>

Subject	Number of Periods Subject is Taught in Each Grade							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Islamic or Christian Religion	6	6	6	6	6	6	6	6
Arabic	10	9	9	9	9	9	9	9
Mathematics	0	6	6	6	6	6	7	7
Applied & Expressive Arts*	5	5	5	4 (2)	4 (2)	4 (2)	0	0
School Environment	0	0	2	0	0	0	0	0
Man and Universe	0	0	0	4	4	4	0	0
Physical Education	0	0	0	2	2	2	2	2
English	0	0	0	0	3	3	7	7
Science	0	0	0	0	0	0	4	4
Health and Nutrition	0	0	0	0	0	0	3	3
History and Geography	0	0	0	0	0	0	0	3
TOTAL PERIODS	21	26	28	31	34	34	38	41
Science & science related subjects as a percent of the total	0%	0%	7%	19%	18%	18%	18%	17%

*For Applied and Expressive Arts, grades 1-3 has no scientific content, grades 4-6 only 50% (shown in brackets) is counted towards science due to the interdisciplinary nature of the subject. It should also be noted that in grades 1-6 the percentages of science related teaching time are only estimates due to the nature of integrated courses.

³² Arora, G.L. (n.d.). Analysis of Curriculum and Suggestions for National Curriculum Framework, pp. 9- 10. *Sudan Basic Education Sub-Sector Study*. UNESCO.

GRADE	SCIENCE RELATED CURRICULUM CONTENT	
1	<i>no science education</i>	
2	<i>no science education</i>	
3	School Environment:	local environment and nature observations -recording of data, drawings of maps and figures
4	Man and the Universe:	<i>“Man in Society”</i> -origins of human society (in a religious context) -structure, organs and systems of the human body
	Applied and Expressive Arts:	<i>The Home</i> -types of houses and construction -house hygiene
5	Man and the Universe:	<i>“Earth, Life and Environment”</i> -solar system (earth and the universe) -geology (composition of earth) -weather -environment and conservation -water and its properties
	Applied and Expressive Arts:	<i>Clothing</i> -raw materials and manufacturing -cleaning
6	Man and the Universe:	<i>“Resources of the Earth”</i> -structure of matter, elements, compounds, physical and chemical change -measurement -animal cells, unicellular organisms, plant structure and propagation -wind and pollution, hydropower, oil, and sustainable resources -liquids and flotation, boats, ships and fishing -domestic and wild animals, crops and pests
	Applied and Expressive Arts:	<i>Safety:</i> -safety in and around the home -first aid -practices which threaten safety
7	Science:	<i>“Science in Our Lives”</i> -measurement, energy, pressure -simple machines and motors, engines -magnetism -chemistry
	Health and Nutrition:	-human reproductive system -the importance of food, food sources and preparation -malnutrition diseases, feeding and care for the sick
8	Science:	<i>“The Modern World”</i> -sound, light, electricity, carbon -manufacture of sugar, refining -microorganisms, diseases
	Health and Nutrition:	-sexually transmitted diseases, feeding the pregnant and lactating woman and child, childhood diseases, vaccinations, nutrition for the elderly -cultivation and agricultural practices, vegetables, fruits and cereals

³³ Salman, S.A., Al-Dasees, I.S., Ibrahim, A.G., El-Haj, A.Q.M., Al-Araki, M.A., Bashir, A.-T.A., Ghafour, H.A. et al. (2003, December 03). Country Case Study-Sudan: Sudanese Experience in the Development and Evaluation of the Basic Education Curriculums, pp. 25-27. *Association for the Development of Education in Africa*. Grand Baie, Maurice.

³⁴ Whittle, P.A. (2001). *Sudan Basic Education Sub-Sector Analysis*, p. 9. Khartoum:UNESCO.

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<http://www.odci.gov/cia/publications/factbook/geos/su.html>
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http://portal.unesco.org/education/admin/ev.php?URL_ID=1449&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1106238584
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