



Inspirations from Scientists and Engineers Who Are Blind and Visually Impaired - Lessons to Initiate New Direction for Science Education of Blind Students in Nigeria

Sariat Adalakun

University of Birmingham (United Kingdom)
sariatlakun@gmail.com; saa075@bham.ac.uk

Abstract

Preventing students with visual impairment (SVI) from participating in Science and Mathematics lessons is denying them the opportunity of equal educational opportunity promised by the Federal Government of Nigeria. It is against the Education for all Acts (1990) and No child left behind act (2002) which Nigeria is a signatory. Denying SVI this opportunity put them at a risk of lonely, isolated and unproductive lives (Texas school for the blind and visually impaired). Not only is the possibility of producing future scientist who have impaired vision but the contribution of science in making the blind or visually impaired live a fulfilled life cannot be overstressed. To John Gardener, a blind Physicist it is an awful thing to do to a kid, just wave a course because he cannot learn it. This paper showcase inspirations from scientists who are blind or visually impaired, their contributions in the field and specific techniques used that enabled them to do science are reviewed to serve as direction for Nigeria. For instance, Supalo, a professor of Chemistry employ paid readers to draw responses on all assessment, emphasise the need to develop habit of thinking creatively, know what adaptive technology is available and be good in problem solving skills. Gary Vermeiji said the prevailing attitudes about science and the blind must be reformed. Scientifically inclined blind should not be steered toward the social sciences away from fields in which laboratory and outdoor studies are important. He believes the chief factor holding the blind back from science is ignorance.

1. Introduction

Education in the Nigeria National Policy on Education is seen as instrument par excellence for effecting individual and national development. The Educational policies in Nigeria like other countries are driven by the international agreement or acts. For example the right of all Nigerian to education is provided in section 18 of the 1999 constitution. Similarly the formulation of the National Policy on education in 1977 and the repeated revision of the in 1981, 1989, 2004 and 2008 is influenced by the Education for all Acts, the IDEA etc Section 8 of the 1977 and revised 1981 and 1989 education policy Provision is devoted to education of children with special educational needs and more elaborate sections are provided in the 2004 and 2008 revised policy. The latest special provision was influenced by the enactment of Child Right Act in 2003 which was enacted into law in 2004 using Universal Basic Education (UBE) to provide free, compulsory 9 years basic education for all Nigerian of school age. Nigeria is moving in the right direction. However, students with visual impairment are affected greatly by attitude of educators who preconceive without adequate knowledge what the SVI can and cannot do. [1][2]

Can students with visual impairment become scientist? Can they participate and contribute meaningfully in science disciplines? Are there role models? What can Nigeria Government, educators, teacher trainers, family members and course mate gain from the experience of the role models? Is it possible in Nigeria? Has anyone in Nigeria studied STEM discipline? What about the resources and logistics? These and other questions are the focus of this paper.

Many blind or visually impaired people have studied STEM courses. The scope of this paper cannot allow me to draw inspirations from many of them. I purposively selected few role model in STEM disciplines. A brief biography at least to show the onset of blindness, Specific inspirational quotes



from the role models to show areas of importance to the SVI, their families, friends, school mate, Science teachers, TVI (Resource persons or specialists), Teacher trainers and the Government.

Fig 1 Professor Cary Supalo



1.2 Biography

Cary Supalo lost his eyesight in 1982 at a very young age of seven. He started as a business administration major at DeKalb's Northern Illinois University, later transferring to Purdue University to earn two bachelor's degrees, one in chemistry and one in communications, then went on to earn a Ph.D. in chemistry from Penn State University. He is a trained chemist. Along the way, he added majors in computer science, engineering and liberal arts. Cary Supalo is the founder and president of Independence Science, an access technology company that develops and distributes blind and low vision tools that increase students' access to hands-on experiences in the science, technology, engineering, and mathematics (STEM) classrooms.

1.3 Quotes

Below are some of his sayings influenced by his experience: "I believe in a can-do attitude," said Supalo

"I wasn't allowed to touch anything in high school," he said "We're not making these blind kids enjoy science," Supalo said. "The overall perception is that they cannot do what they need to do. That's where I come in."

I just want give back to the population that I am a part of," Cary says Lab experiments are commonly viewed as too difficult for someone with a visual impairment and thus a student is relegated to note taker or secretary." "My experience has taught me that blindness need not be a barrier in the pursuit of one's ambitions to achieve whatever goals he or she aspires to achieve."

Table 1 Strategies

S/N	Inspirations
1	Training for the TVI typically doesn't differ much from the training provided for a science teacher, despite their varying roles. Cary believes that an understanding of these roles is essential for a student to be successful in the science classroom. "The role of the TVI emphasizes how to adapt the concept for the student, but the TVI doesn't need to have a mastery of the curriculum,"
2	"The role of the science teacher, on the other hand, is just the opposite. They need to have a mastery of the science curriculum but don't necessarily need to know all the adaptations."
3	Through support from friends and faculty members at Purdue University, he was encouraged to study Chemistry



2 Lev Semenovich Pontryagin [3 September 1908 - 3 May 1988]



2.1 Biography

He was born in Moscow and lost his eyesight due to a primus stove explosion when he was 14. Pontryagin attended the town school where the standard of education was well below that of the better schools but the family's poor circumstances put these well out of reach financially. Pontryagin received many honours for his work. He was elected to the Academy of Sciences in 1939, becoming a full member in 1959. In 1941 he was one of the first recipients of the Stalin prizes (later called the State Prizes). He was honoured in 1970 by being elected Vice-President of the International Mathematical Union [3]

Table 2 inspirations

S/N	Inspirations
1	Despite his blindness he was able to become one of the greatest mathematicians of the 20th century, partially with the help of his mother Tatyana Andreevna who read mathematical books and papers to him
2	But how does one read a mathematics paper without knowing any mathematics? Of course it is full of mysterious symbols and Tat'yana Andreevna, not knowing their mathematical meaning or name, could only describe them by their appearance. For example an intersection sign became a 'tails down' while a union symbol became a 'tails up'. If she read ' A tails right B ' then Pontryagin knew that A was a subset of B !

3 Geerat J. Vermeij a blind Biologist



3.1 Biography

Gary became blind since age three, but he has made a career out of seeing things most people can't see. He has been a member of faculty of Department of Biology in Maryland University from 1977-1988. Currently, he is a Distinguished Professor of marine ecology and paleoecology in the Geography Department of the University of California. Dr. Vermeij has also been honored with numerous awards including the U.C. Davis Faculty Research Award in 2004, the Daniel Giraud Elliot Medal by the National Academy of Sciences in 2000, the Paleontological Society Medal in 1997, a \$280,000 MacArthur Fellowship Award in 1992, and a Guggenheim Fellowship in 1975.



Table 3 Quotes/inspirations

1	"Blindness is a nuisance that can be largely overcome," Vermeij says. "It is not a disaster. It is not to be pitied or revered. It is just a condition that has to be dealt with as you get on with life."
2	As at the time Gary was studying science, there's essentially nothing in Braille,"
3	"Most people who try to imagine what it's like to be blind think of blackness, and, you know, that's just not the right analogy. The world for me is not black. In fact, it's very much the opposite for me because I hear all kinds of wonderful sounds. I can feel all kinds of wonderful things. I smell wonderful things. I taste nice things. So for me, the world has not lost any of its beauty or its appeal or its challenge just because I happen to be blind".
4	"One of the general sadness is that the blind are discouraged by presumably well-intentioned people from pursuing what they want to pursue".
5	The biggest obstacle to him was when the state Agency for the blind declined to pay someone to read books about shells to him
6	"I see it as my main mission to be as successful as I can be at my chosen profession and that it represent real scientific accomplishment. If that rubs off on the blind, that's fine."
7	They should have equal opportunity Nobody should be denied a chance at the fullest life possible by someone else's notion of what's good for them
8	"Many blind people feel themselves terribly inferior as a consequence of having been told that so many times. A very important first step is to make people feel it's okay to be blind."

4 Emmanuel Karemi Dinglip

Emmanuel a Nigerian became blind at the age of seven after measles attack He attended Gindiri School for the blind in Plateau State, Nigeria for his primary education. He also attended Boys Secondary School Gindiri for his secondary education. He made good grades in his secondary final examination. Emmanuel studied Mathematics at the University of Jos Nigeria and graduated with second class honours in the year 2000. He is currently working with the Federal Ministry of Education Headquarters, Abuja [2]

Though, much is not available in the literature on Emmanuel but his ability to study Mathematics in Nigeria when resources in schools cannot be compared with current situation in terms of quality and quantity worth commendation. He studied when equal education opportunity to all Nigerian citizens has not been enacted into law in Nigeria. This shows that SVI, teachers, teacher trainers and Government should take inspiration from this.

5 Abraham Nemeth



5.1 Biography [16 October 1918-2 October 2013]

Abraham Nemeth, mathematician was born in New York. He was blind from birth. He attended regular public school as a totally blind child. He majored in psychology at Brooklyn College and received a master's degree from Columbia University and a PhD in mathematics from Wayne State University.



The Nemeth Braille Code for Mathematics and Science Notation was published in 1952 and he also developed MathSpeak, a standard system of reading mathematical formulas out loud. This was a landmark step in the opportunity for blind students to engage in scientific studies.

He joined the department of mathematics at the University of Detroit In 1955, where he worked for thirty years. He was the chairman of the Michigan Commission for the Blind between 1991- 1993. He received many awards like the Migel Medal, award by the American Foundation for the blind in 1999. The Creative Use of Braille Award from the American Printing House for the Blind in 2001, the Exemplary Advocate Award by the Division of Visual Impairments of the Council for Exceptional Children awarded him and also a co-recipient of the Dr. Jacob Bolotin award

Table 5 Inspirations

S/N	
1	His determination to pursue his love of math and science despite the lack of Braille materials in these fields led in 1952 to the creation of what is now known as the Nemeth Code for Mathematics and Science Notation. He was discouraged from studying Mathematics while in the college because it was assumed that a blind person would not be able to follow equations and calculations written on a blackboard
2	"to expect from a blind child what you expect from a sighted child."
3	His father walked with him on the streets to make him comfortable with his surroundings: "My father encouraged me to touch the raised letters on mailboxes, fire hydrants and police and fire call boxes. That's how I learned the letters of the alphabet."
4	Nemeth distinguished himself from many other blind people by being able to write visual print letters and mathematical symbols on paper and blackboards just like sighted people
5	He never had a guide dog and only rarely used a cane and believed that a blind person could master virtually any skill or discipline, no matter how technical

Conclusion:

There are lots of inspirations in the sayings and experiences of the role models discussed in this paper. The SVI should have high self-esteem, to believe in themselves and never yield to people discouraging them from achieving their maximum potentials.[2] The family members and the society at large should expect what they expect from the brilliant sighted from the SVI. The teachers should accommodate them in their classes.[1] Teacher trainers should inculcate the right trainings for the TVI/resource persons in schools and finally Nigerian Government should make available provisions in terms of assistive technology and other resources necessary to make their full inclusion in Science possible.

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