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Engendering Holistic Development of African Child: the role of Agricultural Engineering in transforming The Way We Farm

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I am highly honoured to be invited to give this lead paper at the 15th International Conference and meeting of CYLAP Network (National Research and Development Network of Children and Youth in Agriculture Programme). The Network is a body of professionals (academics/researchers, development practitioners, extensionists, sociologists, psychologists, rural youth development experts and programme leaders in agriculture, etc.). The theme for this year's conference is "Engendering Holistic Development of the African Child".

By the way of introduction, I am a lecturer at the Federal University of Technology, Akure. My area of expertise is Agricultural and Environmental Engineering. This will explain my passion in the course of delivery of this paper. It is obvious that we have some common grounds which are education and agriculture for holistic development of the African Child.

I will draw from my childhood experience as one born from parents who were traders in the cosmopolitan city of Ibadan, my formal training and exposure as an Agricultural Engineer and also from my career over decades as a university lecturer in the field of Agricultural Engineering.



I call to remembrance my childhood days in a family of a man and four wives with about eighteen children of varied age differences. I had a partner who is male but born of different mothers. We did things together. One of which I like to report here is farming at preschool and primary school days. We grew crops mostly vegetables and maize and also did fishing. Harvest time was always hilarious. Nobody asked us to do these but inspiration came out of mere adventurous spirit and the willingness to practice what we learnt in school. Our parents did not participate nor discouraged us but just watched in admiration. We found it exciting. Perhaps, it could be the reason why I later opted out for a profession in agricultural engineering in life. Though we lived at the heart of Ibadan, the environment was serene and nature was at its best. Birds of varied species flew around unperturbed and one could catch fishes at the river with the help of fishing rod and a bait of earthworm at the then “gentle and unpolluted” Ogunpa river. Needless to say that today, the environment has completely changed: the birds are gone and the river horribly polluted.

Permit me to acknowledge my shortcomings in the area of educational studies since I do not have formal degrees in education. I admit that I have quite a lot to learn in this area.

I like to start the paper by narrating a story of a young boy (let’s call him Kingsley) in a village in Africa who transformed a hopeless situation around owing to the impact of cognition. There was famine where the family lived and it had not rained for a long time. The boy who had learnt at school and reading books at the library that electricity could be generated by transforming wind energy into electrical energy. He decided to try it. With the help of fan blades and an old radio, he succeeded in making the radio working. The movement of the fan blades transformed the wind energy into electrical energy. He was so excited with this discovery ran to the farm to share the news with his father. He met his father toiling in the hot sun making ridges in preparation to plant crops in anticipation of the rain. With excitement announced to his father that he could transformed wind energy into electrical energy. He demonstrated his discovery to his father with the hope that daddy will be happy with him and that he could then use this idea to provide wind energy to drive the water pump to bring water from a deep well. He told his father “With electricity, I can make water, I can make rain”. To his surprise the father was not impressed at all. The father was very angry with him. He shouted at him “get this stupid thing away from here; Forget about the school, Forget about the library. I was wrong. It’s damn well time you learned how to farm!” He shouted. The little boy was disappointed, but the mother intervened and

appealed to his father to release the bicycle to the boy for this experiment. The father reluctantly agreed. With help of the whole family a giant wind mill was erected. To the amazement of his father, the experiment worked! The water pump worked and water was pumped out of the well. It was channeled to the dry land farm. The village rejoiced and father hugged the little boy. The farm land was thus irrigated and crops were planted, sprouted and grew. We will keep this story in mind while discussing round it to illustrate how African children can be motivated and mobilised to get involved in farming. First, let's inject some theories of holistic development of an African child. An African child is unique and he is totally different from a child from the United States of America or Europe or China. The culture, upbringing, and language are completely different.

Holistic approach to the development of a child

There are several dimensions to human development: cognitive, social, cultural, physical, emotional, and spiritual and these are integrally interwoven. There should be no emphases on the acquisition of discrete skills. The child's whole context, the physical surroundings, the emotional context, relationships with others, and the child's immediate needs at any moment will affect and modify how a particular experience contributes to the child's development. In other words, development is holistic; it consists of inter-dependent dimensions. This means that the child's development cannot be fragmented into health, nutrition, education, social, emotional and spiritual variables. All are interconnected in a child's life and are developing simultaneously. Holistic education is a philosophy of education based on the premise that each

person finds identity, meaning, and purpose in life through connections to the community, to the natural world, and to humanitarian values such as compassion and peace (Fig. 1).



Fig. 1. Holistic Approach

The Role of Child-Level Characteristics in Young Children's Academic Skills

In the story above, Kingsley demonstrated that he is the active agent of his own learning and development (Bronfenbrenner, 1979; Piaget, 1965; Vygostky, 1986). He showed that his development occurs not only within the varied context in which he lived but also within a dynamic web of multiple strands of developing skills, where developing skills in one strand influence developing skills in another. His skill formation also indicate that fundamental skills can aid the learning of more sophisticated ones (Bailey, Duncan, Odgers, and Yu, 2017; Heckman, 2006). The young boy's own characteristics provide the building blocks for his academic skill development. These characteristics encompass at least three aspects including cognition, behavior, and affect.

The Role of Cognitive Characteristics

The literature has identified three important cognitive skills that are related to a child's academic development; language, visuospatial, and executive functioning. Language skills, which refer to the ability to understand and use the acquired language, are important for learning across multiple domains, especially for young children. Certainly, Kingsley mastered the language skill

at an early stage in life which manifested as a tool for him to think and operate (Vygotsky, 1986). Experiences have shown that, children with better language skills are better able to interact with others and learn from peers, adults, and classroom instructions (Vygotsky, 1986). We know that within our context in Nigerian, the language of instruction in school is English language. If a child does not master rapidly the language of instruction he cannot understand the subjects taught and hence poor academic outcomes (Dickinson, 2011; Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, and Poe, 2003). It is evident that there is also a growing body of evidence that shows that general language ability, such as receptive and expressive vocabulary, is predictive of a young child's reading skill (e.g., Pan et al., 2011) and number and mathematics competence. An African child has a basic conflict with language taught in school and his native language. This barrier is not often easily overcome by many children. Often the young child battles with this for a long time. Only some quickly get over this and until he be able to bring the cognitive skill into fruition.

Visuospatial skill is the ability to sense visual impulses and it is another cognitive skill set that is often associated with academic outcomes. It is a multi-dimensional construct that contains three subskills, namely spatial perception, mental rotation, and spatial visualization (Linn and Petersen, 1985). Children with this skill develop into scientists and engineers. Visuospatial skills are also crucial to mathematics and science learning. Spatial perception is a simple one-step operation which requires one to identify target features of visual stimuli from distractions. Mental rotation refers to the ability to mentally rotate two- or three-dimensional objects or figures. In contrast, spatial visualization contains multiple cognitive processes such as transformation, manipulation, and logic reasoning of objects. Other than language and visuospatial skills which can be conceptualized as skills of specific cognitive modules, executive functioning is a central cognitive control system that stores and coordinates information from different modules and encompasses three core components, including working memory, inhibitory control, and cognitive flexibility (Diamond, 2013; Goldstein and Naglieri, 2013). Executive functioning is greatly involved in learning, because children need to distribute their attention to tasks, process information, monitor their progress, and resist distracting impulses.

The Role of Behavioral and Affective Characteristics

Some researchers have shown that there is a link between behavioral integration and children's academic skills. There is a way how behavioral pattern is related to academic performance.

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Children acquire knowledge and skills through their interactions with the social world (Vygotsky, 1986); thus, social behavior may also be crucial to young children's acquisition of academic skills. Social skills may help children to engage in high-quality interactive learning in the classroom, whereas problem behavior may prevent them from doing so.

There is a wealth of evidence that children who show an eagerness and interest in learning and have positive attitudes toward learning are more likely to succeed in various academic domains, whereas those who feel bored in learning and have academic anxiety are more likely to have poor academic performance (Arnold, Fisher, Doctoroff, and Dobbs, 2002; Fisher, Dobbs-Oates, Doctoroff, and Arnold, 2012). The teachers' attitude in the classroom play a crucial role affective factors in young children's academic learning.

The Role of Family status, income and Parenting Practices

Another contributing factor to children's academic skill development is parental involvement. Some parents show keen interest in their children academic achievements, while some do not. The reasons could be due to parents' level of education and understanding. There are parents who want their children to be more involved in farming and agricultural practices. That is, parents' involvement in specific content area differ based on their occupation.

Nigeria as an Agrarian Society

Although the discovery of oil has tuned the economy of Nigeria to mono economy, the larger part of the Nigerian populace is predominantly rural. It is often stated that about 70% of the population are peasant farmers. Outside oil, agriculture plays a prominent role in the nation's economy. An **agrarian society**, or agricultural **society**, is any community whose economy is based on producing and maintaining crops and farmland. Another way to define an **agrarian society** is by seeing how much of a nation's total production is in agriculture. An **agrarian society** is a **society** that depends on agriculture as its primary means for support and sustenance. Wealth comes from the land. On the other hand, an **Industrial society** is characterized by the use of external energy sources, such as fossil fuels, to increase the rate and scale of production. Today, the Federal Government has seen the need to diversify our economy. Concerted efforts are being made therefore to focus on agriculture and agricultural related industries.

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The key characteristic of agrarian country is that the economy, **wealth** and society in general is centered primarily on agriculture. Human and animal labor are the primary tools employed for agricultural production. Agrarian societies employ a division of labor with members specializing in specific tasks. In spite of the significant growth of other sectors, **Nigeria** is basically an **agrarian society** since political independence in 1960. Today **agricultural** production growth is low relative to population growth.

Major crops include beans **rice**, sesame, cashew nuts, cassava, cocoa beans, **groundnuts**, gum arabic, kolanut, maize (**corn**), melon, millet, palm kernels, palm oil, plantains, **rice**, **rubber**, sorghum, soybeans, bananas and yams. In the past, Nigeria was famous for the export of groundnut and palm kernel oil. **Agriculture** as a branch of the world economy plays a significant role in human life. Its main goal is to meet the population's needs for food and provide the industry with raw materials.



The role of Agricultural Engineering in transforming the way we farm

Agricultural engineering is simply introduction of engineering and science in solving agricultural problems. Solutions these problems brought about by agricultural engineering are:

- Drainage and Irrigation
- Processing and storage of agricultural produce
- Soil conservation
- Mechanisation
- Environment and Farm structures

Each of these interventions require the use of tools and equipment. Children can always be introduced to agricultural Engineering. Farming though not a simple profession, involve children and they can be made attractive to a child. In African context, the society is by and large an agrarian society. Every member of the family is involved. The process of agriculture from planting crops and raising animals to feed the population can be presented as a basic concept and not complex in practice. It started from the invention of hoes, scythes, and plows to the introduction of tractors; innovation is at the heart of agriculture. The advent of the digital age and the emergence of many more technologies, and the farming industry are means of introducing agricultural engineering to children at school. Children can be introduced into modern farming methods by the introduction of computer and digital technology into pedagogic into the school curriculum. The role of an African Child in Agriculture is ripe for transformation. It is obvious that Children learn faster through what they can see and importantly through practical means.

What's New in Agricultural Engineering?

Here's a closer look at several developments changing the sector, along with one school at the forefront of this exciting agricultural revolution.

The phase of agricultural engineering is rapidly evolving, with many new, game-changing technologies on the horizon. It is an exciting career in constant flux due to rapid technological changes, meaning people working in it are likely to learn something new every day.

Today's agriculture routinely uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems allow businesses to be more profitable, efficient, safer, and more environmentally friendly.

Conclusion

I will conclude by proposing a paradigm of ideas that we promote interest and engagement of children in agriculture in this country:

- (i) Creation of informal groups at various levels i.e. preschool, primary and secondary school levels who are interested in practical and precision agriculture. The levels will be based on age groups and membership will be voluntary;

- (ii) Instructors of these children will be carefully selected and should be professional educators in all the field of agriculture or agriculture allied industry; Training would involve for example, coding, computer skills, modern techs etc. ;
- (iii) The formation of this would be formalized and be structured like “boys scout” or “girls brigade” and should have the government backing with well stated aims and objectives;
- (iv) Funding could be directly by the government; for example, the Industrial Training Fund.

An African Child is by no means inferior to a child from Europe, Canada or United States of America. If given same environment, Nigerians have been able to prove to the world that we can out smart many in the field of agriculture. We should remember that Agriculture used to be the main stay of our economy and it can happen again if we encourage and orientate our children into it.

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