



**Federal University of Technology,  
Minna**

**CONCEPT MAPPING:  
A VERITABLE TOOL  
IN  
SCIENCE EDUCATION**

By

**PROFESSOR VICTORIA IFEOMA EZENWA  
B.SC.ED., M.ED., PH.D. SCIENCE EDUCATION**

DEAN  
Sch. of Sci. & Tech. Education  
Federal University of Technology  
Minna

**INAUGURAL LECTURE SERIES 7**

**23<sup>rd</sup> June 2005**

**CONCEPT MAPPING:  
A VERITABLE TOOL IN SCIENCE EDUCATION**

**BY**  
**PROFESSOR VICTORIA IFEOMA EZENWA**  
B.SC.ED., M.ED., Ph.D. SCIENCE EDUCATION

DEPARTMENT OF SCIENCE EDUCATION  
SCHOOL OF SCIENCE AND SCIENCE EDUCATION,  
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,  
NIGER STATE, NIGERIA.

DFEW  
Sch. of Sci. & Tech. Edu. Minna  
F.U.T. Minna  
THE SEVENTH INAUGURAL LECTURE SERIES OF THE  
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

© COPYRIGHT V. I. EZENWA 2005

**PUBLISHED BY KINGSPLAZA COMMUNICATION  
TOP OF THYWILL SUPERMARKET  
OPPOSITE F.U.T. GATE BOSSO, MINNA**

**www.kingsplaza.com**

**E-MAIL: KINGLY\_BIZ@YAHOO.COM**

**PHONE: 066-224875**

**MOBILE: 0803-452-3022, 0805-4566-928**

## **DEDICATION**

This lecture is dedicated to God - the Father,  
the Son and the Holy Spirit.

The Chairman  
Vice Chancellor  
Deputy Vice Chancellor  
Members of Council  
Senate Members  
The Registrar  
Other Principal Officers of the University  
Deans of Schools  
Distinguished Professors and Scholars  
Directors of Centers  
Heads of Departments  
Members of the Academia  
Friends of the University  
Staff and Great Students of F.U.T. Minna  
Distinguished Guests  
Gentlemen of the Press  
Ladies and Gentlemen

## INTRODUCTION.

I thank the Almighty God for a day like this. It is with humility and elation that I stand before you this day to deliver this inaugural lecture titled: **“Concept mapping: A veritable tool in science education”**. This landmark and unforgettable occasion invariably comes once in the career of the academic. It is therefore with great joy and a deep sense of appreciation to the institution and indeed the entire community that I stand before you today to deliver the seventh inaugural lecture of this great institution. I have chosen the topic of my inaugural lecture to reflect and cover an area of my research interest in instructional development. My research interest and work covered three major related areas namely:

- Concept mapping,
- Misconceptions,
- Vee mapping and laboratory practices.

Education is the major issue in this lecture, it is followed by science education which is the target and concept mapping, the chief tool for getting at the target. In a world based on science and technology, it is education that determines the level of prosperity, welfare and security of people. It is a known fact that no nation can rise above the quality of its educated citizenry. In the process of education, teachers play a pivotal role. The professional preparation of teachers is therefore crucial for the qualitative improvement of education. In my view, the enterprise of science education is central to development, firstly and lastly, it is the students that matter. Educators are very much concerned with students learning and academic achievement. Research reports reveal that our students are not performing as they should and they are becoming incapable of comprehending fundamental (basic) concepts in science. Poor understanding of science concepts

leads to poor performance which has serious implication for national development, future leaders and students choice of career and profession. The neglect of students-centered learning and students view have been identified as a major reason for the problems in science education. The success story of Japan and other developed countries in science and technology is based on well planned instruction. Hence, a change in instructional strategy that will enable students learn meaningfully by examining their own conceptions was sought. In search of such method, strategies based on construction of knowledge by the learner from their individual experiences were developed. These strategies are summed up as the **"constructivist view"** or using the term of von Glaserfeld (1989), the **"Generative learning Model"**. One strategy that has gained ground in the search for improving learning and performance is concept mapping. Data available to date from a variety of qualitative and quantitative research studies strongly support the value of this metacognitive tool-concept mapping, for both cognitive and affective gains. The knowledge that students are expected to learn is composed of concepts. Concept maps are representation of meaning. Concept mapping as a metacognitive strategy serves to help students organize their cognitive framework into more powerful integrated pattern.

This paper which is in four main sections, discusses education, curriculum trend in science education and evidences of declining performance of students in science in the first section. The next section introduces the emergent new approach, within the constructivist framework concept mapping, to teaching and learning that is fast gaining ground and has been shown to bring about meaningful learning. The psychological and epistemological foundations underlying the strategy are also presented here. The third section looks at the efficacy of concept mapping as a veritable tool in science education and ways of raising the performance of students in science using concept mapping instructional strategy. The collaborative role of the teacher and students in raising the standard of performance in science is given pre-eminence in the concluding section of this lecture.

On this note, Mr. Vice Chancellor sir, it is my pleasure and honor to stand before this distinguished gathering to present my inaugural lecture entitled **"Concept Mapping: A veritable tool in Science Education"**.

## 1.0 EDUCATION

Education is as old as man. One of the most important insights of most African states by the time they obtained their independence was the recognition that education is the greatest instrument mankind has devised for his own progress and national development. Education generally is not only profitable but a prerequisite for any meaningful and sustained national development. No wonder, the Federal Government of Nigeria adopted education as an instrument per excellence for effective national development. There cannot be any substitute for education. The essence of education in any part of the world is to assist individuals maximize their potentials for optimum self development and the development of the society. Formal education takes place in the classroom setting.

Of all the factors that determine the conduciveness of the classroom environment, the teacher is the most important. He is the pivot of teaching and learning activities. The effectiveness of a teacher is measured by the extent to which he helps his students learn. In other words, teachers' success is measured by the learning that results from their instruction. Teacher education seeks to help the individual teacher to grow and develop as a person, provide him with skills and professional abilities to motivate his students and help them in acquiring the right type of understanding, concepts, values, and attitudes necessary for survival in the society. Worldwide, countries continue to evolve educational processes or procedures for effective learning through research. Research enlivens teaching and inspires learning. Research is an essential component of teaching. There is no doubt that being a good researcher will improve a good teacher but we do question seriously whether someone who does no research can be and remain, a good teacher.

Teacher education is confined mainly to colleges of education and university levels with heavy emphasis on the professionalization of teaching. What is to be taught is determined by the philosophy of the nation. The National Policy on Education (1981) is an official document that spelt out in clear and unequivocal terms, the policies that guide government efforts in using education as a tool for the attainment of the overall national objectives. From the curriculum, syllabi are drawn up for each subject area which are closely linked to performance standard and measures of learning outcome. In Nigeria, this had been adequately done particularly in the 6-3-3-4 system of education. Education activity is centered on the learners for maximum self-development and fulfillment. The status of students is therefore a very important input into education and their number and quality are important to educational development.

Secondary school students form the major population of my research work. Secondary education in the overall national education system is both dual and strategic. It commands both the consumer and producer status. Secondary education dictates the pace of education at the primary and tertiary levels of the educational system. It consumes the products of the primary schools, on one hand, and yields input for the tertiary level on the other. The broad aims of science education are:

- i. preparation for useful living within the society and
- ii. preparation for higher education (NPE, 1981:16).

The objectives of secondary education for Nigeria as stated in the National Policy on Education (FRN, 1981) include the following:

- i. to equip students to live effectively in our modern age of science and technology.
- ii. to raise a generation of people who can think for themselves.
- iii. to inspire the students with a desire for achievement and self improvement both at the secondary and in later life (Section 4, Pg 16).

In order to meet the objectives; Federal Government included Biology, Chemistry and Physics as core subjects in the secondary schools.

At the secondary school level, we have the following grade of teachers:

- i. NCE holders.
- ii. University graduates with professional training.
- iii. University graduates without professional training.
- iv. University graduates who hold postgraduate Diploma in education.
- v. University graduates with Masters degree.

Today, more than half of the teachers in our secondary schools are B.Ed/B.Tech (Ed) graduates. These are trained by the various departments, faculties/schools, in Colleges of Education and Universities. These departments and schools/faculties teach the pedagogy of education. Student teachers are given:

- i. good understanding of what teaching is all about.
- ii. good understanding of subject area.
- iii. good understanding of the students.

Teacher education, thus develops in the recipients the required ability to effectively facilitate learning.

Education at whatever level aims at developing the individual who in turn is expected to contribute to the development of the society. When an individual is developed, by extension a nation is developed. An adage says 'change the individual and you change the society'. People, therefore become educated not merely by attending schools but by the acquisition of useful experiences. In many areas of human existence, we learn from parents, friends, institution, church, mosque, library, clubs, TV, press, radio and so on. Of course, we cannot be carried away by any illusion that mere supply of books and increased student population are enough to bring about desired education. Only nations that are prepared and equipped with meaningful teaching and learning will be part of the dynamic world and all its evident benefits including rapid socioeconomic development.

## 1.1 SCIENCE AND INSTRUCTIONAL PROBLEMS

Modern world is permeated by the consequences of science and technology. "Science" is generally conceived as the source of knowledge and "Technology" as the application of that knowledge to a particular sphere of product. Science is concerned with understanding of natural phenomena and creating conceptual framework for its explanation.

Science education is a dual concept-science and education. Science education remains the precursor to acquiring the scientific know-how. Science educators train students for teaching science at the secondary school or tertiary levels. Science curriculum is built around basic science concepts with varying degrees of magnification to the level of specific science lesson. The relationship of classroom methodology and teacher education to performance is an issue that concerns the whole curriculum. Industrialised countries like Europe and America have increasingly come to realize and recognise that curriculum at whatever level must be accompanied by appropriate teaching strategy.

One of the main aims of research in science education is to provide data in order to answer the question "what curriculum and instructional method are most



