EMPOWERING WOMEN THROUGH SCIENCE AND TECHNOLOGY EDUCATION FOR HUMAN DEVELOPMENT

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ABSTRACT

The paper examines the need to empower women in and for science and technology education with a view of opening up avenues for more women to labour for development and enjoy the fruits of development at family, community, society and at the third world levels.

However, empowering entails the possession of good working memory(WM) ability as the base-line for participating in science and technology education. Central to this paper is a study that reveals no significant difference in the WM ability of male and femal chemistry learners in Nigeria secondary schools. The paper presents arguments that the bio- and chemo- technology at the informal education sector where the majority of women is found, should be studied for the purpose of scientific theories derivations for the school system.

It also posits the need to integrate the formal and informal technological practices and considers this as a major instrumentation for science education for human development.

It, however, highlights major crucial interventions by women, for regional cooperations and in women to bring about human development.

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INTRODUCTION

The central role of Science and Technology Education in the process of bringing about a meaningful human development is well recognised all over the world. Hence. Science and Technology Education has been accorded a high priority in education policies, curricular offerings, and network support services through national efforts and international cooperations. The developing countries in Africa need manpower and other indigineous resource in scientific and technological fields.

Available statistics show, however that many more males than females enrol in school subjects that lead to careers in science and technology. The general pattern in Africa is that females are very much under- represented in science and Technological Education as a result of educational inequalities, lack of functional guidance and counselling services, relationship of sex to occupational prestige, influence of schooling, family background, interest, training opportunities, lack of adequate orientation programmes, societal discrimination against the females in education and occupational choice, adaptation of Science and Technology, etc.

A unifying attribute of Science and Technology education (STE) in Africa is its inability to optimally transform the continent scientifically and technologically. This is related to adaptability syndrone as pointed out by Ajeyalemi (1990) who viewed Science and Technology education in Africa generally as a cue of what transpired and imported from the developed world. Furthermore, many of the adapted interventions and projects into the formal school system in Africa feature numerous cases of presenting the enviroment as a suspect of unscientific theories at the expense of the mind, scientific processes and values (Busari; 1990). Consequently, the observed levels of participation and performance have failed to make social, economic, physical and emotional human development a reality.

The exegeses of Okali (1998) and Odhiambo (1975) coupled with the consistent poor performance of students in the sciences (see Table 1) further suggest the need for significant changes towards balancing the formal and informal technological practices. The other relevant and non- controversial aspect

TABLE I

SUMMARY OF WEST AFRICAN EXAMINATION COUNCIL CHEMISTRY SSSCE RESULTS FOR BOTH GENDER

Grade Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
1-6 Credit Level	20.7	10.8	4.1	10.4	19.0	23.0	23.7	36.7	33.7
F9	36.4	51.7	36.0	69.4	52.0	46.8	47.5	34.5	39.5

SOURCE: WEST AFRICAN EXAMINATION COUNCIL, LAGOS

relates to the central role of Science and Technology Education in the empowerment of women in human development

PROBLEM

Although there are a variety of positive and exciting innovation in the policies, curricula, textbooks, teaching, evaluation and awareness campaigns for Science and Technology Education the participation of women science and technology educaion is still very low as generally shown by low female enrolment and low female participation in science and technology-based careers.

Consequently, the central focus in this paper is : How can the science policies, curricula, teaching and evaluation be positively innovative to encourage and sustain the interest and participation of women in science and technology education with a view to enhancing optimal women participation in human development. How can women empowerment be optimally enhanced through women participation in science and Technology Education for human development, with particular reference to developing countries? How can science and tachnology be taught to engender women empowerment in such developmental issues as career choice, employment opportunities, combating poverty, raising productivity, widening access to education, improving nutrition and living conditions, widening access to employment, improving health conditions, maintaining cultural values, maintaining non- discriminatory legal, political and economic recognition?.

PURPOSE

The purpose of this paper is:

a. to attempt a re-examination of the concept of empowerment
b. to highlight the importance of science and technology education as a panacea for human development.
c. to present an arguement that non- formal, formal, informal Science and Technology Education should be a major instrumentation for empowering women in the mainstream of participatory development; and
d. to identify basic ability which women scientists should possess to make them expand in ideas and be productive in practice.

BASIS FOR THE STUDY

Thus, there is a valid basis for:

(i) investigating the working memory and alphabetic arithmetic tasks of male and female senior secondary schools (sss II) students to establish a base - line information on why more female youths should be encouraged to learn science which should be seen as an objective and as an instrument for expanding youth ideas.

(ii) highlighting and studying women's contribution vis-a-vis the scientific and technological processes at the formal and informal education systems.

(iii) examining the possibility of deriving informal scientific theories from Nigeria technological practices vis-a-vis the ways of improving science education for haman development.

ASSUMPTIONS

(i) In science, the mind of the adult can build only as high as the foundation constructed in youth will support (Beveridge, 1957)

(ii) The female youths are not well represented in science and technology not because they do not have the working memory to cope but that the society gives a greater opportunity to the males than to them.

Thus, a comparative study on the working memory ability is carried out by Busari for confirmation. The purpose of presenting this study is to enable us assess the working memory ability of both gender in school, which women and men scientists should possess to make them expand in ideas and be productive in practice.

Memory, in the behavioural sense of it, covers the conservation of habits or the result of training together with the recall of memory-images and acts of simple recognition (Piaget and Inhelder, 1973). Thus, the WM is seen as constisting of limited capacity work space that can be divided between inforamation storage nd control processing. One can infer that relevant and useful ideas need be given rather than scientific facts and theories that are dependent on learning experiences and products from the developed world.

METHOD

In the study, sex and age differences in senior secondary school students WM

and AR tasks were assesed. Three schools having national representation and teaching - learning environment equivalence in Lagos state, Nigeria were used. Ninety SSS II chemistry (45 male; 45 female) students of age range 15 - 17 years participated in the study.

Two research instruments were used:

(a) **WM** task: A 20 item WM task was developed. This was validated by two chemistry education experts at the University level and a chemistry teacher at the secondary school level. The split-half method was used for testing it's reliability, the coefficient of which was found to be 0.86.

(b) **AR** task used consisted of 24 three- letter sets divided into six groups. Each group contains four sets of letter and is located to six different arithmetic operations. It was also validated and it's reliability coefficient was found to be 0.72. For each of the WM and AR tasks, thirty minutes were used to carry out the activity. Each correctly answered item in WM task was scored 5 points while one point was awarded to each correctly converted set score.

The Pearson's product rank correlation was used to correlate the scores in the WM and AR tasks by gender and age, while the t-test was used to compare performances on the two tasks. Tables II and III are the elaborations of the analysis.

FINDINGS

TABLE II

CORRELATES OF WM AND AR SCORES BY GENDER AND AGE

GENDER	r
Male	0.41
Female	0. 33
AGE	
15years	0.16
16 years	0. 46
17 years	0. 28

GRAPHICAL PRESENTATION OF WM TASK/AR TASK FOR MALE & FEMALE

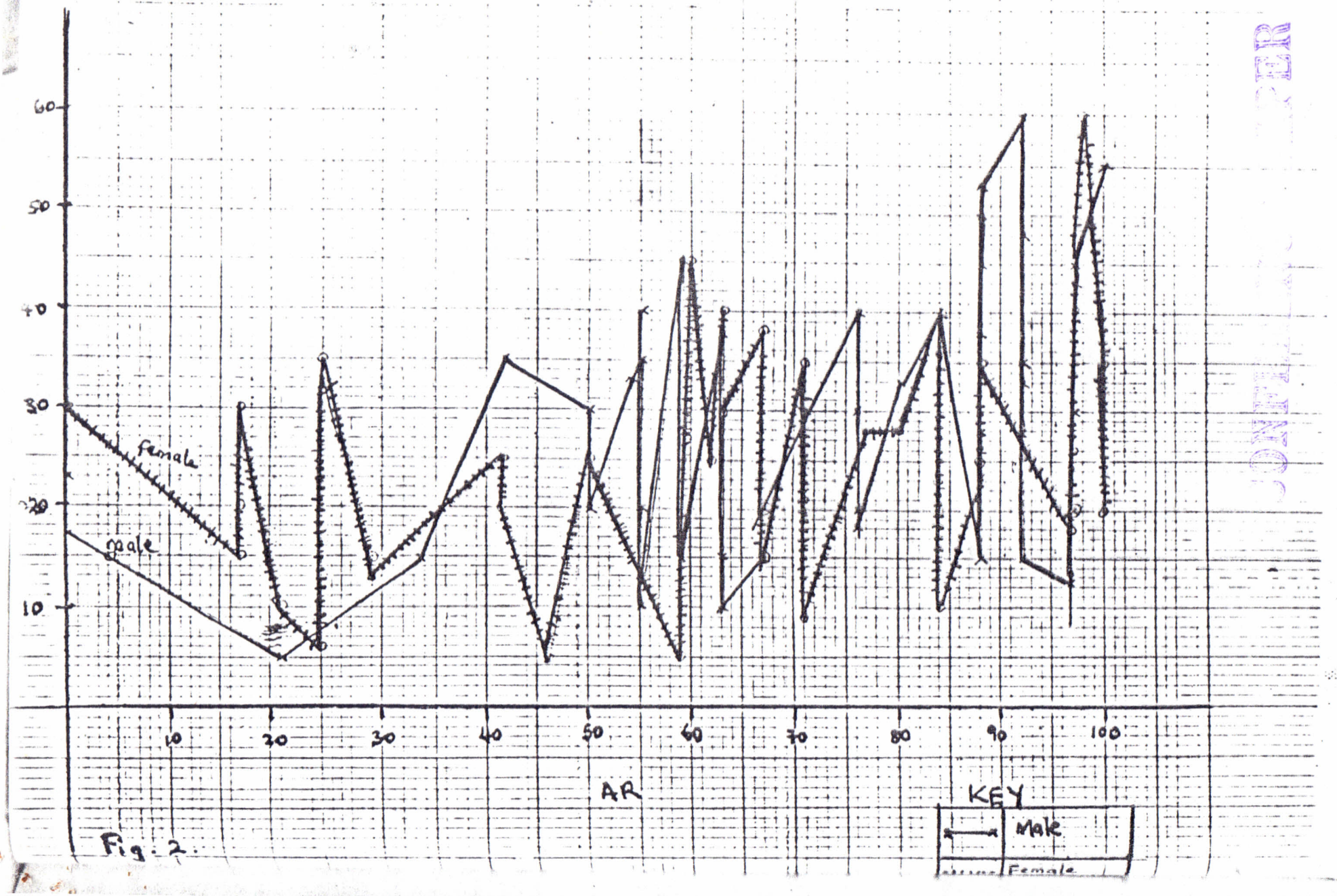

Fig. 2.

GRAPHICAL PRESENTATION OF WM TASK/AR TASK FOR THE THREE AGE GROUPS

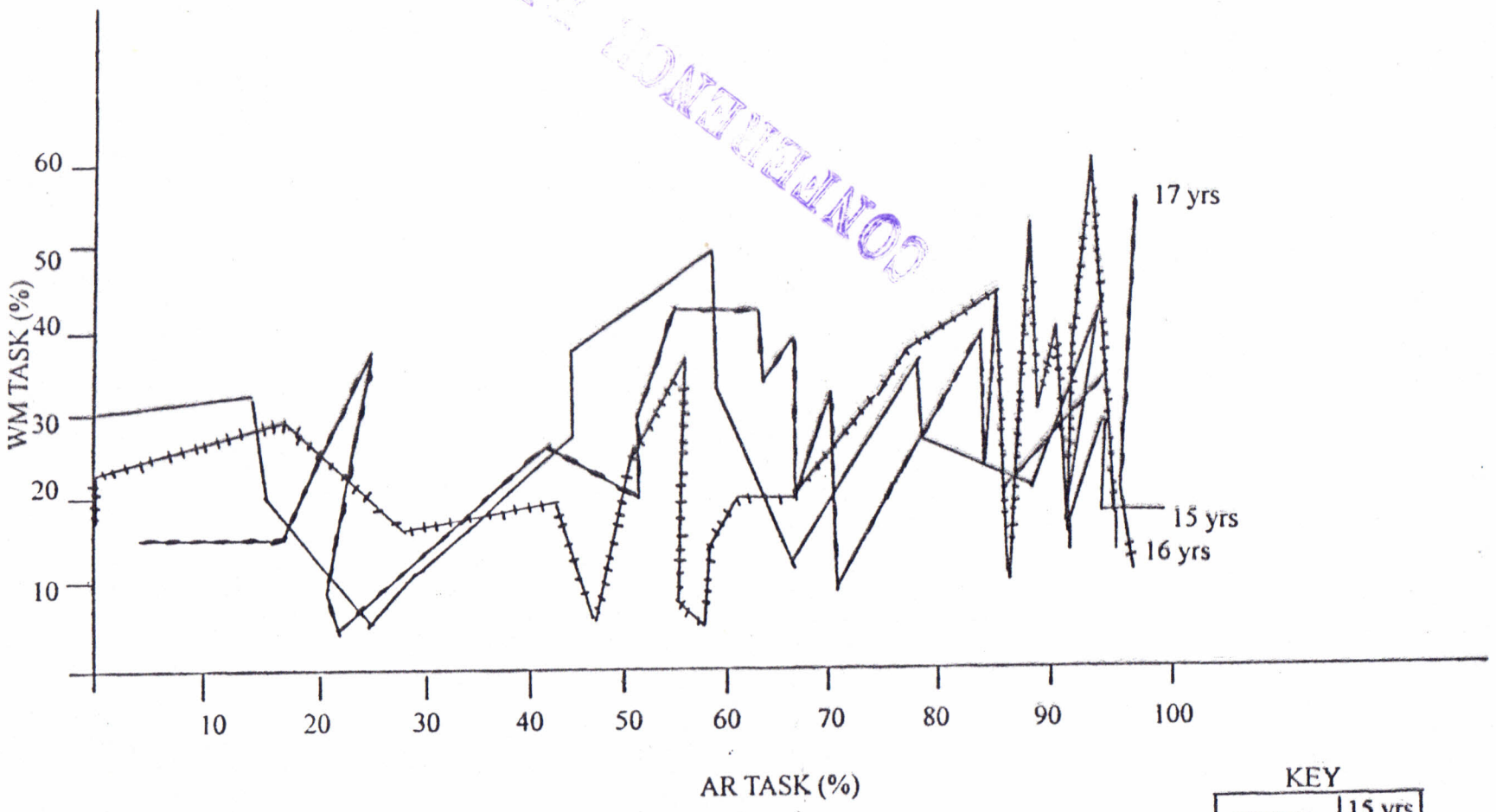

Fig. 1

TABLE III

COMPARISONS OF PERFORMANCES OF BOTH GENDER ON THE TWO TASKS

Task	Female (N = 45)		Male (N = 45		
AR	X	S.D	X	S.D	tcal
	62.5	28.9	71.3	24.4	1.56^{ns}
WM	24.3	11.3	29.1	13.2	1.85^{ns}

ns = not significant at $p < 0.05$

For the age group, fig I shows that the 16 years olds have the highest scores both in the AR and WM tasks. Table II does not reveal any significant difference in the performance of both male and female on both tasks. Uninterestingly, there is a general low WM ability of both gender which could be attributed to the limited learning experiences provided in the school curriculum. In essence, the science and technology basis of Africa must be provided in the curriculum and be thoroughly understood. Here, we must also recognize the role of the mind in sensitization processes which great scientists in the developed world discovered by chance. More importantly, is the contribution of women and men to human development in the context of science and technology which may depend greatly on what has been conserved in their memory during training.

CONTRIBUTIONS OF WOMEN TOWARDS HUMAN DEVELOPMENT IN THE CONTEXT OF SCIENCE AND TECHNOLOGY EDUCATION .

Women scientists and technologists though few (see Table Iv) are mostly found in teaching in Nigeria, especially in the Universities and Research centres. Conversely, other sectors especially the industries record low participation of women due to training and other socio-economic cultural problems. Nevertheless, the concern of this section is to draw our attention to the practices in the informal sector.

Inspite of the observed 70% of the health problems being parasitological or microbial and 15% being nutritional (Anya, 1984), women must have contributed

TABLE IV

MAJOR OCCUPATIONS OF WOMEN IN PERCENTAGES

	Zones			
Occupation	**A**	**B**	**C**	**D**
Farming and Food Processing	83.3	31.6	55.9	42.5
Full time Housewife	06.2	08.4	13.1	27.5
Non-Farming Occupation (e.g trading)	06.8	56.3	28.4	24.7
Others	0.00	0.7	0.40	01.4
Wage occupation	04.6	03.1	02.1	05.3
N	1504	2413	1500	1828

Key Zone A South East; Enugu and Cross - River States
B South West: Oyo, Osun, Ondo states
C Noth West: Kaduna and Niger States
D. Morth east: Adamawa, Bauchi and Tarab States

SOURCE: The Nutritional Status of Women and Children in Nigeria, FGN/ UNICEF 1994, p. 32.

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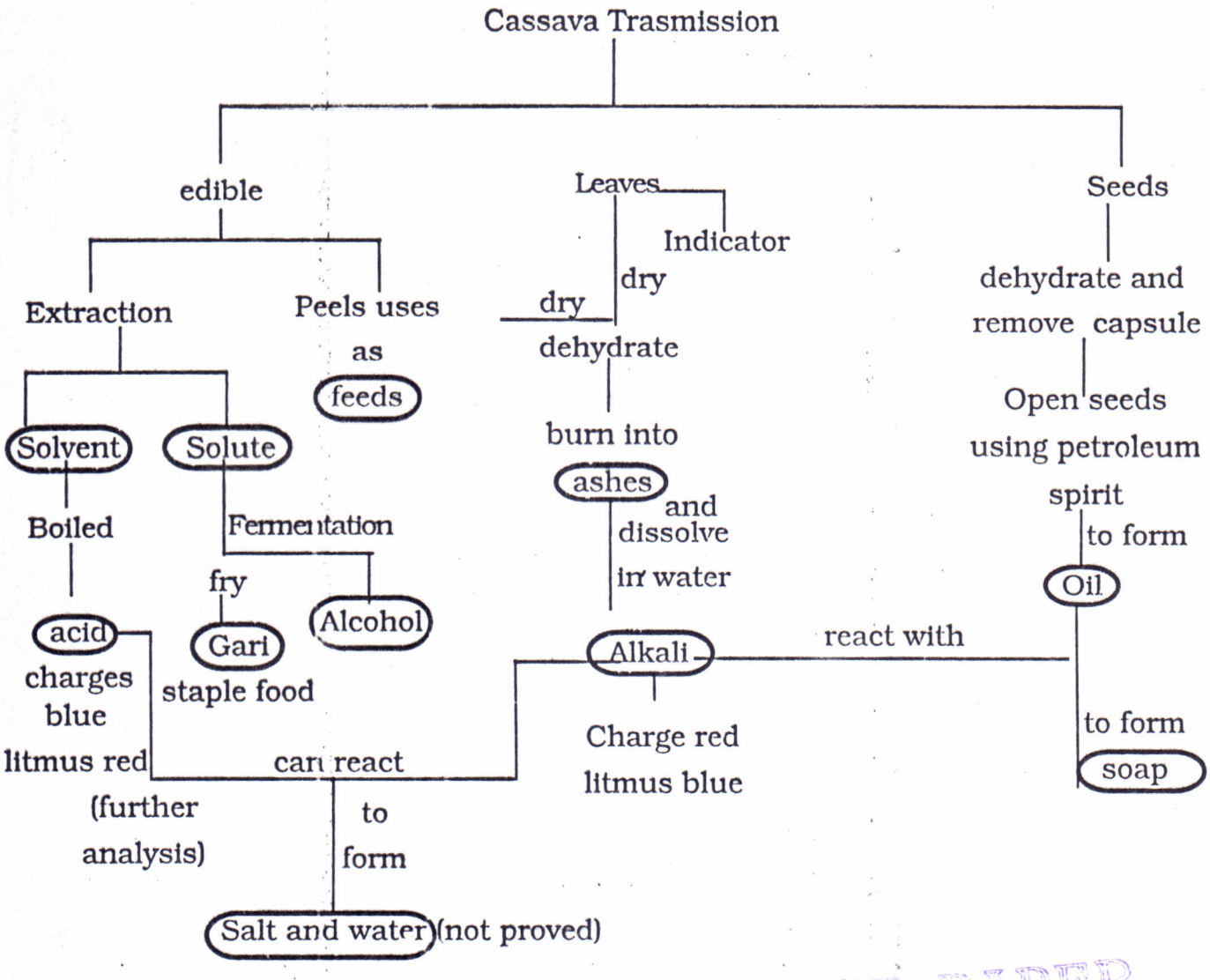

Other products

* insecticides from liquid extract mixed with a little quantity of dissolved camphor
* adhesive from starch with little quantity of water and alkali

FIG III CASSAVA TRANSMISSION AT INFORMAL EDUCATION LEVEL

DR. O.O. Busari

tremendously in the area of health care and nutrition (see table iv). using topical resources to reduce these to the level observed. Yet, these women understand less of biological theories, processes and products. Furthermore, women are more involved not only in biotechnology (eg agricultural production) but in chemo - and physico technology (eg chemical processing). As an illustration Figure III shows and overview of bio- and chemo-technology in cassava transformation. Yet the learners and even some scientists cannot claim to have a total understanding of the ecology and chemistry of Nigeria environment. Perhaps, the determination of the quality and standardisation of these practices should be a challenge to women scientists in Nigeria and Africa to harness research efforts towards successful integration of the environment into the school curriculum. Perhaps, our main aim should be to integrate cultural technological education with women education. In the same vein, since empowerment entails a complexity of change in developmental issues such as raising productivity, improving living conditions, be it health, nutritional etc) and maintaining cultural values and peaceful co-existence, women scientist's must be encouraged to participate in decision - making at the legislation level.

* Since successful human development must depend on the understanding of the biology, physics and chemistry of Nigeria environment, the informal women technology practitioners require some training in science to sensitize their horizons, creating awareness to enable them cope with discoveries by these women scientists.

* Since the type of men and women scientists who will develop Africa of tomorrow is potentially contained in the science and technology education of today, the environment should be the major instrumentation for empowering the youths.

WAYS OF IMPROVING WOMEN CONTRIBUTIONS TOWARD HAVING SCIENCE EDUCATION FOR HUMAN DEVELOPMENT.

The rest of this paper will be devoted to ways of improving and sustaining women performance in science. Though, it is a known fact that more women ever than before are involved in science and technology, no appreciable progress can be said to have been observed as far as science education for human development in African environment is concerned when the levels of poverty, diseases, peace uncertainties and environmental degradation are measured. In this study, it had

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been proved that Wm ability of a female learner is not different from that of the male. Thus, a re- thinking of science and technology education centering on alleviating daily - ilfe problem is urgently required in schools. How do you describe a situation where energy, water and heath concepts are taught in schools at all levels of the Nigerian education system and the products (men and women scientists inclusive) who are even labour of development are still searching daily, for energy, water and health resources which are abundant in their environment.

Success in this direction hinges primarily on five crucial factors:

(i) Women should be recognised as an important agent for human development and should be given functional and relevant scientific and technological experiences and employment opportunities so as not to only labour for development but to enjoy the fruits of development.

(ii) a new dimension to research and development in the Continent is urgently required. It may be pertinent to call on women scientists to study the history (analysis), relevance and adequacy of scientific theories and facts in technological practices. So far, emphases have been on quality and standardization of production for the industry and not scientific theories derivations for the school curriculum

(iii) any significant expansion and development in, for and by science education in Africa could be achieved with well - defined, well meaningful and well-enforced policies on integrating science education at formal, informal and non-formal sectors in order to sustain efforts and Will inspite of uphill problems

(iv) co-operation among women scientists, media women, women enterpreneurs, etc from third world countries is required, in order to train and equip women with scientific skills at local and state level advancements towards popularising population science and technology of their environment.

The efforts of the:

- National Agricultural Research System (NARS) /Sub - regional Organisation (SRO) partnership,
- Forum for Agricultural Research in Africa (FARA), and
- Scientific, Technology & Research Commission of OAU - a statutory organ in charge of science and technology cooperation among States, established in 1964, to strengthen science education for human development are noted. Nevertheless, the use of the environment for school curriculum should be examined and emphasised.

(v) the industries should be charged with the responsibility of funding research by women scientists and articulate the data for men and women demonstration of positive attiudes to science and for gradual development of scientific attitudes towards the environment.

CONCLUSION

The central thesis in this paper is the strong arguement that the low enrolment and subsequent low particiption of women in science and technology education is a major constraint on human development. it is also our contention that if women empowerment for human development is not to be an elusive proposition, women should be more actively involved in science and technology education. The problem is largely that of denied opportunities. All corrective and facilitative measures should be explored with a view to optimising women participation in science and technology

Finally, the progress of women scientists in the industries and of female learners in science and technology education should be seen as the progress of a state and of the world.

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