

***A Publication of the Faculty of Education,
Lagos State University, Ojo, Lagos.***

CIENCE AND VELOPMENT



Komfandor

SCIENCE AND DEVELOPMENT

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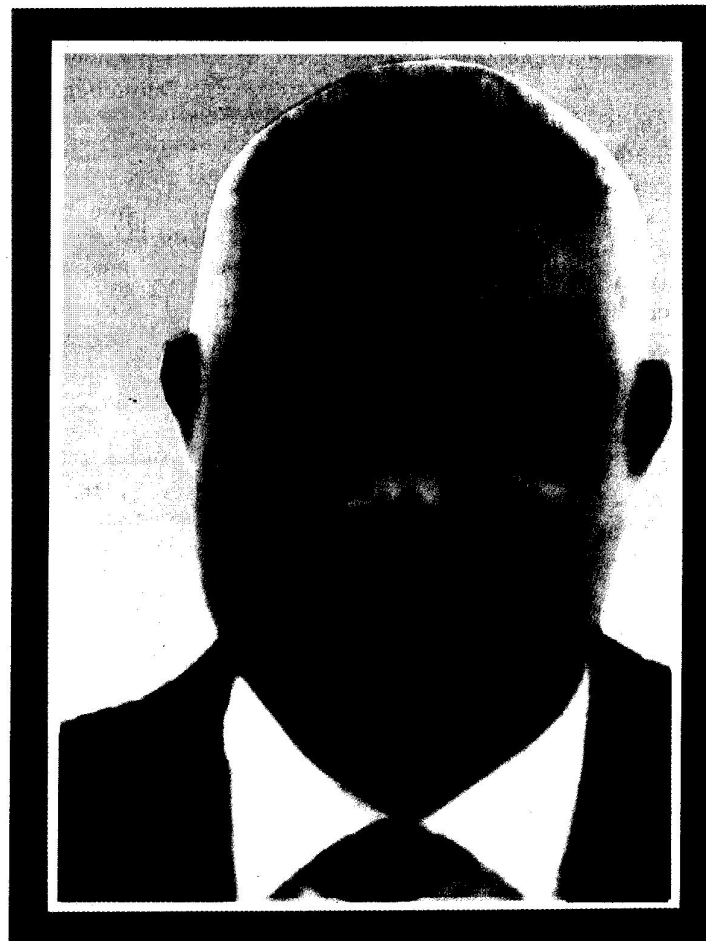
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Oyo State College of Education
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National University of Lesotho in South Africa
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Lagos State University, Ojo Lagos State, Nigeria
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Program, Faculty of Education
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Dean, Faculty of Education
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Chairman Senior Staff Disciplinary Committee
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Dean, Faculty of Education
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Member, Lagos State University Governing
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Chairman, ASUU Ethnic Committee
1996 - 2002

National University of Lesotho

Statutory Member of Senate

Member, Faculty of Education Executive

Faculty Research and Conference Committee

Chairman Committee on PGDE Program of the Department of Science
Education

Reviewer and Editor of Textual Materials (Science) Developed for Distance
Learning.

Member - Faculty of Education Executive Board, Faculty Research and
Conference Committee, Committee of

Professors, Organising Committee of the National Conference on
Mathematics, Science and Technology Education, Organizing Committee of

1999 BOLESWA Conference and Workshop organized by the Ministry of
Education for Teachers in Research Methodology

Learning Teaching Education Project, World Bank Sponsored
2001 - 2002

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University of Ibadan Scholar for Masters and Ph.D Programs
1980-1983

Appointed Chairman Board of Governors, Government College,
Ojo Lagos
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External Examiner, University of the Western Cape for Masters

Dissertation Exaternal Examiner to University if Ibadan for Ph.D Thesis

External Examiner, Ed.h Cowan University, Western Australia for

Ph.D Thesis Consultant for National Teachers Institute, Kaduna
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Consultant for Universal Basic Education Commission
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Psychological Foundations of Science Education, Historical Foundations of Science Education, Philosophical Foundations of Science Education, Test Development in Curriculum Research, Curriculum Evaluation, Research Methods, Instructional Strategies in the Sciences, and Supervised many master's dissertations Ph.D Courses Taught Advanced Statistics, Advanced Research Methods, Curriculum Implementation, and currently four Ph.D Students

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Research in Progress

Biology, Chemistry, Physics Teachers' Science Teaching Orientations, Classroom Practices and Students Achievement in the subject Comparative Analysis of Senior Secondary School Students' World -view, Classroom Practices and achievement Science

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Publications

ODUBUNMI, E. O. (1991): Analysis of Plot Teachers' learning outcomes in Primary Science Journal of the Science Teachers Association of Nigeria Vol. 27, No1

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ODUBUNMI, E. O. (2001): Improving Science Teacher Education Program (STEP) through Research Based Strategy. Science Education International Vol. 12 No. 1

ODUBUNMI, E. O., (Reviewer and Ed.) 2001: Diploma Education Primary Science Year 1-Distance Teacher Education Program (DTEP) NTTC, Ministry Education, Lesotho.

ODUBUNMI, E. O. (2006) Science and Technology Education Nigeria: The Euphoria, Frustrations, and Hopes, 21st Inaugural Lecture, Lagos State University.

ODUNMI E. O. (2008): Curriculum Implementation in Nigeria: Its Influence on the dynamics of Education in Lagos

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Faculty of Education Lagos State University', pp 311-322

ODUBUNMI E. O. (2009): Science Education Challenges in (Kayoda Oyesiku, Segun Ogunsaju and Joshua Oni) Contemporary School Administration in Nigeria 169-84. Tai Solarin University of Education.

Recent Publication in Journals and Edited Proceedings

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ODUBUNMI, E. O. (2005): Scientific and Technological Development in Emergent Societies in (Nwatoku, N.C. Akinpelu B. And Makinde. S. O. Eds.) Education: A Socializing Agent, P263-286

ODUBUNMI, E. O. (2005): Practical Approach to the Teaching and Learning of Genitic Concepts in (Oke. M., Ango M. C., Odeyemi J. O. Nwosu I. J. And Etokebe, I. J. Eds) Proceedings of the 2005 national' Biology Panel Workshop held at the Benue State University. P1-13

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ODUBUMI, E. O. (1997); Observing Science Teachers Teach. Paper delivered as Guest Lecturer at the 1st STAN Workshop for School Heads, Principals and Administrators

Foreword

Science and Development is a book of readings in honour of *Professor Emmanuel Olagunju Odubunmi*. The book contains well researched articles on the following subthemes:

- *Science Education for Development*
- *Science, Technology and Development*
- *Sciences, Humanities and Development*
- *Sports Science, Health Education and Development*
- *Science and Management Education*

This book of readings is a repository of knowledge on science and its relationship with development. It is hoped that the information therein will be of immense benefits to the solution of problems and challenges of development in Nigeria.

Professor Odubunmi has devoted his time and energy to science education throughout his stay in the university system. This is so because he believes that science education has intrinsic value for human development and improvement of quality of life, as well as being a tool for building a better society for all and sundry.

The book is divided into various chapters. The authors are seasoned, experienced and respected scholars from across the country. Contributors paid much regard to simplicity and clarity of language to make it a book of interest to all.

The effort of members of the editorial board and that of the faculty board members are highly appreciated.

Thank you and God bless

Prof. R.O. Okuneye
Dean Faculty of Education
Lagos State University, Ojo

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Exercise: Its Relevance and Prescription

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Abstract

There is need for every individual in the society to keep fit and stay healthy. This fact has made many people, especially the elites in the society to turn away from living a complete sedentary life by engaging themselves in exercise. This paper, however, reviewed the importance of exercise to the Lives of individuals in the society, how to prescribe exercise and what factors should be considered in the process of exercise prescription. The paper concluded that exercise could be likening to medicine, very advantageous when used as prescribed by experts, and could be extremely dangerous when abused or misused.

Introduction

The need to keep fit cannot be overemphasized; its value goes beyond ability to cope with the daily demand of life. Of recent, there is general awareness in respect of the role of exercise in prevention of various deadly diseases [Musa, 1997; Odulaye, 1998; Alawale and Amusat, 2001; Oyelese and Moredayo, 2001 and Okuneye 2001; 2002].

Many elites today are turning from living a complete sedentary life by engaging themselves in exercise sometimes as a pleasure and healthful experience. They believe in regular exercise for physical fitness and well being. Some do it to look slim and trim, while others exercise to decrease the risk of heart disease.

The latest terminology is 'Aerobics' a more appealing magical word coined by Dr. Kenneth Cooper of Aerobic centre at Dallas, US [Odulaye, 1998]. Man as a matter of fact likes something new, appealing, fresh and arresting. Consequently, Dr. Cooper got the Americans Pumping Oxygen into their systems through aerobic exercise. The impression created seemed to be; 'why becoming a doctor's regular client if I can prevent myself from becoming one'. 'Why not sacrifice gallons of sweat via exercise [aerobics] to stay healthy'.

Via engagement in regular exercise, the heart pumps more blood with fewer strokes into the various organs of the body needing it. The lungs process more air and with less effort. The blood supply to the muscles improves and the total, systemic, blood volume increases; oxygen as a matter

of fact has affinity for blood and oxygenated blood however is the real life in man.

Through exercise, the body physical working capacity [PWC] is improved by bringing in oxygen and delivers it to the body tissues and cells where it is combined with foodstuff to produce energy. Oxygen consumption is increased, so also endurance capacity.

Apart from the medical benefits and health maintenances benefits of exercise, Okuneye [2002] identifies its importance to certain group of people. These are the elderly, pregnant women and the disables.

It has been proved that regular exercise enhances muscle function in the elderly ones. And it also help to decrease systolic and diastolic blood pressure as well as resting heart output can be significantly enhanced in older individuals particularly in those with a previously sedentary life.

Okuneye [2002] also asserts that the elderly who exercise regularly maintains normal gait all through life. Gait abnormalities are common component of disability among inactive older individuals and this condition further limit functional morbidity in them. In the same vein, Ajiduah and Okuneye [1991] reported that functional parts of disable body respond equally well to exercise as in able body individuals. This means that regular exercise can result in improved cardiovascular and pulmonary functions of disable just as in the able body individuals.

On the part of the pregnant womert, exercise has been indicated for obstetrics and gynecological condition. Okuneye [2002] suggests that health maintenance programme during pregnancy should include exercise regimen for the purpose of increasing and maintaining muscles strength and flexibility which are required to reduce back pain associated with weight gain and centre of gravity shifts in pregnancy.

Bryant and Peterson [1998] are of the opinion that many women would like to continue strength training during pregnancy, but are hesitant due to the seemingly inconsistent and diverse opinions on the subject. In recent years, however, a growing number of professionals from the medical and exercise science communities have tendered specific advice for pregnant women interested in strength training. Most experts agree that, based upon the limited data available, proper strength training poses little risk to the mother or developing foetus [Biyant and Peterson, 1998]. Infact, it may be very beneficial for a pregnant woman.

Bryant and Peterson [1998] further state that not too long ago, women were instructed to stay in bed for up to two weeks following an uncomplicated delivery. Fortunately, medical professionals now know better; it is now generally accepted that the sooner a woman gets moving, the better off she is. Exercise, particularly strength activities, can help tone the

abdominal region, improve posture and help a woman regain her pre-pregnancy shape.

So far, it has been established that regular exercise greatly improves quality of life in individuals and enhances living a more fulfilling life. However, this same exercise which is of great value could be of grave damage to individuals when engaged in them without prescription. What then is exercise prescription?

Exercise Prescription

From grammatical point of view, the word 'exercise' could be regarded as bodily activity or any regular movement or series of movement taken by individuals for the sake of health or fitness. It could also be seen as activity designed or programme to train and develop the body or specific part of the body.

On the other hand, to prescribe means to *say, write or tell with authority*. Therefore, prescription is the act of prescribing. It is the oral or written order or direction for making up and use of a prescript [i.e. what has been prescribed].

With this concept, one could define exercise prescription as a written or oral order, or direction of properly and scientifically designed bodily activities for the purposes of disease prevention, rehabilitation or other purposes.

Okuneye [2002] is of the opinion that exercise can only become a beneficiary if it is properly and scientifically designed such that a right type with adequate intensity, duration and frequency is chosen for participation. Exercise programme should be planned based on an established goal, that is, whether it is for cardiovascular conditioning, muscular strengthening, body fat or weight reduction or a life time's exercise for multiple positive results. Once there is a clear-cut goal, exercise can then be prescribed following the specific needs of individuals.

Citing Clifford, Tan and Gorsuch [1991], Okuneye [2002] emphasizes that prescribing an exercise regimen should be as specific as prescribing medication. Prescription of exercise should be well graded such that the intensity and duration of exercise are calculated. This is important because exercising at random has some demerits; the intensity may be insufficient or the duration inappropriate while excessive exercise can lead to exhaustion, muscle soreness, muscle tear and joint damage [Nwankwo, 1997, and Okuneye, 2002].

Who should prescribe Exercise?

Like medical prescription, exercise prescription should be handled by medical professionals. According to Awopetu [2000], there are two major types of exercise programmes;

- I. The unsupervised exercise programme; and
- II. The supervised exercise programme

Unsupervised exercise programme is the type that is not supervised by experts in the field of exercise physiology. This category of exercise does not spare the participants in electronic media exercise programmes dubbed keep fit programmes.

Supervised exercise programmes are those under strict professional supervision. The supervised exercise programme is directly under the supervision of the exercise director and for the physician. Qualified professionals must always be in attendance in all supervised programmes; this is for achievement of set goal and for safety purposes.

Awopetu [2000] identifies the professionals that are essential in exercise prescription. They include:

- I. The physician
- II. The programme director
- III. The exercise leader; and
- IV. The exercise technician

The physician is a knowledgeable and skillful person in area of sports medicine. He is expected to take part in the screening before exercise testing. Screening involves preliminary medical evaluation, heart rate, blood pressure and electrocardiogram [ECG] testing. The physician should give necessary assistance and direction for graded exercise test administration, direction and assistance during emergency situations; and in interpretation of observations and results of exercise testing.

The programme director is responsible for providing leadership and direction to 'the exercise programme'. The director prescribes appropriate exercise for the participants on individuals' basis, supervises the programme to ensure its safety and effectiveness. He must be a professional in the field of exercise science, preferably a higher degree in exercise physiology, physical education and/or medicine. Awopetu [2000] recommends that the programme director, in addition to his academic qualification should have at least one year experience in the running of an exercise programme from a similar organization.

The exercise leader who is a professional in physical education, physical education, exercise physiology or physiotherapy, handles the execution of prescribed exercise under the guidelines established with physicians and

programme director. And also assist both the physician and programme director in assessing participants' response to exercise.

The exercise technicians should be a professional in physical education, nursing, physical therapy, occupational therapy, laboratory technology or medical technology. The technician is responsible for preparation of the graded exercise station for test administration, screening of participants, computation and analysis of data obtained during graded exercise and implementation of emergency procedure.

In a nutshell, for effectiveness, exercise should be handled by team of personnel.

Prescribing Exercise

Awopetu [2000] opined that for exercise to be meaningful, its prescription must include the intensity, the duration, the frequency and the types of exercise.

Intensity:

In a supervised exercise programme, the prescribed Intensity must be guided by the functional capacity of individuals and the maximal heart rate. While Maximal Heart Rate [HR_{max}], is the highest rate at which one can exercise safely [Jensen & Fisher, 1979; Getchell, Pippin & Vames, 1987 and Odulaye, 1998], the latter refers to the maximal oxidative capacity [maximal oxygen consumption; VO₂max] during an all-out test of cardiorescular fitness. According to Jensen and Fisher [1979], several studies have correlated the energy required to walk at various speed and grades on treadmills with oxygen cost or *MET level*. The relationships are helpful in evaluating work capacity of individuals.

A MET is an expression of energy cost, it is the way in which metabolic rate [VO₂] can be expressed. One MET unit is equivalent to VO₂ at rest and has a nominal value of 3.5ml O₂/[kg- mini. Any steady state activity may be described as an equivalent number of METs by kilogrammes of body weight. Three METs would equal three times the resting cost or 10.5ml/kg/min.

There are several ways to predict the cost of various activities. Though charts have been developed to predict the energy cost of recreational activities [Jensen & Fisher, 1979 and Odulaye, 1998], equations have been developed as well and for more accurate prediction of energy cost. An example of the equations is:

$$VO_2 \text{ [ml/kg-mini]} = \text{speed [m/min]} \times 0.1 \text{ ml O}_2/\text{kg-min per m/min} + 1 \text{ MET [3.5 ml/kg-mini]}.$$

For instance to compute the value for VO₂ and MET corresponding to a horizontal walking speed of 80m/min. [4.8km/hi is:

$$VO_2 = 80 \text{ m/min} \times 0.1 \text{ ml/kg-mm per mlmin} + 3.5 \text{ ml/kg - min}$$

$$\begin{aligned} &= 11.5 \text{ ml/kg-min} \\ \text{METS} &= 11.5 \text{ ml/kg-min} \div 3.5 \text{ ml/kg-min} = 3.3. \end{aligned}$$

However, the functional relationship between %VO₂max [i.e. METS] and Heart Rate [HR] provides the basis for regulating and monitoring sub-maximum exercise [Odulaye, 1998]. This can be done using the following:

1. Training MET intensity [TMET] and
2. Training Heart Rate [TRH]

Odulaye [1998] citing Pollock [1979] asserts that when Heart Rate response is normal, 80% and 85% of maximum heart rate [MHR] occurs at 70% of maximum MET capacity [MMET]. Therefore for practical purposes, training values are approximated by fixed percentage of 75% MMET and 80% MHR. Based on the results of the graded exercise test, the calculation of lower and upper ranges for TMET [70% and 80% MMET] and THR [75% and 85% MHR] is recommend [Odulaye, 1998].

For example a young man with an average resting heart rate [BHR] of 68 achieves an MHR of 144 at an MMET of 9.0. The ranges for TMET and THR would be calculated as follows:

$$\begin{aligned} \text{TMET} &= 9 \times 0.70 = 6.3 \text{ METS [lower limit]} \\ &9 \times 0.80 = 7.2 \text{ METS [upper limit]} \\ \text{THR} &= 144 \times 0.75 = 108/\text{mm [Lower limit]} \\ &144 \times 0.85 = 122/\text{mm [upper limit]} \end{aligned}$$

This method is described to provide a satisfactory range of TMET and THR which may be used to guide clients in exercise programme at initial stage. While Awopetu [2000] suggests prescription of 80% of functional capacity for healthy conditioned young athletes, Okuneye [2002] is of the opinion that the target heart rate during pregnancy period should be set around 25% lower than for the general population. Prescription for the unhealthy ones varies from diseases to disease and from person to person.

Duration

This also varies based on individuals and goal[s] of design. Odulaye [1998] suggests 30 to 44 minutes of exercise at training intensity to be optimum and Awopetu [2000] opined that patients on rehabilitative programmes could exercise between 5-10 minutes. And normal participants on conditioning programmes have an exercise programme between 20-30 minutes in the first week. Progressive changes of duration are also recommended as soon as the functional capacity improves.

Frequency

For consistent results exercise training should be conducted up to three or four times per week. This is necessary to ensure effectiveness in the achievement and maintenance of considerable level of physical fitness.

Types of Exercise

This falls under three broad categories [Awopetu, 2000];

- a) Cardio respiratory endurance activities, which include walking, jogging, running, cycling, swimming, dancing and varieties of games. It should be noted here that competitive games are not recommended for sedentary and high-risk individuals.
- b) Flexibility and Relaxation Activities. These activities are effective during warm-up and cool-down periods. The objective, however, is to increase the range of movement and relieve tension.
- c) Muscular strength endurance activities: they are exercises performed with high tension, low repetition of either a dynamic or static in nature.

The essence of exercise training is to achieve cardiovascular, muscular and metabolic adaptation to an increased aerobic work stimulus [Odulaye, 1998]. Therefore, exercise programmes should emphasize aerobic activities involving large muscles mass.

Conclusion

To conclude, however, it will be appropriate to briefly highlight some basic factors that need consideration before engaging patients or clients [as the case may be] in exercise programmes. There is need to consider the individual body habitus, family medical history, overall life style and interest in prescribes or exercise. This can be achieved through baseline medical and physical assessment. Individual's risk must be thoroughly assessed particularly among those with family history.

Of course, there are times when exercise could be bad idea. Nelson [2002] mentioned some condition when exercise is to be avoided. These include unstable angina, poorly controlled diabetes or uncontrolled blood pressure, a recent major surgery and other serious health crisis. In such cases, one has to wait until the doctor satisfies him okay. Once the condition is stable, one can start to exercise, but at easy and doable level.

On the side of pregnant women, Bryant and Peterson [1998] state some conditions in which exercise should not be engaged in. These are:

- i. Contraindications for exercises during pregnancy
- ii. Absolute contraindications
- iii. Heart disease
- iv. Premature labour

- v. Incompetent cervix
- vi. History of three or more spontaneous abortions or miscarriages
- vii. High blood pressure
- viii. Anemia and blood disorder
- ix. Thyroid disease
- x. Diabetes irregular heart rhythms
- xi. Excessive obesity
- xii. Extreme underweight
- xiii. History of precipitous labour
- xiv. History of intrauterine growth retardation
- xv. History of bleeding during present pregnancy; and
- xvi. Extremely sedentary life style.

Exercise is like medicine, it is advantageous when used as prescribed but could be extremely dangerous when abused or misused.

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