IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 9, Issue 5 Ser. II. (Sep. - Oct .2019), PP 16-22
www.iosrjournals.org

Strategies for Effective Training of Physics Students As Perceived By Labour Employers

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***Abstract**: The purpose of this study was to determine strategies to be applied ineffective training of physics students as perceived by labour employers. The questionnaire as the major instrument used in data collection. Five research questionnaires were analyzed using the frequency table and mean of the score with a total population of 300 registered business organizations. From the analysis of data collected, the following findings, among others, were made: Physics instructors/lecturers should apply different strategies especially the use of modern ideas, in training of effective physics graduates. Skills that relate to physics jobs should be taught to physics students. The physics curriculum should be based on the requirement of jobs for which the physics graduates are prepared for. Based on the findings, the following recommendations, among others, were made: Strategies such as lab work, visits to industries, problem-solving methods, and those strategies that relate to student competency should be applied in training physics graduates. Skills such as the use of practical and science equipment for creativity should also be taught to physics students. Employers of labour should also be involved in the training of physics graduates.*

***Keywords:** physics students; effective training; strategies; labour employers.*

Date of Submission: 29-08-2019 Date of Acceptance: 14-09-2019

I. Introduction

According to American Heritage Dictionary of the English Language (2016), it defined physics as the science of matter and energy and of interactions between the two, grouped in traditional fields such as acoustics, optics, mechanics, thermodynamics, and electromagnetism, as well as modern extensions, including nuclear and atomic physics, cryogenics, solid-state physics, particle physics, and plasma physics.

American Physical Society (APS 2017), explained that in order to bring the physics discipline forward into the 21st century, physics graduates must shape their skills for careers in industrial and entrepreneurial settings, while faculty members must confront the attitude that careers in the private sector and entrepreneurial settings are somehow inferior to their academic counterparts. Fortunately, there are many things that you as a graduate can do to broaden your career focus. Before you anticipate entering the job market, you can (and should) spend time planning career and self-assessment. There are several good tools available often through a university's career resources centre which will help physics students gain insights into which career paths that might be a good match for them as a person, rather than just a collection of skills. These instruments can provide a basis of suggestions that you can consider (apart from "academic physicist").

Physics literacy is widely considered as indispensable in modern developed and highly technological countries (deBoer 2011). Supporting students in developing physics literacy is supposed to satisfy society's need for open- minded well- educated citizens and the labour market's need for skilled workers in science and science- related fields (Roberts 2007).

The present economic crisis is a global issue. Advance countries have been trying hard to find solutions to this global crisis that has hinder human endeavours. But no encouraging solutions have been found. The Nigerian National Policy on Education (2013) set four major general objectives, which all levels of education in the country (from primary to the tertiary institution) are intended to pursue. These are;

i. The inculcation of the right type of value and attitude for the survival of our Society
ii. The inculcation of national consciousness and national unity
iii. Training of the mind in the understating of the world around.
iv. The acquisition of appropriate skills, abilities and competencies, both mental and physical, as equipment for the individual to live in and contribute to the development of his country.

In spite of these laudable objectives, the graduates of Nigerian educational system seem to lack the spirit of national consciousness, unity, skills, abilities and competencies needed by the nation and so are unable to perform effectively to the welfare of the country and the society at large. It is also acknowledged that the acquisition of requisite skills and attitude is a means of heightening the productive power of the nation. Students in our secondary/high schools and higher institutions of learning have been receiving skills and knowledge without the development of desirable values and attitudes. As such, the educational system of Africa seems to have failed to meet the strategies for effective preparation of students of which the teaching of physics in African schools is not left out.

Umezulike and Ndinechi (2008) lamented that poor performance and ability of physics students to apply modern technological ideas and equipment could be attributed to poor use of effective teaching strategies. Effective teaching strategies, according to Emeniru (1989), are broad patterns of thinking or actions, steps, or methods which a teacher follows to help his students reach the goals set for the course. In another development, Jeyaprekash (2005) is of the opinion that teaching of physics should not only develop the intellectual skills of the students but also provides opportunities for students to work individually, in pairs, small and large groups, for self and national development since the emphasis is gradually changing from acquiring education for public employment to education for self-reliance.

II. Instructional Strategies

Okwuanaso and Nwazor (2000), hold the view that a strategy is art or way of planning operations, especially of troops, so as to fight successfully and win. It entails skills in hand; it is a tactic for achieving an objective. It consists of various parts, methods, designs and techniques all of which join together to help achieve the goals. Umezulike and Ndinechi (2008) suggested that Computer Assisted Instruction (CAI), inquiry, demonstration, role play, team teaching, assignment/workbook, field-trips, group work and programmed instruction are effective teaching strategies. Okwuanaso and Nwazor (2000) maintained that there are two types of instructional strategies.

1. The traditional and
2. Modern instructional strategies

According to them, traditional strategies of instruction are such teacher-based approaches to the teaching-learning situations where the teacher dominates the students through his expertise in the subject he is teaching which is not very much acceptable in the preparation of physics students for the job. Another traditional strategy of instruction is the lecture method where the teacher does all the talking as an expert who knows much of the topic he is teaching. Textbook method is yet a traditional method where several authors use syllabuses of schools and write on those books to become texts for class use. In some cases, the questioning method is also regarded as a traditional strategy, when it is used by the teacher to dodge his weakness or unpreparedness. It is the method rather than the names that determine whether a strategy is traditional or modern.

On the other hand, the modern strategies are said to be more acceptable in educating, especially the physics students for job. This is because according to Okwunaso and Nwozor (2000), the modern strategies have three components viz, doing, viewing and abstracting. With the modern strategies of instruction, each student is exposed to direct purposeful experience, continued experiences, dramatic experience and participation. These modern instructional strategies include: discussion group, use of film strips, practical, sliders, field trips, project method, debase and tape recording, among others.

III. The Physics Curriculum

Eyiuche (1982) noted that there are various jobs, which a worker is expected to perform in a work place, and there are target levels of efficiency, which these jobs are to be performed before they can be judges to have been performed well. It is in the pursuit of these objectives that Nigeria Federal Ministry of Education changes from the 0ld 6;5:2:3 system of education to the new 6:3:3:4 system introduced in 1981 and the intending 9:3:4 system of education. This agrees with the views of Obiekwe (2017) that the deficiencies noticed in the 6:5:2:3 system of education will be wiped off in the new 6:3:3:4 system of education is one of the areas that have been given a prominent place. This stems from the fact that physics helps to diversify the curriculum and then create opportunities for the harnessing of different talents inherent in various individuals. Oyedeyi (1987) confirmed this when he expressed the view that physics subjects help to produce a person who is occupationally competent in today's society through mastery of basic abilities, skills and technical information according to the standard of the job or occupation. In order to achieve this, the physics curriculum should be implemented where the physics subjects/topics are arranged according to occupations and the need for world of work. This will enable the students to major in specific physics occupations at graduation.

In South African contexts, Department of Basic Education's Guidelines for Inclusive Teaching and Learning (2010), states that National Curriculum Statement Grades R-12 aims to produce learners that are able to identify and solve problems and make decisions using critical and creative thinking, translate vocational skills into nation-building function and work effectively as individuals and with others as members of a team (South Africa. Info 2019). Further education and training (FET) have also been the responsibility of the Department of

Higher Education and Training since 2009, which covers training provided from Grades 10 to 12, including career-oriented education and training offered in technical colleges, community colleges and private colleges (Moloi et al 2014).

A Task Team on Undergraduate Curriculum Structure has been commissioned by the CHE to investigate undergraduate curriculum reform in South Africa for a flexible curriculum structure. The task team identified three major problems with existing curricula proffered in higher education institutions. The first of these is the major structural problem of the discontinuity between secondary and higher education in South Africa. The second major structural problem is that, as recent in-depth curriculum analysis has increased, many curricula contain key transitions for which many students are differentially prepared. These transitions can be between knowledge domains and various forms of intellectual demand. The third major structural problem is the need to enhance undergraduate curricula to meet contemporary local and global conditions (CHE 2013).

Strategies For Training of Physics Students

According to Orhan (2009), changes taking place in industries, firms and organizations are such that many traditional skills and jobs are becoming obsolete and, in their place, new jobs and new skills are being created. Ohakwe (2001) agrees with Orami (1981) on the issue of obsolete materials/equipment which had led to the rejection of some physics graduates in the labour market because they could not cope with the new changes/challenges in modern physics business and industrial duties.

Okwunanaso and Nwazor (2000) suggested individualized instruction where students receive counselling, practical, tutorials services and other personalized help from a member of the school staff, demonstration of audio-visual lessons, or other class activities which expose students to a common stimulus. They further suggested filed trips as a teaching strategy in which student and their teacher travel to production firms and industrials for a useful, practical and visible illustration of ideas taught in the classroom. Field trips as an instructional strategy give room for the acquisition of first-hand information and provide ample opportunities for the development of interest in the job. Bolarinwa (2005), suggested that adequate funding, provision of enough modern teaching material/equipment, modern workshops and laboratories are effective strategies for the preparation of physics graduates.

SKILLS NEEDED BY LABOUR EMPLOYERS

The Oxford Advanced Learners Dictionary of Current English (2016) defines skills as the ability to do something expertly well. It is an application of knowledge to the performance of an action. In order to bring about versatility in organization, the physics graduate in organization must possess designed skilled in order to perform effectively to the satisfaction of his employee. In addition, Orhan (2009) stated that many lecturers often are afraid to gain new skills, as they do not want to show themselves incompetent. Considering the understanding, abilities and views of lecturers about active techniques of learning methods would play a significant part in trying to improve the quality of teaching in physics. Since Lecturers always have to use active learning techniques in the curricula to ensure their teaching quality.

American Physical Society (APS 2017), added that another good way of learning more about careers outside of academia is by setting up a meeting with people in businesses or organizations of interest so you can learn more about the opportunities they give and the skills they require. If the interaction goes well, your contact with the sector could become a precious part of your professional network. Establishing these types of gatherings while you are still studying will imply you have a contact that can be helpful later when you become more focused on joining the job market.

ROLE OF LABOUR MARKET IN TRAINING PHYSICS STUDENTS FOR JOBS

The labour employers can improve the effectiveness and skills of the physics students through the provision of some of these means: provision of equipment for workshop and laboratories, adequate funding, scholarship, provision for industrial training, and others. Oladipo (2000), advocated that government alone cannot provide all these services and called on philanthropic individuals, organizations and religious bodies to assist the government in provision these services by giving out loans, bursary, donations, provision of scholarship as well as allowing schools free excursion (field trips) in their various organizations.

STATEMENT OF THE PROBLEM

Nowadays, the high rate of labour turnover of industrial workers like a researcher, computer graphic designer and inventor in the public and private business organizations suggests that most employers of labour are not satisfied with the output of contributions in their field of studies including physics graduates. Many effective teaching strategies have been suggested by many authors and writers for teaching physics in school but successful use of these strategies becomes impossible.

The causes could be attributed to individual students, governments, education authorities, physics instructors or all of the above.

The problem of the study is to determine the strategies that could be employed in the training of the physics students to make them both relevant and effective in their employment posts after school. In other words, the concern of this study includes finding answers to such questions as what specific skills are demanded of physics graduates by employers of labour? And how best can such skills be imparted to physics students during the course of their studies?

PURPOSE OF THE STUDY

The purpose of this study is to investigate and find out the strategies to be applied in effective training of physics education graduates for jobs as perceived by employers of labour in various companies. In specific terms, the study is aimed at:

1. Finding out the strategies physics educators or instructors could utilize in the training of physics students for desired jobs.
2. Examining how useful the skills taught to the physics students are in their places of work.
3. Finding out whether the curriculum of physics is based on requirements of the job for which the graduates are trained.
4. Finding out the extent the labour employers should be involved in the training of physics students.
5. Examining the roles of instructors/lecturers in impacting physics ethics in the students in order to expose them to practical hand-on experience in physics based-firms.

RESEARCH QUESTIONS

The following research question guided this study:

1. What strategies should be physics educators apply ineffective training of students for jobs?
2. What type of skills should be taught to physics students in order to prepare them for jobs?
3. To what extent should physics curriculum be based on the requirement of jobs for which the physics graduates are prepared?
4. To what extent should the employers of labour be involved in the training of physics students for the job market?
5. To what extent should the physics students be exposed to practical experience to prepare them for the labour market?

RESEARCH METHODOLOGY

The study surveyed and was carried out among three hundred (300) registered business organizations in Abuja, Nigeria and Pietermaritzburg, South Africa. Sampling one hundred and fifty (150) registered business organisations in each country. The data collection tool was a structured questionnaire created by the researchers. Data collected through the questionnaire were analyzed using the frequency tables and mean of scores of Likert five (5)-points, disagree 2 points and strongly disagree 1 point. Mean scores of 3.5 and above were accepted, those that ranged from 2.5 – 3.49 were neutral, while those ranging from 0.5 – 2.49 did not qualify to be accepted

IV. Result of the Study

The data are presented in five (5) tables and analysed in accordance with the forty-eight (48) research questions.

TABLE 1; RESPONDENTS' RATINGS ON THE STRATEGIES PHYSICS EDUCATORS SHOULD APPLY IN EFFECTIVE TRAINING OF PHYSICS STUDENTS FOR DESIRED JOBS.

s/n	Items	Fx	$\overline{X}$	Decisions
1.	Use of lecture method	1198	3.99	Accept
2.	Field trips method	1202	4.01	Accept
3.	Use of project method	1298	4.33	Accept
4.	Use of problem method	1268	4.23	Accept
5.	Use of strips and slides	1004	3.35	Neutral`
6.	Use of role-playing method	1008	3.36	Neutral
7.	Use of exploratory experience	1206	4.02	Accept
8.	Strategies that relates to occupational information	1157	3.86	Accept
9.	Strategies that encourage student's competency	1229	4.10	Accept
10.	Use of Practical and lab work	1240	4.13	Accept

Table 1 above shows that responses of the respondents in connection with the strategies to be applied by the physics educators in the effective preparation of their students for jobs.

Out of the ten (10) strategies on the questionnaire, eight (8) of the items fell within the acceptable region while to two (2) of the items- use of strips and slides, and us of role-playing method showed neutrality. Some of the strategies that top the mean column are: use of project method with a mean of 4.33, use of problem solving 4.23, use of practical and lab work 4.13, strategies that encourage student's competency 4.10, used of exploratory experiences 4.02 and field trips method 4.01. From the analysis, the training of physics graduates involves a good number of strategies that would enable them to excel in their field of study

TABLE 2: RESPONDENTS' RATINGS ON THE SKILLS THAT CAN BE APPLIED IN THE TRAINING OF PHYSICS GRADUATES.

s/n	Items	Fx	$\bar{X}$	Decisions
11.	Ability to identify, solve problems and make decisions using critical and creative thinking	1366	4.55	Accept
12.	Ability to communicate effectively using computer, visual, symbolic and/or language skills in various modes	1346	4.49	Accept
13.	Ability to translate vocational skills into nation building function	1346	4.49	Accept
14.	Ability to work under pressure	1164	3.88	Accept
15.	Ability to collect, analyse, organise and critically evaluate information	1404	4.68	Accept
16	Ability to organise/manage oneself and respond effectively to employers demands	1263	4.21	Accept
17	Ability to demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation	1212	4.04	Accept
18	Ability to work effectively as individuals and with others as members of a team	1332	4.44	Accept
19	Sense of judgement and initiative	1269	4.23	Accept
20	Ability to communicate and write properly in English/accepted language	1324	4.41	Accept
21	Ability to use science and technology effectively and critically showing responsibility towards the environment and the needs of others	1347	4.49	Accept

The data in table 2 above shows the responses of respondents, eleven (11) items were rated high as they all fell within the acceptable mean range of 3.50-5.00.

All the items that topmost in the mean are: ability to collect, analyse, organise and critically evaluate information with a mean of 4.68, ability to communicate effectively using computer, visual, symbolic and/or language skills in various modes and ability to translate vocational skills into nation-building function had a mean score of 4.49 respectively.

Ability to identify, solve problems and make decisions using critical and creative thinking had a mean score of 4.55. So far other items in 14, 16, 17, 18, 19, 20, and 21 had a mean score of 3.88, 4.21, 4.04, 4.44, 4.23, 4.41 and 4.49.

TABLE 3: RESPONDENTS' RATINGS ON THE EXTENT TO WHICH PHYSICS CURRICULUM SHOULD BE BASED IN THE TRAINING OF PHYSICS GRADUATES.

s/n	Items	Fx	$\bar{X}$	Decisions
22	Physics curriculum should contain pre-vocational subjects	1235	4.12	Accept
23	Physics curriculum should provide opportunities for harnessing of different talents inherent in individuals.	1246	4.15	Accept
24	Physics curriculum should be based on modern information technology	1245	4.15	Accept
25	Physics curriculum should be work oriented and contains nation-building ideas	1242	4.14	Accept
26	Physics curriculum should be based on education for self reliance	1305	4.35	Accept
27	Physics curriculum should be based on the requirement of jobs.	1314	4.38	Accept
28	Physics curriculum should help students acquire skills and technical information about jobs.	1365	4.55	Accept
29	Physics curriculum should provide exploratory experience	1245	4.15	Accept
30	Physics curriculum should expose students to today's challenges in the world of work.	1314	4.38	Accept

Table 3 shows the responses of the sampled labour employers on the extent to which physics curriculum should be based for training of physics graduates. All the nine (9) items used in testing this research question fell within the accepted mean score of 3.50 – 5.00.

The respondents accepted that the physics curriculum should provide for the acquisition of requisite skills and that technical information for students should be based on education for self reliance, self improvement and should be work oriented. They also accepted that the curriculum should contain pre-vocational subjects, be based on modern information technology, expose students to today's challenges in the world of work and provide for occupational competence and nation-building ideas for the physics graduates.

TABLE 4: RESPONDENTS' RESPONSES ON THE EXTENT THE EMPLOYERS OF LABOUR SHOULD BE INVOLVED IN TRAINING OF PHYSICS GRADUATES.

s/n	Items	Fx	$\bar{X}$	Decisions
31.	Encouragement of in-service training	1280	4.27	Accept
32.	Encouragement of professional growth through conference, workshop and seminar	1299	4.33	Accept
33.	Provision of on-the-job training	1332	4.44	Accept
34.	Providing fund for purchase of educational materials	1270	4.23	Accept
35.	Giving scholarship/bursary to students of Physics	1335	4.45	Accept
36,	Provision of office machines, software and equipment	1305	4.35	Accept
37.	Providing well equipped laboratories	1275	4.25	Accept
38.	Taking care of staff welfare and development of standard	1245	4.15	Accept
39.	Providing and accepting students for industrial training	1200	4.00	Accept
40.	Allowing study level for workers	1230	4.10	Accept

This table shows some of the area which employers of labour should be involved in the effective training of physics graduates for jobs. Ten (10) items were used to test this research question. All the ten (10) items fell within the acceptable mean range of 3.50 – 5.00.

The respondents agreed that employers of labour should encourage in-service training, professional growth through conference, workshop and seminars, provision of on-the-job training, scholarship/bursary award, provision of office machines, software and equipment, well-equipped laboratories and accepting students for industrial training.

TABLE 5: RESPONDENT'S RATING ON THE EXTENT PHYSICS STUDENTS SHOULD BE EXPOSED TO PRACTICAL WORK EXPERIENCE.

s/n	Items	Fx	$\bar{X}$	Decisions
41.	Through industrial work experience/training	1353	4.51	Accept
42.	Involvement in vocational choice programme	1287	4.29	Accept
43.	Proper supervision at school	1332	4.44	Accept
44.	Providing students with practical learning experiences	1350	4.50	Accept
45.	Relate students experience to the world of work	1206	4.02	Accept
46.	Creation of conducive environment for practice	1293	4.31	Accept
47.	Motivation of students to acquire life long skills	1314	4.38	Accept
48.	Inclusion of professional ethics in the curriculum	1191	3.97	Accept

The data in table 5 above indicate that all the eight (8) items used in testing this research fell within the acceptable mean score of 3.50-5.00. out of the item used in testing this research question provision of industrial work experience/training has a mean score of 4.51, providing students with practical learning experiences 4.50, motivation of students to acquire life-long skills 4.38, proper supervision 4.44, creation of conducive environment for practice 4.31, involvement of students in vocational choice programme 4.29 and inclusion of professional ethics in the above strategies are also adopted, the physics graduates will adapt to the world of work.

V. Summary of Findings

Form the analysis of the result, it has been found out that in order to effectively train physics graduates for jobs, the physics educators should apply strategies like use of practical/lab work, use of problem-solving, and questioning skills or strategies in the teaching processes.

It was also discovered that in order to prepare physics graduates effectively for jobs, the curriculum should contain skills and technical information about jobs. The curriculum should be based on self-reliance, self-improvement and ought to be work-oriented. The employers of labour i.e. the government, private, profit and non-profit organizations should be involved in effective training of physics graduates for jobs by giving scholarships to physics students, equipping physics laboratories and providing practical materials for physics students. Finally, physics students should be involved in the vocational choice programme, industrial training and practical learning experiences.

VI. Conclusion

It was found out that if different strategies especially the modern ones, were applied in training of physics graduates, they would perform very effectively in their places of work. Different types of skills, especially those that relate to their jobs, should be taught to physics students in their preparation for jobs. Physics curriculum should contain technical and vocational information about jobs and it should be work-oriented and be based on physics for self-reliance and provide for occupational competencies for graduates.

Labour employers, in their bid to get involved in effective training of physics graduates for jobs should provide avenues for students' industrial work experience scheme (SIWES), in-service training, on the job training and provide opportunities for attending conferences, workshops and seminars. They should also award scholarships to physics students, provide physics materials and equipment and equip physics laboratories.

Finally, physics graduates should be involved in the vocational choice programme, go for industrial training, and be provided with practical learning experiences.

VII. RECOMMENDATIONS

Based on the findings, the following recommendations were made:

1. Modern strategies should be employed by physics educators in training physics graduates.
2. Useful skills that are related to the jobs the physics graduates will perform in their work places should be taught to the students.
3. Employment of qualified personnel in teaching physics courses so as educate the physics graduates.
4. Provision of well-equipped laboratories for practical learning purposes. Facilities and funds should also be made available to Universities for meaningful training of physics graduates.
5. Physics gradates should be encouraged to go on study leave, on the job training and in-service training
6. Proper supervision of physics students at school and especially during practical sessions

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Chikwelu E. E.. " Strategies for Effective Training of Physics Students As Perceived By Labour Employers" . IOSR Journal of Research & Method in Education (IOSR-JRME) , vol. 9, no. 5, 2019, pp. 16-22.