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# Professional development of mathematics educators for open and distance learning through effective collaboration

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**Open and Distance Education has become a viable alternative to Conventional Education in Nigeria. More so, Open and Distance Learning (ODL) Institutions depend on collaboration with conventional Institutions in order to thrive and succeed. Therefore, Mathematics Educators need better tools to address the challenges of education. This paper unmask the extent to which collaboration between ODL and conventional Institutions contribute to effective teaching and meaningful learning in Nigeria. Data were collected from the academic staff of National Open University of Nigeria (NOUN) using structured questionnaire. Mean, standard deviation and chi square were used for data analysis. The findings revealed that ODL can bring sustainable development when well supported with effective collaboration between ODL and Conventional Institutions. This can be strengthened and sustained through professional development of Mathematics Educators. This professional development should include training for effective teaching and meaningful learning, the use of modern technologies and development of course materials.**

**Key words:** Opening and distance Learning, professional development, mathematics educators, conventional, collaboration.

## INTRODUCTION

Today's workforce requires abilities of critical thinking, problem solving, and be also ICT compliant. Thus, institutions are faced with ever-increasing demands in their attempts to ensure that learners are equipped to enter the workforce and navigate a complex world. For an individual to possess higher order skills and critical thinking, he/she should have a good knowledge of Mathematics, since Mathematics, Science and Technology move hand in hand. As Baiyelo (2007) observed that Mathematics is widely regarded as the language of science and technology and Abiodun (1997) stated that, while science is the bedrock that provides the springboard for the growth of technology, Mathematics is the gate and key to the sciences. Ukeje (1997) further revealed that Mathematics has contributed enormously to the modern culture of Science and Technology. Hence, without mathematics there is no

science, without science there is no modern technology and without modern technology, there is no modern society.

Furthermore, other researchers supported that Mathematics is considered as the bedrock of all scientific and technological breakthrough and advancement of all activities of human developments as well as the only language and cultural common to all studies (Harbor-Peter, 2000; Uzo, 2002). Mathematics is an expanding and evolving body of knowledge as well as a way of perceiving, formulating and solving problems in many disciplines. The subject is a constant interplay between the walls of thought and applications. Therefore, there is need for professional development of Mathematics Educators for effective teaching and meaningful learning in both Open and Distance Learning (ODL), and conventional institutions, especially at higher level of education.

Higher Education is considered as the pinnacle of the educational pyramid (Odili, 2011), as education in itself is the most important instrument of change in any society (FME, 2004) and any fundamental change in the intellectual and social outlook of any society has to be preceded by an educational revolution in Nigeria came in form of open and Distance education. Thus, ODL has been integrated and recognized as a viable alternative to the conventional (face-to-face) system of tertiary education.

According to UNESCO (2002), Open and Distance Learning (ODL) represents approaches that focus on opening access to Educational and training provision, freeing learners from the constraints of time and place, and offering flexible learning opportunities to individuals and group of learners. Peratton and Hulsman (2003) and Creed (2001) defined Distance Learning as an educational process in which a significance proportion of the teaching is conducted by someone far removed in space and/or time from the learner. Open learning in turn, is an organized educational activity, based on the use of teaching materials, in which the constraints on study are minimized in terms of access, entry or time and space, method of study, or any contribution of these. Hence, the concept of Open and Distance Learning (ODL) suggest an educational approach designed to reach learners in their homes, offices, shops, amongst others, providing the learning resources for them to quality without attending formal classes in person, or create opportunities for lifelong learning, no matter where or when they want to study (Ojo et al., 2006).

The National Policy on Education (FME, 2004) recognized the place of ODL in achieving lifelong education. Some institutions are uni-mode while others are dual mode Institutions. The uni-mode institutions are delivered either through the conventional methods or distance learning methods of instructions. The dual mode institutions combine conventional and distance learning methods of instructions.

ODL system of Education is seen as a Panacea to the problem of socially induced constraints on the acquisition of education that may lead to the ability to attend higher institutions of learning, acquire certificate, and become a qualified skilled worker by being able to study for the course of study chosen by individual. Thus, Nations of the world, in recognition of this, sought to provide quality education for majority of their citizens in an equitable and accessible manner. This is contingent on the realization of the leaders that a nexus exist between education and nation development processes (Jegede, 2000). This reality has led many countries, developed and developing alike, to make huge investments in the education of their people. This effort is gearing towards fulfilling the nations commitment in provide education to all as declared by the World Forum on Education For All (EFA) 2015 goals. FME, (2002) clearly stated the goals as:

*... ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life skills programmes; and improving all aspects of quality of Education, and ensuring excellence for*

*all so that recognized and measurable learning outcomes are achieved especially in literacy, numeracy and essential life skills. By giving this opportunity to maximize the use of high-level academic personnel who would be able to teach larger numbers of students especially after sustainable distance learning materials are developed and distributed.*

Thus, effective adoption of ODL calls for professional development of Mathematics educators who are part of the servicing staff of the Institutions in Nigeria – a professional development that prepares Mathematics Educators to integrate 21<sup>st</sup> century skills in ODL environment for effective and meaningful learning.

In response to the strong social demand for access to tertiary education in Nigeria, the National Open University of Nigeria (NOUN) was established and now has 53 study centres. NOUN is a responsive model for higher education which will hopefully reduce the challenge of gaining access to tertiary education as well as to create a vehicle for delivery of continuing professional development. As a result of shortage of manpower (severe shortage of qualified academic staff, and difficulties of recruiting and retaining academic staff) in Nigeria Universities, the Open Universities of Nigeria has to crave and thrive by depending highly on collaboration with the conventional Institutions for academic staff as instructional and tutorial facilitators (Okonkwo, 2005).

In ODL system of Education, Mathematics lecturers are to conduct regular tutorial meetings and facilitate instructions in Mathematics and Mathematics based courses at a distance and at the various study centres. They are to assist with professional workshop, course development and course designs. Besides, they are responsible for tutor marked assignment, supervision of research projects and thesis as well as assisting on the conduct and marking of examination.

In addition, Knowledge Management Technologists are required to support the electronics and computer mediated learning environment created as a result of the ODL (NOUN, 2004; Okonkwo, 2005). However, Mathematics Educators are faced with the challenges brought about by the emergent globalize system of education in the 21<sup>st</sup> century. In line with this trend of events, UNESCO (2008) observed that one of the solutions to the challenges to educational development is the use of ICT. Mathematics, Science and Technology Educators can make use of benefits of technologies for effective teaching and meaningful learning. This study therefore, looked at professional development of Mathematics Educators in line with identified needs, challenges and benefits in collaboration between ODL and Conventional system of Education. Effective collaboration between Mathematics Educators and ODL Institutions is imperative in meeting the challenges for sustainable development in the system.

## **Objectives**

The objectives of the study include:

- i. To identify the extent to which the collaboration

between ODL and Conventional Institution contributes to best practices in areas of needs in Nigeria's ODL Institutions;

ii. To identify the extent to which the challenges hinder best practices in the collaboration between ODL and Conventional Institutions in Nigeria;

iii. To identify the extent to which result from collaboration between ODL and Conventional Institutions beneficial to Nigerian's ODL Institutions; and

iv. To determine the extent use of technology in ODL Institutions enhance sustainable development in Nigeria system of Education.

### Research Questions

The study answered the following research questions:

i. To what extent does collaboration between ODL and Conventional Institutions contribute to best practices in areas of needs in Nigeria's ODL Institutions?

ii. To what extent do challenges hinder best practices in the collaboration between ODL and Conventional Institutions in Nigeria?

iii. To what extent does result from collaboration between ODL and Conventional Institutions beneficial to Nigeria's ODL Institution?

iv. To what extent does use of technology in ODL Institutions enhance sustainable development in Nigeria system of Education?

### Hypotheses

The following hypotheses were tested:

**H<sub>0</sub> 1:** Collaboration between ODL and Conventional Institutions has no significance contribution to best practices in areas of needs in Nigeria's ODL Institutions.

**H<sub>0</sub> 2:** Collaboration between ODL and Conventional Institutions has no Significance challenges that hinder best practices in Nigeria's ODL Institutions.

**H<sub>0</sub> 3:** Result from collaboration between ODL and Conventional Institutions has no significance benefits to Nigeria's ODL Institutions.

**H<sub>0</sub> 4:** Use of technology in ODL does not enhance sustainable development in Nigeria system of Education.

### Significance of the Study

This study would provide insight on empirical evidence on the collaboration effort of Mathematics Teachers in teaching and learning Mathematics at the ODL Institutions and improve upon. It would help Mathematics teachers to discover the effect of their interest, participation in professional development programme, production and supply of adequate resource materials, their workload and attitudes towards effective teaching and meaningful learning in Mathematics.

The findings of this study would lead to the improvement of the qualities of Mathematics Teachers, as their professional interest would be taken into consideration during their engagement in the service of ODL programme. Above all, the study would add to the pool of knowledge in

the area of effective teaching and meaningful learning in Mathematics as well as a serving as the springboard for further researches in Mathematics education in Nigeria and beyond.

## METHODOLOGY

### Research Design

The study adopted a survey design in order to determine the professional development of Mathematics Educators towards Collaboration between ODL and conventional institutions as it affects areas of needs, challenges, benefits and technology.

### Participants

The population for this study is the staff of the 53 study centres of NOUN in the six Geo-political zones of Nigeria – North-West, North-East, North-Central, South-West, South-East and South-South zone.

Sample drawn from the population consist of academic staff of NOUN, using both male and female academic staff serving in NOUN with minimum qualifications of master Degree in Mathematics and Mathematics related subjects. They have varied teaching experiences in tertiary institutions from 2 years and above. Sixty academic staff (10 from each Geo-political zone) consisting of course coordinators and programme leaders were randomly selected because they are directly involved in the collaborative processes.

### Research Instruments

The data for this study were collected by using structured questionnaire developed by Olaitan and Nwoke (1988) where 5-point Likert scale was adopted in structuring the questionnaire items. Five responses; Strongly Agree (SA); Agree (A); undecided (U); Disagree (D) and strongly Disagree (SD) were obtained and the response were assigned weights of 5, 4, 3, 2 and 1 for favourable statements. The study used 40 questionnaire items and 10 each for the 4 research questions and hypothese.

### Administration of Instruments

The instruments were administered by the researcher and 3 research assistants. Sixty copies questionnaire were administered and were all retrieved.

### Data Analysis

The data were analyzed by computing the mean, variance and standard deviation for each item in answering research questions and chi square ( $X^2$ ) was used in answering the research hypotheses at 5% level significance. To take a decision whether an identified factor is indicated by the

**Table 1.**The Extent to Which the Collaboration between ODL and Conventional Institutions Contributes to Best Practices in Areas of Needs in Nigeria

S/N	ITEM	5	4	3	2	1	X	V	SD	Decision
1.	Provision of skilled manpower for item writing tailored to enrich question bank	17	35	7	0	1	4.12	0.54	0.73	Accept
2.	Provision of right personnel for conduct of examination	9	34	11	6	0	3.77	0.66	0.81	Accept
3.	Subject specialists for marking candidates' examination answer scripts	19	32	5	4	0	4.99	0.67	0.82	Accept
4.	Proper orientation of personnel's involved in examination related activities	15	26	7	8	4	3.67	1.39	1.18	Accept
5.	Skilled manpower for tutorial and academic counseling of distance Learners	16	30	3	5	6	3.75	1.32	1.15	Accept
6.	Adequate financial resources to take care of the services provided	16	25	7	8	4	3.68	1.42	1.19	Reject
7.	Skilled manpower for effective supervision of students' projects and practicals	16	25	7	7	5	3.70	0.66	0.81	Accept
8.	Development of enriched course materials by experienced academics in conventional institutions	20	37	2	1	0	4.27	0.58	0.76	Accept
9.	Pooling of expertise leading to course content integrity in line with NUC standard	28	21	6	4	1	4.18	0.78	0.89	Accept
10.	Capacity building for staff of conventional institutions to expertise in various areas of distance learning	16	31	5	5	3	3.87	1.12	1.06	Accept
Total		172	296	60	48	24				

Expected Frequencies: 17.2 29.6 6.0 4.8 2.4  
 $\chi^2$ : Cal (66.16), df = 27, Crit. (40.11)

respondents should be accepted as significance and contribute to best practices in collaborative areas of needs, challenges, benefits of technology, the researcher choose a mean ( X ) score of 3.50 and above while an item that scored less than 3.50 was not accepted. However, the variance ( V ) and standard Deviation ( SD ) were also computed to show how individual scores from the mean scores were dispersed.

## FINDINGS AND DISCUSSION

The results of the findings are presented in tables and the four (4) tables reflected on the 4 research questions and hypotheses. The tables show the mean, variance, standard deviation as well as the observed frequencies ( $f_o$ ) and Expected ( $f_e$ ) in which decision regarding the research questions and hypotheses are presented.

### Research Questions one

From the responses of the respondents in the Table 1, all the 10 items of the questionnaire were accepted to be significant. It is an indication that effective collaboration between ODL and Conventional Institutions lead to best practices in areas of needs in Nigeria's ODL Institutions. The responses to the items also show that qualitative and skilled personnel reveal the importance Mathematics

Educators in these areas of needs for effective professional development.

### Research Question two

Table 2 shows that there are various challenges that hinder best practices in collaboration between ODL and conventional institutions in Nigeria. Except that capacity building of hired personnel for effective ODL Programme is found to be inadequate. These challenges arose as a result of improper implementations of principles guiding the operation of ODL programmes. There should be strict compliance of guiding principles as presented by the National University Commission (NUC) in Nigeria. Proper professional development should be made for Mathematics teachers and other personnel in order to forestall the challenges faced by the ODL Institutions. This can be done through regular training and retaining as well as organizing of workshops, seminars, conference and public enlightenment on issues that relates to ODL system of education. These activities will go a long way in updating the staff knowledge and eliminating the challenges that hinders effective collaboration. The management of ODL Institutions should plan strategies that will change the attitude of professionals and bring about acceptable conditions for collaboration in area of manpower need, such as course materials development, effective teaching and meaningful learning.

**Table 2.** The Extent to Which the Challenges Hinder Best Practices in the Collaboration between ODL and Conventional Institutions in Nigeria

S/N	ITEMS	5	4	3	2	1	X	V	SD	Decision
1.	Provides of facilities by conventional institutions may not be readily available	12	26	5	10	7	3.43	1.68	1.30	Accept
2.	Available facilities may be inadequate in number	24	30	1	3	2	4.18	0.88	0.94	Accept
3.	Available facilities lack ODL needs like ICT support for efficiency of operations	15	26	2	14	3	3.60	1.51	1.21	Accept
4.	Some higher conventional staff may have different orientation and are difficult to manage	20	29	5	6	0	4.05	0.68	0.83	Accept
5.	Remuneration of course writers is not worth the effort due to scarcity of fund	28	23	4	3	2	4.28	0.60	0.78	Accept
6.	Course writers are unwilling to cede write course materials to ODL institutions	20	31	1	5	3	4.00	1.13	1.06	Accept
7.	Course writers prefer to write textbooks, publish and earn royalty on them	26	28	3	3	0	4.28	0.60	0.78	Accept
8.	Capacity building of hired part time personnel for effective ODL delivery is not adequate.	5	28	10	9	8	3.22	1.27	1.13	Reject
9.	Bough-in materials may raise curriculum and cultural issues	12	30	7	5	6	3.60	1.40	1.18	Accept
10.	The cost of adaptation and translation of bought - in course materials is significant	10	31	6	7	6	3.53	1.42	1.19	Accept
	<b>Total</b>	172	264	51	76	37				

Expected Frequencies: 17.2 26.4 5.1 7.6 3.7  
 $X^2$ : Cal (96.11), DF = 27, Crit. (40.11)

### Research Question Three

In Table 3, respondents have indicated the benefits derived from effective collaboration between ODL and Conventional Institutions in Nigeria. The findings have also revealed that Mathematics teachers have important roles to play in order to ensure positive attitudes towards the programmes and sustain the benefits. This can be done through professional development of the Professionals. Thus, Mathematics Teachers preparation should take note of these benefits and plan strategies that would enhance their realization in the classroom for effective teaching and meaningful learning in ODL Institutions.

### Research Question Four

In Table 4, the respondents have indicated that use of technology enhances best practices in areas of needs and benefits of ODL in Nigeria system of education are enormous. It also confirmed that the challenges of education for sustainable development in the country would reduce to the barest minimum and in particular, remedy those challenges that hinder best practices in ODL Institutions.

#### Hypotheses

The essence of the research hypotheses is to further confirm the findings in the research questions. The hypotheses were tested at 27 degree of freedom and 5% level significance.

**H<sub>0</sub>1:** In Table 1, the calculated value of is 66.16 while the critical value is 40.11. Hence,  $Cal(66.16) > Crit(40.11)$ ,

reject the  $H_0$  in favour of  $H_a$ . This implies that collaboration between ODL and Conventional Institutions has significance contribution to best practices in areas of need in Nigeria's ODL Institutions.

**H<sub>0</sub>2:** The result in Table 2 shows that calculated value is 96.11 while the critical value is 40.11. Thus,  $Cal(96.11) > Crit(40.11)$ , which reject  $H_0$  in favour of  $H_a$ . This implies that collaboration between ODL and Conventional Institutions has significance challenges that hinder best practices in Nigeria's ODL Institutions.

**H<sub>0</sub>3:** In Table 3, the calculated is 82.36 while critical value is 40.11. Hence,  $Cal(82.36) > Crit(40.11)$ , which reject the  $H_0$  in favour of  $H_a$ . This also implies that result from collaboration between ODL and Conventional Institutions has significance benefits to Nigeria's ODL Institutions.

**H<sub>0</sub>4:** The result in Table 4 shows that calculated value is 52.23 while the critical value is 40.11. Thus,  $Cal(52.23) > Crit(40.11)$ , which reject the  $H_0$  in favour  $H_a$ . This implies that use of technology enhances sustainable development in Nigeria system of education.

The results of the tested hypotheses correspond with the results of research questions that collaboration between ODL and Conventional Institutions contribute to best practices in areas of needs, challenges, benefits and technology in Nigeria's ODL Institutions. This result is also in line with the contribution of NOUN (2004) and Okonkwo (2005), and realization of Education For All (EFA) initiative in Nigeria.

This sustainable development in education can not be achieve without an extended outreach and qualitative improvements in individualization of instructions, access to

**Table 3.** The Extent to Which Result from Collaboration between ODL and Conventional Institutions Beneficial to Nigeria's ODL Institutions

S/N	ITEM	5	4	3	2	1	X	V	SD	Decision
1.	Provides increase access to learning opportunities as well as geographical access	29	20	0	6	5	4.03	1.63	1.28	Accept
2.	Provide increase opportunities for updating, retraining and personnel enrichment	26	27	3	2	2	4.22	0.87	0.93	Accept
3.	Supports the quantity and quality of existing educational structures	19	21	1	12	7	3.55	1.98	1.41	Accept
4.	Provision of tutoring and academic counselling of ODL learners	17	29	11	2	1	3.98	0.75	1.87	Accept
5.	Balancing educational inequalities between age groups and between genders	18	30	4	6	2	3.93	1.06	1.03	Accept
6.	Enhances item development, conduct of exams and marking of answer scripts	20	31	1	5	3	4.00	1.13	1.06	Accept
7.	Enhances readiness of course materials as at when needed	14	28	6	8	4	3.67	1.36	1.16	Accept
8.	Production of quality course material because of the expert input from the conventional system	11	32	5	7	5	3.62	1.33	1.15	Accept
9.	It is effective to hire manpower on part time basis, reduces overhead cost	10	29	9	11	1	3.60	1.04	1.02	Accept
10.	Helps to popularize ODL activities and boost quality assurance	30	23	0	5	2	4.23	1.08	1.04	Accept
	Total	194	270	40	64	32				

Expected Frequencies: 19.4 27 4 6.4 3.2  
 $\chi^2$ : Cal. (82.36), df = 27, Crit (40.11)

**Table 4.** The Extent to Which Use of Technology in ODL Institutions Enhance Sustainable Development in Nigeria System of Education

S/N	ITEM	5	4	3	2	1	X	V	SD	Decision
1.	Enhances outreach of ODL provisions to distance learners and individualization of instruction	25	21	6	8	0	3.85	1.09	1.04	Accept
2.	Leads to easier access to information & wider range of opportunities for learning	30	18	6	4	2	4.17	1.14	1.07	Accept
3.	Helps to overcome geographical distance & lack of educational infrastructure	21	23	7	5	4	3.87	1.37	1.17	Accept
4.	Helps to overcome personal, cultural and social barriers to learning	20	28	6	6	0	4.03	0.83	0.91	Accept
5.	Facilitates the collaboration with international, regional and sub-regional networks	26	27	3	4	0	4.25	0.69	0.83	Accept
6.	Enhances partnership with information, communication and industrial sectors.	22	25	7	5	1	4.13	0.98	0.99	Accept
7.	Enhances the generations of public interest in the use of ODL mode of schooling	10	35	6	4	5	3.68	1.18	1.09	Accept
8.	Allows for new delivery system such as use of simulation techniques	17	25	8	6	4	3.75	1.36	1.16	Accept
9.	Provides increased opportunities for updating re-training and personal enrichment	11	29	8	9	3	3.77	1.24	1.11	Accept
10.	Delivers educational campaigns and other information to large audiences	26	25	3	4	2	4.15	1.03	1.01	Accept
	Total	208	256	60	55	21				

Expected frequencies: 20.8 25.6 6 5.5 2.1  
 $\chi^2$ : Cal(52.23), df = 27, Crit (40.11)

information and better use of modern techniques through professional development of Mathematics Teachers who offer some of these services. Since Mathematics is the

language of science and technology (Baiyelo, 2007), and the gate and key to the Sciences (Abiodun, 1997), Mathematics Educators are to be trained and retrained in the pedagogy,

to possess efficient and adequate ICT skills needed in the globalization of education.

## Conclusion

The carrying capacity of Conventional Institutions is not enough and cannot ensure that the learning needs of all Nigerian citizens are met. Therefore, adoption of ODL calls for professional development of Mathematics Educators who are part of high-level academic personnel needed for ODL delivery in Nigeria, and in response to strong social demand for access to tertiary education. More so, professional development of Mathematics Educators toward effective collaboration between ODL and Conventional Institutions is a move in the right direction for realization of Education For All (EFA) initiative in Nigeria. Therefore, it is obvious that Open and Distance Education has come to stay as a viable alternative to the Conventional Education System in Nigeria and rely largely on the service provided by Conventional System of Education.

## RECOMMENDATIONS

The implications of the findings call for Professional development of Mathematics Educators to be able to:

- Product instructional course materials for ODL;
- Use modern technologies for effective teaching and meaningful learning in large class size at a distance;
- Develop modern pedagogy of ODL – use of simulations, audio and video conferencing, online instruction and evaluation, etc.
- Use modern technology in assessment of learning outcomes.
- Forestall the challenges faced by ODL Institutions, taking cognizance of benefits derived from ODL and plan strategies that would enhance realization of the set goals of NUC and Education For All (EFA) initiative in Nigeria.

## Conflict of interests

The author declare that he has no conflict of interests

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