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# AN ASSESSMENT OF TOOLS FOR ONLINE LEARNING OF SCIENCE AND MATHEMATICS IN ODL INSTITUTIONS IN NIGERIA

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The Nigerian government is advocating for education for all by the year 2020. In order to achieve this goal, there is a need to give individuals the opportunity to have access to education. The gap between the number of candidates seeking admission in higher institutions in Nigeria and those eventually admitted is usually wide and there is no sign of a positive signal towards education for all by the stated period. For instance, in the year 2016, 89 231 candidates applied for admission in to universities but only 24 422 secured admission. This may account for why the National Universities Commission (NUC) is encouraging universities to operate with a dual mode system, to accommodate those that can be admitted into the regular university system and those who were not successful, but are still willing to study. It is believed that open and distance education will be able to bridge the gap.

Open distance learning is an alternative to regular (contact) university education. In recent times, attention has been focused on the use of the open distance education mode as a means for providing education to different categories of individuals who would have otherwise been denied access to education, if it were only the face-to-face mode of learning that existed. It is the type of education that provides an opportunity for an individual to study and earn his or her degree without regular attendance on a campus. Open distance education entails that a learner be provided with course materials that are detailed, interactive and easy to understand which the learner can study on his or her own, without necessarily consulting a tutor. As the name implies, open distance education is designed to give an opportunity to mature learners, who still have the need for updating their certificates, improving their knowledge and skills and thereby making career progress without losing their means of livelihood. Distance education according to the plan of action for a decade of Distance Education in Nigeria, 20012010 refers to:

Various methods by which a variety of media and technologies are used to provide and /or improve access to good quality education to large numbers people either because they missed



the opportunity earlier in life or because their socio – economic situation would not permit them to acquire education through formal education school system.

Distance education is characterised by quasi-separation of the teachers and learners. The learners are expected to embark on their learning primarily on their own. For this to be achieved effectively, the learning or course materials must be up to standard and has to be prepared in such a way, that the reader would get the maximum benefit from it .

According to Wilson, (2004: 33), distance education is a type of education provided by a mode other than the conventional face-to-face method, whose goals are similar to and just as noble and practical, as those of on-campus, full time, face-to-face education. Also, UNESCO (2002: 7) refers to ODL as the approach that focus on opening access to education and providing training. Learners are free from the constraint of time and place it offers flexible opportunity to learn. Liu (2008: 19) sees distance education as a process whereby tutors and students are separated spatially and by time. Distance learning, therefore, is a type of learning in which the learner and the facilitator (at different places, time and space) communicate with each other through the use of print and electronic media. As supported by Vonderwell andand Turner (2005: 66) open distance education provides instruction through print and/or electronic communication media to persons engaged in planned learning in a place and time different from that of the instructor. Hence, distance learning is any mediated instruction that occur at distance with whatever means or technology. In this regard, open distance education is suitable for individuals who are interested in working (keeping their jobs) and learning. Mwilongo (2015: 11) opines that open distance learning is a field of education that focuses on teaching and learning methods and technology with the aim of adopting teaching and learning process often on an individual basis. This applies to students who are not actually present in a traditional educational setting such as a classroom. The Malaysian Qualifications Agency (2011: 2) further put forward that open distance learning is aimed at bridging the time, geographical, economic, social, and educational distance between students and institutions, students and academics as well as students and their peers. Weller (2002: 20) and Croft, Dalton and Grant (2011: 9) stated that distance learning applies mainly to the constructivism pedagogical approach in which learners are required to actively construct their own knowledge, based on personal experiences.

Learners have no more reason to attend regular classes with open distance education. They are reached through the provision of readable materials that are interactive in nature, so that the materials and information presented to them are as if it were taught in a classroom setting. Willis (1994: 66) cautions that materials produced for open distance learners must not infringe on copyright, materials must be up-to-date and must be in the appropriate presentation. Weller (2002: 19) further states that a resource-based approach to teaching requires that learners consult a wide range of materials and sources independently of the tutor. This provides the freedom to explore information that best suits their learning styles. Connolly, Jones and O'Shea (2005) observed that one of the major challenges of open distance education is developing appropriate materials which the learners need to successfully embark on their learning. Course materials need to be produced with utmost professional care. This means that the materials produced whether print or to be deployed on the internet for the learners must meet publishing standards. Croft, Dalton and Grant



(2011: 9) point out that prior to the use of internet, two approaches to distance learning were developed and used. These are the paper-reliant approach, where course materials were produced and sent to learners and the use of instructional videos and television.

According to the University of Washington Learning and Scholarly Technologies (Lane and Yamashiro 2006: 30), the interaction in ODL can be classified into three categories: learner-content interaction, where the learners interact with a web-based instructional program with the system adapting to their inputs; and learner-instructor, which can take place through synchronous and asynchronous communication. Synchronous interaction involves the real time interaction of the learner with the facilitator, examples include radio lecture, video conferencing, audio over web, or instructional television. While asynchronous interaction on the other hand is a situation where the communication between the instructor and the learner is not relative. Examples of asynchronous instruction include the use of print material, computer-based instruction or computer-based teaching, recorded video, recorded audio, correspondence (print), asynchronous web-based instructor (WBI). The last and third type is the learner-learner interaction which provide opportunity for the social negotiation of knowledge and construction of meaning (Baxter, Preece, Dodd and Dodd 2000: 32).

The interactions in ODL regardless of the type, require the use of tools, resources or technologies for facilitation to be effective and for learning to take place at different places, time and space (Liu 2008: 8). There are varieties of technologies available for teaching and learning in ODL, but instructors must focus on the needs of the learners, the requirements of the content, and the resources available before selecting a delivery system. Examples of ODL technologies include audio tools such as tapes and radio; instructional video tools which include still images such as slides, pre-produced moving images, computer-assisted instruction (CAI), computer-managed instruction (CMI), computer-mediated education (CME) such as fax, electronic mail, world wide web applications and real-time computer conferencing. With the whole education sector in Nigeria suffering from inadequate funding, what do we now say about open and distance learning programmes in Nigeria? ODL in Nigeria is faced with considerable challenges such as poor attitude of students to learning, inadequate experts, poor attitude of facilitators to online tutoring, inadequate funding, inadequate learning tools and technology, erratic power supply, lack of functional internets services, inadequate human and material resources and many more constraints. Hence, ODL institutions in Nigeria are struggling to survive in the face of these challenges (Jones and O'Shea 2004). The Nigerian government needs to reorganise its priority in this regard. For instance, the budget allocation for education in the year 2016 and 2017 was only 9.6% and 6.07% respectively as against the minimum 26% of the GDP or annual budget of a nation recommended for funding of education by the UNESCO (2002: 21-24).

## Statement of the problem

Open distance learning is the type of learning in which a learner is expected to embark on his learning mostly on individual basis without necessarily being in a classroom or in a group. For the developing world, ODL is a promising and practical strategy to address the challenges of widening access thus increasing participation in higher education. It is increasingly being seen as an educational delivery mode which is cost-effective without



sacrificing quality. In Africa, where resources are scarce and tertiary education provision is poor, ODL education has been considered as a worthwhile and cost-effective means of increasing provision without costly expenditure in infrastructure. To achieve successful learning, an open distance learner requires interactive course materials that will aid his/her studying to achieve the desired success in his/her academic endeavours. Despite the place and importance of courseware in open distance learning, most of the times learners are faced with a non-availability or shortage of course materials to study with erratic power supply, poor internet service and many more challenges (Liu 2008: 31). As a result of all these, ODL requires workable tools and technologies for effective communication because the learning system approach requires communication through a distance between the learner and the facilitator. Hence, the need for assessing the technologies and tools available for the online learning of science and mathematics in ODL institutions in South-West Nigeria.

### Aim of the study

The study aimed at assessing the tools available and accessible for online learning of science and mathematics, in an ODL institutions in South-West Nigeria. The objectives of the study are therefore to:

1. Evaluate the synchronous tools/technologies available and used for learning mathematics and science in an ODL institution in South-West Nigeria;
2. Determine the asynchronous tools/technologies available and used for learning mathematics and science in an ODL institution in South-West Nigeria; and
3. Evaluate the student's perception of learner support services available in an ODL institution in South-West Nigeria.

### Research Questions

1. What are the synchronous tools/technologies available and used for learning mathematics and science in an ODL institution in South-West Nigeria?
2. What are the asynchronous tools/technologies available and used for learning mathematics and Science in an ODL institution in South-West Nigeria?
3. How do students perceive learner support services available in an ODL institution in South-West Nigeria?

### Hypotheses

1. Adequate provision and use of relevant tools/technologies will not significantly affect learning of mathematics and science in an ODL institutions in South-West Nigeria.
2. Provision of relevant learner support services will not significantly affect learning of mathematics and science in an ODL institutions in South-West Nigeria.

### Methods

The survey design method was adopted for the study. This enabled the researcher to collect information using questionnaires from the sample. A 31 item questionnaire titled *Assessment of Tools and Technologies Available for Learning Science and Mathematics*



(ATTALSM) in ODL institutions was designed and used for the study. The questionnaire had three sections; the first was to sort the bio-data of the respondents, the second addressed the research questions raised and was divided into four clusters according to the research questions while the information collected from the third part was used to test the research hypothesis.

The instrument had a 4-point response scale of Available and Well Used (AWU), Available but Scarcely Used (ASU), Available but Never Used (ANU) and Unavailable (U) weights of 4,3,2,1 respectively. The instrument was validated by two experts in test and measurement and one experienced lecturer from Distance Learning Institute, University of Lagos. Their suggestions and corrections were used in modifying the questionnaire to suit the study. To determine the internal consistency of the instrument, Cronbach's alpha method was used, a reliability coefficient of 0.69 was obtained. A total of 350 copies of questionnaire were administered through personal contact and e-mail, however only 248 were duly filled and returned, and used for the analysis. Frequency counts and percentages were used to answer the research questions while the chi-square statistical tool was used to test the null hypotheses at 0.05 level of probability.

## Results

### Research question 1

What are the asynchronous tools/technologies available and used for learning mathematics and science in ODL institution in South-West Nigeria?

Table 12.1: Asynchronous tools

| Item | Tools  | AWU | ASU | ANU | U  | Total | %AWU |
|------|--|-----|-----|-----|----|-------|------|
| 1    | Internet   | 120 | 76  | 22  | 30 | 248.0 | 48.4 |
| 2    | Print materials  | 158 | 62  | 6   | 22 | 248   | 63.7 |
| 3    | Learning platform (Moodle)                                       | 114 | 92  | 28  | 14 | 248.0 | 46.0 |
| 4    | Computer softwares   | 120 | 86  | 14  | 28 | 248.0 | 48.4 |
| 5    | Social Media (Facebook, Twitter, Google Hang outs and WhatsApp ) | 120 | 76  | 22  | 30 | 248.0 | 48.4 |
| 6    | Fax  | 46  | 82  | 58  | 62 | 248.0 | 18.5 |
| 7    | Voice mails  | 41  | 68  | 63  | 76 | 248.0 | 16.5 |
| 8    | Audio tapes  | 58  | 90  | 36  | 64 | 248.0 | 23.4 |
| 9    | Course readings/resources on the web                             | 108 | 74  | 42  | 24 | 248.0 | 43.5 |
| 10   | Interactive board (Star board)                                   | 92  | 80  | 48  | 28 | 248.0 | 46.0 |
| 11   | E-mail   | 88  | 76  | 30  | 54 | 248.0 | 35.5 |

Table 12.1 shows the available asynchronous tools and technologies for teaching and learning mathematics and science in ODL institutions in South-West Nigeria and their rate of use. From the table, it shows that print material is the most commonly used (63.7%) as indicated by the respondents followed by internet, computer software, and social media (48.4%). The next on the table is interactive board (46.0%) followed by course readings/resources on the web (43.5%). Others that are scarcely used include e-mail (35.5%), Audio tapes (23.4%), fax (18.5%) and voice mail (18.5%)

## Research question 2

What are the synchronous tools/technologies available and used for learning Mathematics and Science in ODL institution in South-West Nigeria?

Table 12.2: Synchronous tools

| Item | Tools                          | AWU | ASU | ANU | U  | total | %AWU |
|------|--------------------------------|-----|-----|-----|----|-------|------|
| 12   | Radio                          | 84  | 88  | 24  | 52 | 248.0 | 33.9 |
| 13   | Simulation                     | 56  | 116 | 28  | 48 | 248.0 | 22.6 |
| 14   | Audio over webs                | 62  | 100 | 40  | 46 | 248.0 | 25.0 |
| 15   | Instructional Television (ITV) | 60  | 58  | 46  | 84 | 248.0 | 24.2 |
| 16   | Virtual Classroom              | 92  | 78  | 32  | 46 | 248.0 | 37.1 |

Table 12.2 shows the available synchronous tools and technologies for teaching and learning mathematics and science, in ODL institutions in South-West Nigeria and their rate of use. The table indicates that virtual classroom is the most commonly used (37.1%) as indicated by the respondents followed by radio (33.9%). The next on the table is audio over the web (25.0%) followed by instructional television (24.2) and simulation (22.6). It could be observed that the rate of use of synchronous tools and technologies in these institutions is less than 40%.

## Research question 3

How do students perceive Learner Support Services available at an ODL institution in South-West Nigeria?

Table 12.3: Learner Support Services

| Item | Support Services                                       | AWU | ASU | ANU | UA | total | %AWU |
|------|--|-----|-----|-----|----|-------|------|
| 17   | Face-to-face interaction                               | 156 | 44  | 18  | 30 | 248.0 | 62.9 |
| 18   | Information blog                                       | 90  | 52  | 60  | 46 | 248.0 | 36.3 |
| 19   | Effective counselling services                         | 76  | 76  | 54  | 42 | 248.0 | 30.6 |
| 20   | Use of an on-site facilitator to stimulate interaction | 94  | 74  | 40  | 40 | 248.0 | 37.9 |

| Item | Support Services           | AWU | ASU | ANU | UA | total | %AWU |
|------|----------------------------|-----|-----|-----|----|-------|------|
| 21   | Toll free telephone        | 46  | 40  | 64  | 98 | 248.0 | 18.5 |
| 22   | Electronic bulletin boards | 36  | 70  | 58  | 84 | 248.0 | 14.5 |

Table 12.3 shows the available learner support activities, for enhancing the teaching and learning activities in ODL Institutions in South-West Nigeria and their rate of use. From the table, the most frequently used as indicated by the respondents is face-to-face interaction (62.9%) followed by use of an on-site facilitator to stimulate interaction (37.9%) and information blog (36.3%). The next on the table is effective counseling service (30.6%) followed by toll free telephone (24.2%) then electronic bulletin boards (14.5%). Therefore, it could be observed that the rate of use of learner support activities in these institutions is less than 40% except in the case of face to face interactions.

### Hypothesis 1

Adequate provision and use of relevant tools/technologies will not significantly affect learning of mathematics and science in ODL institutions in South-West Nigeria.

Table 12.4: Chi-square tests on the use of relevant tools/technologies and learning of mathematics and science

|   | Value    | Df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|----------|----|-----------------------|----------------------|----------------------|
| Pearson Chi-square  | 101.394* | 1  | .000                  |                      |                      |
| Continuity correctionb  | 98.483   | 1  | .000                  |                      |                      |
| Likelihood ratio  | 126.913  | 1  | .000                  |                      |                      |
| Fisher's exact test   |          |    |                       | .000                 | .000                 |
| Linear-by-linear association  | 100.986  | 1  | .000                  |                      |                      |
| No of valid cases   | 248      |    |                       |                      |                      |
| *0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.42. Df= Degree of freedom |          |    |                       |                      |                      |

The results above showed a Chi-square value of 101.394, degree of freedom = 1 which is significant, since  $P = 0.000$  is less than 0.05 level of significance (Table 12.4). Hence, the null hypothesis was rejected. This implied that adequate provision and use of relevant tools/technologies will significantly affect learning of mathematics and science in ODL institutions in South-West Nigeria.



## Hypothesis 2

Provision of relevant learner support services will not significantly affect learning of mathematics and science in ODL institutions in South-West Nigeria.

Table 12.5: Chi-square tests on relevant learner support services and learning of mathematics and science

|  | Value   | Df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|--|---------|----|-----------------------|----------------------|----------------------|
| Pearson Chi-square   | 13.420* | 1  | .000                  |                      |                      |
| Continuity correctionb   | 12.375  | 1  | .000                  |                      |                      |
| Likelihood ratio   | 13.507  | 1  | .000                  |                      |                      |
| Fisher's exact test  |         |    |                       | .000                 | .000                 |
| Linear-by-linear association   | 13.366  | 1  | .000                  |                      |                      |
| No of valid cases  | 248     |    |                       |                      |                      |
| *.0 cells (0.0%) have expected count less than 5. The minimum expected count is 29.42. Df= Degree of freedom |         |    |                       |                      |                      |

Statistical analysis revealed a Chi-square value =13.420, degree of freedom= 1 and P= .000 (Table 5). This shows a significant effect. Since P= 0.0000 which is less than 0.05 level of significance. Therefore, the null hypothesis was rejected. Thus, it was concluded that the provision of relevant learner support services will significantly affect the learning of Mathematics and Science in ODL institutions in South-West Nigeria.

## Discussion

This study revealed that both synchronous and asynchronous tools and technologies are grossly inadequate in the sampled institutions. Even in instances where these tools are readily available, they were seldom used in ODL institutions. This study has shown that print materials are the commonly available and used asynchronous tools while the use of interactive boards, course readings on the web, e-mail, audio tapes, fax and voice mails are not commonly available and used. This is not encouraging for ODL institutions as adequate provision and use of relevant tools significantly improve learning of mathematics and science in ODL institutions in the South-West Nigeria. This statement is supported by Thomas (2004: 352) who stated that adequate provision and use of relevant tools improve learning in ODL Institutions.

Also, from this study, it was shown that synchronous tools such as radio, audio over the web, instructional television and simulation were seldom used even when available. The frequently used and available synchronous tool was the virtual classroom of 37.1% level of use and availability. These findings could be because of challenges on use of internet/LMS interactions like bandwidth and erratic power supply faced by ODL facilitators and learners.

Facilitator and learners' online interaction would obviously be hindered and negatively affected when the synchronous/asynchronous tools are not well used. As a result, there would not be room for effective instructional strategies which include all aspects of the instructional processes; the planning and management of online instruction, online teaching techniques, online students' assessment and evaluation techniques. This statement could be said to be supported by the observation made by Vic and Jerry (2002: 23) that effective instructional strategies have led to the success of online learning environment leading to best practices and guidelines.

It is important to note that the ability to use the computer and the internet are basic requirements as ODL learners. Therefore, right from the point of admission into ODL institutions, learners should be provided with adequate relevant tools to facilitate their learning. This is also in line with the report by Lane (2012: 14) that the use of computer and being technology literate are requirements for successful online learning, and without these skills, successful completion of online classes can be negatively affected. Vonderwell (2003: 77) also has a supporting opinion on the use of internet to facilitate learning. The study has also revealed a significant effect of learner support services on the effective learning of mathematics and science in ODL institutions. As it could be observed from the findings, learner support activities in the sampled institutions are less than 40% except in the case of face to face interactions. This also is not encouraging and would hinder the learners' progress, when they are not well supported.

## Conclusion and recommendation

The findings of this study revealed that both synchronous and asynchronous tools are grossly inadequate in the sampled schools. Even when they are available, they are not well used. The study has revealed a significant effect of learner support services on the effective learning of Mathematics and Science in ODL institutions. Based on these findings, it is recommended that the management of various ODL institutions along with the government, should provide all necessary and required resources for effective teaching and learning in ODL institutions.

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