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Impact of Digitization on the Teaching and Learning of Chemistry and Mathematics at the Distance Learning Institute of the University of Lagos

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Abstract. This study aimed at examining the impact of digitization in the teaching and learning of Chemistry and Mathematics in open and distance learning (ODL) at the Distance Learning Institute of the University of Lagos. A sample of 122 Chemistry and Mathematics students and lecturers was selected using simple random sampling. Data was collected using a questionnaire and analysed using descriptive statistics and Chi-Square. The findings were that the respondents lacked adequate digitization facilities and exposure. Their utilisation of digital facilities was characterized as low. It is recommended that the Institute makes digitization a matter of ultimate priority and provides funds for staff and student training.

Keywords: ICT; E-learning; ODL.

1   Introduction

Digitization is crucially important to data processing, storage and transmission, because it allows information of all kinds to be carried with efficiency and to be integrated. This is why it is a favoured way of preserving information for many organisations around the world. In the provision, utilization and maintenance of digitization in ODL it is expected that teachers and learners enjoy more comfort, convenience, portability, durability, security and accountability. However, they could also be constrained by limitations on the teachers and learners; manpower, funding, power, security, location, connectivity, information to digitize, hardware and software requirements and so on. Therefore, this research work is planned to identify the major roles of digitization and problems in using digitized learning and teaching. Despite the benefits associated with digitisation, therefore, its impact need not be taken for granted. There is need to investigate the impact

of digitisation on teaching and learning, even if a host of studies affirm that digitisation is invariably beneficial. This study was conducted to respond to this need, taking the teaching and learning of Chemistry and Mathematics at the Distance Learning Institute of the University of Lagos.

2   Methodology

Data was collected from a sample of 122 participants who were drawn from a population of 250 students and staff of the Distance Learning Institute of the University of Lagos. This was done using a questionnaire. The questionnaire comprised of two sections, namely, A and B. Section A covered the bio-data of the respondents while Section B, which included 64 items, covered attributes of the impact of digitisation on the teaching and learning of Chemistry and Mathematics. Each of these items was structured on a four point Likert scale ranging from a score of 1 to 4, with 1 as "Strongly agree", 2 as "Agree", 3 as "Disagree" and 4 as "Strongly disagree". The data was analysed using frequency counts, percentages.

3   Findings and Interpretation

The findings of the study are summarised in Tables 1 through 4.

Table 1. Role of Digitization in Teaching and Learning of Chemistry and Mathematics in ODL

	SA	A	SD	D	Total
Internet is used for other purposes apart from learning/ teaching	80 (66%)	37 (30%)	4 (3%)	1 (1%)	122 (100%)
Online learning/ teaching is preferred to physical contact	12 (10%)	31 (25%)	32 (26%)	47 (39%)	122 (100%)
Computer Based Test or examination is taken/ given	46 (38%)	53 (43%)	13 (11%)	10 (8%)	122 (100%)
Printing of materials for learning is done	51 (42%)	55 (45%)	11 (9%)	5 (4%)	122 (100%)
Projected lectures are taken/ given	42 (34%)	50 (41%)	13 (11%)	17 (14%)	122(100%)
Video lessons are watched/made	31 (25%)	46 (38%)	18 (15%)	27 (22%)	122 (100%)
There is online interaction with lecturers/ students	31 (25%)	47 (39%)	20 (16%)	24 (20%)	122 (100%)
Learning/ teaching materials are sought online	58 (48%)	48 (39%)	10 (8%)	6 (5%)	122 (100%)
Internet is used for communication	53 (44%)	50 (41%)	10 (8%)	9 (7%)	122 (100%)
Digital Whiteboard is used for Digital Classroom learning/ teaching	30 (25%)	60 (49%)	20 (16%)	12 (10%)	122 (100%)
Virtual library is used to make researches	32 (26%)	51 (42%)	21 (17%)	18 (15%)	122 (100%)
The respondent is aware of online tests	48 (39%)	54 (44%)	8 (7%)	12 (10%)	122 (100%)
Online assignments are used in the Institute	52 (42%)	57 (47%)	8 (7%)	5 (4%)	122 (100%)
Social media is used to interact with lecturers	50 41%)	57 (47%)	9 (7%)	6 (5%)	122 (100%)
Online platforms are preferred to the handwritten	67 (55%)	45 (37%)	5 (4%)	5 (4%)	122 (100%)
Upload or download of online modules helps learning/teaching	60 (49%)	50 (41%)	5 (4%)	7 (6%)	122 (100%)
The respondent started the Institute as a computer literate	56 (46%)	43 (35%)	10 (8%)	13 (11%)	122 (100%)
The Institute teaches the use of computer	18 (15%)	27 (22%)	35 (29%)	42 (34%)	122 (100%)
Online tests are better than paper tests	25 (21%)	32 (26%)	33 (27%)	32 (26%)	122 (100%)
Online assignments are better than the others	31 (26%)	40 (33%)	20 (16%)	31 (25%)	122 (100%)

In Table 1, 117 of the respondents (80 and 37 respectively) agreed that they use the internet for other purposes apart from teaching/learning. Next, 43 of the respondents (12 and 31 respectively) representing 35% agreed that they prefer online teaching/learning to physical contact while 79 disagreed. This shows that more of them disagreed. Then, 81% (38% and 43% respectively) agreed that they prepare/ take Computer Based Tests. Most (87%) of the respondents agreed that they print materials for teaching or learning. Meanwhile, 75% of them agreed that they prepare their lectures using PowerPoint/ take projected lectures. Most of these agreed that they prepare video teaching or watch video lessons. Relatedly, 74% (i.e. 25% and 49% respectively) "agreed" that they use digital whiteboards. Furthermore, 64% (i.e. 25% and 39% respectively) of the respondents "agreed" that they interact online. Interestingly, 106 respondents, representing 87%, "agreed" that they source for teaching/ learning materials online. Most of the respondents "agreed" that they use the virtual library to do research. A similar trend of results was found with regard to online tests, use of social media, use of management information systems and the uploading/ downloading of online modules. Collectively considered, the findings in Table 1 suggest appreciable adoption of ICT at the Distance Learning Institute of the University of Lagos. However, most (77%) of the respondents indicated that the Institute had not given them training in the area of digitisation and computer technology.

Table 2. Challenges in Digitization

	SA	A	SD	D	Total
Computers are expensive to acquire	52 (43%)	43 (35%)	13 (10%)	14 (12%)	122 (100%)
Computers are expensive to maintain	24 (20%)	54 (44%)	14 (11%)	30 (25%)	122 (100%)
Computers are always virus free	14 (11%)	22 (18%)	40 (33%)	46 (38%)	122 (100%)
The internet service is effective	16 (13%)	55 (45%)	20 (17%)	31 (25%)	122 (100%)
Printing is cheap	10 (8%)	25 (21%)	56 (46%)	31 (25%)	122 (100%)
It is inexpensive to subscribe to internet service	18 (15%)	42 (34%)	35 (29%)	27 (22%)	122 (100%)
My files or sites have never been hacked	16 (13%)	51 (42%)	30 (25%)	25 (20%)	122 (100%)
I am always subscribed to the internet	40 (33%)	60 (49%)	13 (11%)	9 (7%)	122 (100%)
I am computer literate	41 (34%)	67 (54%)	7 (6%)	7 (6%)	122 (100%)
I am very fast in typing	21 (17%)	50 (41%)	18 (15%)	33 (27%)	122 (100%)
I can do all sorts of drawing with the computer	15 (12%	35 (29%)	31 (25%)	41 (34%)	122 (100%)
I am aware of and I use special drawing software	17 (14%)	37 (30%)	25 (21%)	43 (35%)	122 (100%)
There are less errors on Computer Based Tests	20 (16%)	50 (41%)	25 (21%)	27 (22%)	122 (100%)
There are less errors in online materials	14 (11%)	55 (45%)	23 (19%)	30 (25%)	122 (100%)
I fix personal computer or devices when they break down	24 (20%)	57 (47%)	23 (19%)	18 (14%)	122 (100%)
I have a personal laptop	41 (34%)	51 (42%)	15 (12%)	15 (12%)	122 (100%)
I have an internet enabled phone	57 (47%)	49 (40%)	9 (7%)	7 (6%)	122 (100%)
I have other devices for accessing the internet	31 (25%)	56 (46%)	16 (13%)	19 (16%)	122 (100%)
I am a software developer	5 (4%)	23 (19%)	50 (41%)	44 (36%)	122 (100%)
I have complementary computer accessories (e.g. printer)	24 (20%)	30 (24%)	45 (37%)	23 (19%)	122 (100%)
I visit the Institute's website	25 (20%)	51 (42%)	17 (14%)	29 (24%)	122 (100%)
I access the Institute's Learning Management System	35 (29%)	63 (51%)	7 (6%)	17 (14%)	122 (100%)
I use YouTube	32 (26%)	59 (48%)	14 (12%)	17 (14%)	122 (100%)

My internet provider is always efficient	21 (17%)	57 (47%)	21 (17%)	23 (19%)	122 (100%)
I am good in internet surfing	26 (21%)	61 (50%)	17 (14%)	18 (15%)	122 (100%)
I am good in videography	13 (11%)	27 (22%)	28 (23%)	54 (44%)	122 (100%)
I am good in computer programming	12 (10%)	24 (20%)	25 (20%)	61 (50%)	122 (100%)
I am good in graphic designing	13 (11%)	28 (23%)	25 (20%)	56 (46%)	122 (100%)
I am good in desktop publishing	18 (15%)	50 (40%)	18 (15%)	36 (30%)	122 (100%)
Power supply is consistent	13 (11%)	49 (40%)	+	27 (22%)	122 (100%)
Internet service provider has adequate network coverage	14 (12%)	49 (40%)	21 (17%)	38 (31%)	122 (100%)

In Table 2, the main challenges affecting digitisation were identified in the areas of acquisition, utilisation and maintenance. Most of the respondents "agreed" that computers are expensive to acquire and to maintain. Most (71% and 51%) of the respondents respectively indicated that "printing", "internet subscription" and computer peripherals are expensive. Only a cumulative percentage of 29 "agreed" that the computers they use are free from viruses, the inference being that viruses are a problem for majority of the respondents. Downtime resulting from erratic power supply and internet service provision was also reported. Nevertheless, on the whole, Table 2 shows significant reach and use of digitalisation equipment among the participants (notably with regard to subscription to the internet, computer literacy [including typing and troubleshooting], computer ownership and utilisation of the Institute's Learning Management System (LMS)'). This indicates a good degree of adoption of ICT at the Institute.

Table 3. Impact of Digitization on Teaching and Learning

	SA	A	SD	D	Total
Online learning/teaching is better for learning all aspects of Chemistry/ Mathematics	13 (11%)	46 (38%)	26 (21%)	37 (30%)	122 (100%)
The online learning/teaching is effective for learning all aspects of Chemistry/ Mathematics	5 (4%)	41 (34%)	48 (39%)	28 (23%)	122 (100%)
Computer Based Test displays all diagrams and signs accurately in Chemistry/ Mathematics	8 (7%)	54 (44%)	23 (19%)	37 (30%)	122 (100%)
ODL can do without the internet in learning Chemistry/ Mathematics	9 (7%)	37 (30%)	51 (42%)	25 (21%)	122 (100%)
The respondent can plot graphs well using the computer	14 (12%)	21 (17%)	39 (32%)	48 (39%)	122 (100%)

From Table 3, it was deduced that majority (59) of the respondents (13 and 46 respectively) being 49% agreed that Online learning is better for teaching/ learning all aspects of Chemistry/ Mathematics whereas; 63 respondents (26 and 37 respectively) being 51% (21% and 37% respectively) did disagree with it. Furthermore, 46 respondents agreed that online learning is effective for teaching/learning all aspects of Chemistry/Mathematics. Also, 62 of the respondents, being 51%, agreed that Computer Based Tests display all diagrams and signs accurately in Chemistry/ Mathematics. Up to 46 of the respondents being 37% agreed that ODL can do without the internet in teaching and learning Chemistry/Mathematics but 76 of them (51 and 25 respectively) being 63% (42% and 21% respectively) disagreed with it. Lastly; 35 respondents (14 and 21

respectively) being 29% (12% and 17% respectively) agreed that They can plot graphs well using the computer then 87 of them (39 and 48 respectively) being 71% (32% and 39% respectively) disagreed.

Table 4. Encouragement of Digitization in Teaching and Learning

	SA	A	SD	D	Total
Institute provides time-to-time orientation on latest trends in digitization	30 (25%)	48 (39%)	23 (19%)	21 (17%)	122 (100%)
The Institute provides financial support to acquire devices	7 (6%)	20 (16%)	59 (48%)	36 (30%)	122 (100%)
The Institute provides free and functional internet for researchers	10 (8%)	28 (23%)	45 (37%)	39 (32)	122 (100%)
The Institute has stand-by engineers and programmers to attend to breakdowns	11 (9%)	51 (42%)	26 (21%)	34 (28%)	122 (100%)
Institute sends staff and students abroad for professional training in digitisation	11 (9%)	36 (30%)	49 (40%)	26 (21%)	122 (100%)
There is consistent power supply in the Institute	26 (21%)	60 (49%)	21 (18%)	15 (12%)	122 (100%)
The Institute has devices for digital classrooms	17 (14%)	61 (50%)	20 (16%)	24 (20%)	122 (100%)
The Institute has enhanced digital devices	18 (14%)	63 (52%)	21 (18%)	20 (16%)	122 (100%)

In Table 4, 78 respondents (30 and 48 respectively) being 64% (25% and 39% respectively) agreed that the Institute provides time-to-time orientation for them on latest trends in digitization as 44 of them (23 and 21 respectively) being 36% (19% and 17% respectively) disagreed. This shows that more of them agreed.

Meanwhile, 27 of the respondents (7 and 20 respectively) being 22% (6% and 16% respectively) agreed that The Institute provides financial support for them to acquire devices while 95 of them (59 and 36 respectively) being 78 (48% and 30% respectively) disagreed. Therefore, more of them disagreed.

In reference to the table also, 38 respondents (10 and 28 respectively) being 31% (8% and 23% respectively agreed that The Institute provides free and functional internet for their research but 84 of them (45 and 39 respectively) being 69% (37% and 32% respectively) disagreed. So because of this, more respondents disagreed.

Then, 62 respondents (11 and 51 respectively) being 51% (9% and 42% respectively) did agree that The Institute has stand-by engineers and programmers to attend to breakdowns hence; 60 of them (26 and 34 respectively) being 49% (21% and 28% respectively) disagreed. This proves that more of the respondents agreed.

Additionally; 47 respondents (11 and 36 respectively) being 39% (9% and 30% respectively) agreed that The Institute takes them outside the country on excursion or professional training on digitization related conferences and workshops although 75 of them (49 and 26 respectively) amounting to 61% (40% and 21% respectively) was of contrary view as they disagreed. With this, more of the respondents disagreed.

Also, 86 respondents (26 and 60 respectively) as 70% (21% and 49% respectively) agreed that There is consistent power supply in the Institute but 36 of them (21 and 15 respectively) being 30% (18% and 12% respectively) disagreed. In consideration of this, more of the respondents agreed strongly with it.

With respect to the same table of information, 78 of the respondents (17 and 61 respectively) being 64% (14% and 50% respectively) agreed that The Institute has devices for digital classrooms while 44 of them (20 and 24 respectively) being 36% (16% and 20% respectively) gave negative responses in disagreement. So, more of the respondents agreed.

Lastly on the table, 81 respondents (18 and 63 respectively) being 66% (14% and 52% respectively) agreed that The Institute has enhanced digital devices and 41 of them (21 and 20 respectively) being 34% (18% and 16% respectively) disagreed. As a result, more of the respondents agreed.

4   Summary, Conclusions and Recommendations

Also, results from research question two clearly revealed that there were challenges encountered by Chemistry and Mathematics students and lecturer in the use of or/and acquiring and maintenance of digitization tools in the ODL. From the responses, although most of the respondents had access to digitization devices and even the internet but are very limited in use of most essential packages that aid teaching and learning such as PowerPoint, videography, programming languages, graphics designing, desktop publishing and some others. They also in higher number decried the inefficiency of internet services amongst high cost of acquisition and maintenance of digitization tools. However, this is partly responsible for digitization utilization in teaching and learning of Chemistry and Mathematics in the Institute.

More so, from the results obtained from research question three, responses gathered from the selected respondents proved that digitization generally goes a long way in having positive impacts in teaching and learning comparing to Chemistry and Mathematics but cannot be solely relied on in effective delivery of teaching and learning of Chemistry and Mathematics due to the technicalities of explaining and understanding of the two learning areas especially considering

the calculations, signs and diagrams that are both technical to draw, analyse and understand. The contributing factors to this kind of result are unreliable power supply, limitations on the lecturers and students in advanced digitization use, non-availability of advanced but easy-to-use digitization tools and others.

Lastly, result gotten from research question four suggested that the Distance Learning Institute, University of Lagos, Akoka still has a lot more to do in empowering and encouraging her Chemistry and Mathematics students and lecturers in up-to-date possession of contemporary digitization tools and current exposure to trending advancements in digitization. Evidences from the research question fours proved that the Institute needs to do more in providing time-to-time orientation for her students and staff on latest trends in digitation, provision of financial support for them to acquire devices, provision of consistent and effective free internet access, employment of proficient standby engineers and programmers to attend to hardware and software breakdowns, expose them across the borders of the country for foreign trainings, improve on consistent power supply and acquire more contemporary digitization devices.

The foregoing analyses show that a lot more needs to be done to sustain optimally; the desired impacts of digitization in teaching and learning of Chemistry and Mathematics in Open Distance Learning (ODL)

The findings revealed that digitization still suffered some constraints in the teaching and learning of Chemistry and Mathematics in ODL. A significant relationship between digitization and teaching and learning of Chemistry and Mathematics in ODL was established, which suggests that the more the application of digitization, the more effective the teaching and learning of Chemistry and Mathematics gets. So it is concluded that digitization is a critical variable in the teaching and learning of Chemistry and Mathematics in ODL. More funds and trainings were needed to further empower the ODL students and their lecturers because it is one thing to have tools for digitization and another thing to have capable manpower to utilize them. The inadequacy of power supply and inefficient internet service provision were both threats to maximal impacts of digitization. Therefore, it was concluded that the Distance Learning Institute of the University of Lagos is not yet ready for heightened adoption of digitization in its operations.

Based on these conclusions, it is recommended that continuous in-house and external training of lecturers and orientation of students on up-to-date embracement of digitization be conducted. Development and training of digitization experts who are specifically prepared for instructional design and development and who will work in partnership with the Institute for parallel consistency in the use and maintenance of digitization tools is also recommended. It is recommended that the Institute generates its own power supply off the national grid to ensure consistent power supply. Partnership with standby internet service providers, to ensure regular internet service provision, is

also recommended. Finally, improvement in support to Chemistry and Mathematics students and lecturers in acquisition of digitization tools and frequent exposure to modern improvements through soft loans, subsidies in purchase or training, payment on instalment for devices is also recommended.

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