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ENGAGEMENT IN SCIENCE COMMUNICATION AMONG SCIENCE AND COMMUNICATION SCHOLARS IN SELECTED NIGERIAN UNIVERSITIES

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ABSTRACT

There is a gross paucity of science communication researches in Nigeria and no research data exists on engagement in science communication between science and communication scholars in Nigeria. This gap necessitated this study. To gather data, we analyzed twelve department handbooks of six universities offering science and communication courses to determine the extent to which science communication was provided for in their curricula. We also conducted interviews with science and communication leaders in the selected twelve departments in the six universities to gauge their involvement in science communication. Some of the key findings were that both science and communication disciplines did not give science communication a commendable emphasis. Also, many academic leaders interviewed did not actually get involved in various science communication activities examined. Based on these findings, we conclude that science communication pedagogy, practice, and scholarship in Nigeria are very low. Therefore, it is recommended that science and communication scholars include more science communication courses into their academic curricula, and get more deeply involved in public and citizen science, media science, and virtual/online science communication efforts. These steps, it is believed, would help advance science communication in Nigeria.

Keywords: *Science communication; inter-disciplinary studies, academia, qualitative research, Africa*

INTRODUCTION

Today's world is driven by science and technology. We are living in an increasingly science and technology society. These are the bedrock of advanced societies and key drivers of strong economies (Maina, 2019). Developments in science and technology are fundamentally altering the way people live, connect, communicate, and transact; with profound effects on development (Chetty, 2012). They play a major and significant role in most aspects of our daily lives - economic, social, political, educational, religious, and cultural (Reddy *et al*., 2013) and continue to occupy outstanding positions in the scheme of things because scientific and technological knowledge are critical for the advancement of any society (Kraker *et al*., 2016).

Also, a nation's level of industrialization and national prosperity depend on science and technology (Royal Society, 1985 cited in Gascoigne & Metcalfe, 2017). Almost all public policy issues have scientific or technological implications. This therefore calls for individuals, groups,

organizations, institutions, communities, and nations to have some understanding of science and technology, their accomplishments, and their limitations (Royal Society, 1985 quoted in Gascoigne & Metcalfe, 2017). In a knowledge-based society, science and technology communication is an important issue in establishing appropriate levels of trust among experts, the public, and other stakeholders (Requier *et al.*, 2020; Shineha *et al*., 2016). What the public knows about science and how the public learns about science have relevance for policy makers, firms, and researchers (Raza, Singh & Dutt, 2002).

Science communication research and practice are basically thought of as the activities of professional communicators and scientists themselves (Gregory & Miller, 1998). They involve sharing of information and raising awareness about science-related topics i.e. the breaking down of dense, dull, and technical scientific concepts into engaging pieces of information for public consumption (Tsanni, 2019). In essence, effective science communication is an avenue through which a number of persons learn about events and developments happening in the world of science which have effects on human lives. The necessity for effective science communication is hinged on the premise that it helps scientists give their work meaning in the eyes of stakeholders – farmers, policy makers, industry, consumers, and the public (Gidado, 2017). Achieving effective science communication and getting science closer to the people or building a scientific culture in society requires much creativity and communication skills (Tsanni, 2019).

Science communication scholars have advocated an increase in public understanding of science or scientific literacy (Thomas & Durant, 1987; Gregory & Miller, 1998). Scientific and technological knowledge should be a public good and as such part of the knowledge should be publicly communicated in order to enable everyone in society benefit from it (Kraker *et al*., 2016). Burns *et al.* (2003) also describe the purpose of science communication as a concise label that personalizes the impersonal aims of scientific awareness, understanding, literacy, and culture. According to Inspiring Australia (2010), we must communicate and engage the wider community in science. There must be a strong, open relationship between science and society, underpinned by effective communication of science and its utilities. As Gallup (2014) notes, it is increasingly important to communicate science and technology benefits to those outside the field in clear terms, and without obfuscating any potential risks. This means not only ensuring that those involved in research and development have the skills to discuss their work in an easily digestible manner, but also that the media properly understand scientific principles and how to report them.

However, science communication is still in its infancy in some countries and there is gross paucity of research on the quantity and quality of science communication among communication and science academics especially in developing nations such as Nigeria. Olson (2009) observes that there has been unproductive negligence when it comes to teaching scientists to communicate science, adding that scientists are responsible for promoting and explaining science to the public and media.

The deficiency in science communication is seemingly of great concern to the world. The Royal Society (2006) reports that science communication was seen as altruistic and neither academically significant nor likely to attract funding, peer respect and career uplift. Similarly, Lucibella (2009) observes that newspapers have been closing their science desks; broadcasting firms reducing airtime for science stories; and that science has assumed least emphasis in the general media.

For Karikari, Yawson, and Quansah (2016) science communication is an important but frequently neglected aspect of scientific training. Yet, science communication research and practice is just one kind of attempt to reduce epistemic asymmetry between people who may know more and people who may know less about a certain subject (Cortassa, 2016). Moreover, the importance of scientific values in general, and helping the public to understand that scientific views are not mere opinions but hard-won knowledge gained from research (Krutwich, 2008), are now more imperative than ever before because of what the 21st Century presages in terms of the altering nature of the world.

Statement of the Problem

Science and technology are global endeavors and essential driving forces in the development process of any nation. Despite the great role science and technology play in human lives and the development process, they are poorly communicated among communicators and scientists themselves. The poor attention given to science education and communication, results in a situation where Gould (2014) citing Samuel Brod's submission that scientists sneer at journalists while news readers sneer at scientists.

However, these times require more than ever before, that there should be a great concern in communicating scientific discoveries for public understanding and better appreciation of the utility of science and its outputs (Ausiello, 2007). According to Gascoigne and Metcalfe (2017),

scientists are struggling for respect and recognition, that they would rather publish their research and academic outputs in peer circles rather than communicate with the public and that more importantly; science communication practitioners should endeavor to provide answers to this striking question: what motivates people to change, value science, and choose careers in science?

This question is very relevant, considering the fact that many problems of involvement, and motivation toward science and technology communication have been recorded (Potvin & Hasni, 2014). While several studies have been conducted on science communication in Europe, America and Australia (Guenther & Joubert, 2017; Gascoigne & Metcalfe, 2017), little is, however, done in science communication especially in Nigeria. Some of the well-known Nigerian-based science communication research efforts mainly dealt with the coverage of health, climate change, science, and nanotechnology in the Nigerian press (see Batta, Ashong and Bashir, 2013; Ashong and Batta, 2013; Batta, Ashong and Obot, 2014; Batta, Ashong and Udousoro, 2015; and Batta, 2019).

Unfortunately, none of these research efforts looked into engagement in science communication research and practice among communication and science academics in Nigerian universities. This study is therefore necessitated by this obvious gap in the literature.

Objectives of the Study

The objectives of this study were to:

1. determine the titles and number of science communication-based courses in the curricula of the selected universities in Nigeria;
2. ascertain the extent of engagement in science communication research and practice among communication and science academics in the selected universities; and,
3. compare the extent of involvement in science communication between communication scholars and science academics in the universities.

To realize these objectives, the following research questions were raised to guide the study:

1. What are the titles and number of science communication-based courses in the curricula of the selected universities in Nigeria?
2. What is the extent of engagement in science communication research and practice among communication and science academics in the selected universities?

3. How do communication scholars and science academics in selected universities compare in their involvement in science communication?

Literature Review

Science Communication Research and Practice in Africa and Nigeria

Generally, the picture of the low status of science communication research and practice in Africa and Nigeria is not rosy (Ndlovu, Joubert & Boshoff, 2016). The increasing development of science communication research efforts are far greater in institutions in North America and Europe; and are dismal in developing countries especially in Africa (Karikari, Yawson & Quansah, 2016). This is reflected in Guenther and Joubert's (2017) systematic and bibliographic study of research papers published in three major science communication journals – *Science Communication, Public Understanding of Science*, and *Journal of Science Communication (JCOM)* from 1979 – 2016 which revealed that research outputs from Africa: South Africa, Botswana, Ghana, Kenya, Nigeria, Tunisia, and Zimbabwe accounted for only 20 papers representing (1.1%) of the total research output under investigation.

There is also scarcity of literature on science communication research in the developing world (Ndlovu, Joubert & Boshoff, 2016). The majority of empirical studies in the field are from developed, English-speaking countries (Massarani, 2015). The USA and the UK jointly accounted for 60% of the total number of authors (including co-authors) when each author is assigned to a country by his/her institution, confirming their dominance over the contributions of others in science communication research activity (Bucchi & Trench, 2014).

Furthermore, Borchelt's (2012) mapping of a decade of science communication outputs from 2000 to 2009 equally shows the dominance of North America in science communication research. Schiele, Claessens & Shi's (2012a) assessed the book: *Science Communication in the World,* and found out that Africa was poorly represented, with only one of the 15 national overviews coming from Africa. Nigeria had only two. Bauer and Howard (2013) noted this paucity of African contributions to science communication research, but expressed the hope that, "as with many things, the future is likely to be in Africa" (p.10).

In Africa, research in this field is mostly limited to studying the practice of science communication (Ndlovu, Joubert & Boshoff, 2016) some of which are: science café's in Kenya (Matheu & Wanjala, 2009); radio for disseminating health information in Malawi (Nyirenda *etal*.,

2016); public internet terminals to support health education in South Africa (Coleman, 2012); and a musical show to communicate physics, also in South Africa (Fish *et al*., 2016). There are researches on media coverage of science on the continent. They include: newspaper framing of climate change in Southern Nigeria (Agwu & Amu, 2013); implications of press coverage of climate change in Nigeria for public participation (Batta, Ashong & Bashir, 2013); the square kilometer array project in South Africa (Gastrow, 2015); coverage of genetically modified (GM) crops in Kenya (DeRosier, *et al*., 2015); climate change reporting challenges and implications for development (Meribe & Oke, 2017); and media coverage and public understanding of climate change, migration and conflicts in Nigeria (Meribe & Oke, 2019).

Africa's low representation in science communication scholarly research is due to some challenges that are common in developing countries (Guenther & Joubert, 2017). These challenges restrict science communication research outputs coming from the continent. Historically, Massarani and Decastro-Moreira (2016) report that science was suppressed in Africa during the colonial times; as it was kept away from Brazilians during the Portuguese occupation. In South Africa, and mainly during the apartheid regime, the majority of the people were isolated from science (Dubow, 2006).

Cultural and language barriers (Fish *et al*., 2016); access to science news (Clayton & Joubert, 2012); lack of funding and infrastructure in Uganda (Bakyawa *et al.;* 2013), lack of institutional support and training in Ghana (Appiah *et al.*, 2015); lack of incentives and censorship of politically sensitive findings in Zimbabwe (Ndlovu, Joubert and Boshoff, 2016) are some examples of the challenges.

Furthermore, there are social and structural barriers that typically limit public science communication in developing countries (Hin & Subramaniam, 2014). The authors explain further that science communication is impeded by the absence of institutional mechanisms such as science academics, scientific societies suitable for promoting science engagement, while inadequacies in science journalism expertise and platforms remain a concern. Poverty, corruption, violence, insecurity, famine and political instability, also pose as a huge challenge for promoting and communicating science (Hin & Subramaniam, 2014; Massarani & Decastro-Moreira, 2016).

However, despite the numerous challenges plaguing Africa, the continent has attempted to attract the interest of both communication scholars and scientists (Lugalambi & Nyabuga, 2011). This requires meaningful research skills, interest and activity (Guenther & Joubert, 2017).

Researchers in the field must have the competence and skills to develop science communication initiatives to appropriately communicate scientific researches to lay people and policy makers (Ashwell, 2012).

In grounding our understanding of the theoretical basis of science communication research and practice, Bucchi &Trench (2008) citing the pioneering works of Cloitre & Shin (1985), Hilgartner (1990), and very classic work of Fleck (1935), explain that the process of scientific communication occurs in four prominent stages in what has been named the continuity model of scientific communication. These stages include the intra-specialist level, inter-specialist level, pedagogical level, and popular level. The understanding is that rather than see research and practice in science communication as separately occurring at sharp, distinct levels, there is rather a continuum of engagements. As this study may likely show, academics may exhibit differing levels of engagement depending on the culture of science and science communication in a given country. In some countries, where the culture is consolidated (European Commission, 2012) strength in all the stages of the process is discernible. In Third World countries for instance, their strengths may be at the intra specialist and pedagogical stages; while observed weakness is characteristic at the inter-specialist and popular/public stages.

METHODS

This study adopted the qualitative research technique in gathering data for the purpose of realizing the research objectives and answering the research questions. The technique included an examination of 12 Student Handbooks obtained from six communication studies departments and six science departments from six selected universities. The universities were selected on the basis of the six geopolitical zones of Nigeria and clustered from federal, state, and private universities. One university was selected from each geopolitical zone of Nigeria. The criterion for the selection of the universities was purposive and the rationale was to determine the extent to which science communication courses were undertaken by science and communication disciplines.

The six universities selected for this study, the geopolitical zone it represents and a brief rationale for the selection are summarized below:

1. **North East Nigeria**: American University of Nigeria, Yola (AUN, Private University): AUN was selected because of its emphasis on science and information technology.

2. **North West Nigeria**: Bayero University, Kano (BUK, Federal University): BUK was selected because it is one of the biggest universities in Nigeria, a first generation university and does attract substantial grants for its programs.
3. **North Central Nigeria**: Nasarawa State University, Keffi (NSUK, State University): NSUK was selected for its efforts in initiating the mainstreaming of science communication into science and communication education in Nigeria.
4. **South West Nigeria**: Covenant University, Ota (CU, Private University): CU was selected because of its ranking as the foremost private university in Nigeria and its online profile.
5. **South-South Nigeria**: Rivers State University, Port Harcourt (RSU, State University): RSU was selected because of its location in Nigeria's oil/gas industry and focus on science and technology education.
6. **South East Nigeria**: University of Nigeria, Nsukka (UNN, Federal University): UNN was selected because of its large size, its being one of Nigeria's earliest universities and for its establishment of a science/technology park.

For the qualitative content analysis aspect of the data gathering process, content categories were created to include science courses, communication courses, and science communication courses while the text describing the courses was the unit of analysis. These descriptions were analyzed in terms of the title and the number of courses that equip both science and communication students to understand science communication. Coding sheets were used to gather data from the content of the Departmental Students manuals from the selected science and communication studies departments in the six universities.

The qualitative content analysis technique was supported by oral interviews of academic leaders (Heads of Departments) of the 12 academic departments (six science departments and six communication studies departments). The relevance of these interviews was to evaluate the involvement of science and communication academics in science communication. An interview schedule was used to obtain responses from the heads of departments of selected science, and communication disciplines. The interviews took place on different dates for about 20 to 30 minutes, were recorded, transcribed, and summarized. Then, we used the explanation building technique to analyze and discuss the data and results. In the oral interview, these major themes were covered: involvement in the exchange of science communication scholars; engagement in

science communication research; joint authorship of scholarly science communication articles; inclusion of science communication in student's curriculum; participation in media science, citizen science, and science policy formulation, and the promotion of public understanding of science.

Limitations of the Study

Nigeria has more than a hundred and fifty universities. Studying all these universities would have been very exhausting. The six universities selected above are not fully representative of Nigeria's university system but they are in terms of ownership structure. However, they could supply data that would adequately provide a strong basis for gauging engagement and involvement of science and communication scholars in science communication in those institutions. Also, because of the sample size, it would not be required to generalize the results to the entire tertiary education and university system in Nigeria.

FINDING AND DISCUSSION

Findings and Discussions from Analysis

Research Question No.1: What are the title and number of science communication-based courses in the curricula of the selected universities in Nigeria?

The first research question was posed to find out the science communication-based courses in the curricula of the selected universities in Nigeria. To determine these, a qualitative content analysis of the Departmental Handbooks (manuals) of the six selected universities in Nigeria was carried out. The data from this analysis are summarized in Table 1 below:

Table 1. Science Communication Courses in the Six Selected Universities

Universities	Departments	Number of Science Courses	No of Comm. Courses	Number of Science Communication Courses	
				Science	Comm.
Bayero University, Kano	a) Mass Communication	–	60	–	5
	b) Agricultural/Environmental Engineering	100	–	0	–
	a) Mass Communication	–	160	–	3

Covenant University, Ota	b) Civil Engineering	210	-	1	-
Nasarawa State University, Keffi	a) Physics	70	–	0	–
	b)Mass Communication	–	71	–	2
American University, Yola	a) Communication/Multi-media Design	–	52	–	1
	b) Natural/Environmental Sciences	33	-	1	–
Rivers State University, PH	a) Microbiology	67	–	0	–
	b) Mass Communication	–	49	–	1
University of Nigeria, Nsukka	a) Mass Communication	–	94	-	1
	b) Plant Science/ Biotechnology	85	–	2	–
Total		565 (54%)	486 (46%)	4 (0.71)	13 (2.67)
		1051 (100%)		17 (1.6%)	

Source: Departmental Handbooks of the Six Selected Universities in Nigeria

Table 1 above shows that at the Department of Agricultural and Environmental Engineering, Faculty of Engineering, Bayero University Kano, a total of 100 courses are listed as core/cognate courses, general studies courses, entrepreneurial courses, and none deals with the communication of science whether among peers or with the public. At the same University, at the Department of Mass Communication, 60 courses are listed. Out of these 60 courses, five courses namely Development Communication I, Development Communication II, Specialized Reporting, Health Communication, and Agricultural Communication relate to science communication. However, the course descriptions for Development Communication I show that it is an examination of the applications of mass media as tools for development in developing nations. There is no specific mention of science, technology or innovation as they relate to development. The second part of Development Communication, Agricultural Communication and Specialized Reporting are all listed as optional courses.

At Covenant University Ota, 160 courses are recorded as both compulsory and required courses in several emphases of the Mass Communication program. Of this number, three (3) courses contain elements of science communication as described in the student's manual. These are Specialized Reporting depicted as focusing on the environment, science and technology,

health, politics, and the economy; and Advanced Reporting which underscores science, medicine, and Science & Technology Reporting.

The Civil Engineering Department at Covenant University, Ota lists a total of 210 courses including general, compulsory, elective, industrial training, and university-wide courses. Of these, only one science communication course entitled: Technical/Engineering Communication is offered in the program and pertains public speaking and multimedia presentation skills, equipment manual writing, among others.

Table I equally shows data about the 70 courses mounted in the Department of Physics, Nasarawa State University, Keffi. Out of that number, no course relates to science communication. However, in the Department of Mass Communication in that University, of the 71 courses offered there, two deal with science communication. The first part of the course deals with concepts, definitions, rationale, and importance of science (communication) in society. Part II which is listed as optional emphasizes the translation of scientific materials into lay language and other popular forms.

Additionally, Nasarawa State University Keffi hosts the Institute of Strategic and Development Communication (ISDEVCOM) which has received funding from international donor agencies including Robert Bosch Stiftung to design a model curricular that could assist universities in teaching science communication so as to increase uptake of research findings for the purposes of development. The eventual aim of the project is to make science communication compulsory for students in Mass Communication and all undergraduates and postgraduate students in the Natural and Applied Sciences.

At the American University Yola, Table 1 shows that 33 courses are designated for students of Natural and Environmental Sciences students who may choose to concentrate on Bioinformatics, Biomedical Sciences, Biostatics, Conservation Biology, Environmental Health, and Public Health. Of the 33 courses, one entitled: Communicating in the Sciences, pertains to science communication. The description of this course is not about the popularization of science but how scientists can communicate effectively within the scientific community.

Also, the Department of Communication and Multimedia Design at AUN, Yola permits students to concentrate on Journalism, Public Relations/Advertising, Radio/Film/Television, and in Multimedia Design. A total of 52 courses are offered and one – Specialized Reporting under the

journalism concentration emphasizes the coverage and reportage of special journalism beats which may include science, technology, health, the environment, etc.

In the Rivers State University, Port Harcourt, Table 1 shows that the Department of Microbiology lists 67courses as faculty courses, compulsory/department courses, and required courses. However, an examination of the courses also shows that there is no course that pertains to the public communication of Microbiology. On the other hand, the Department of Mass Communication in the same university details 49 courses as the requirement for student graduation. Of this number, one course is on Science and Technology Reporting depicted in the students' manual as introducing students to the dynamics of writing popular science articles for newspapers and magazines. Emphasis is on translation of scientific language, familiarization with literature of science and interviewing of scientists.

Table 1 also indicates that at the Department of Plant Science and Biotechnology, University of Nigeria, Nsukka, 85 courses are listed in the Departmental Handbook as major, required (ancillary) and elective courses. Of this number, two relate to science communication. They are Phyto-bioinformatics which aims to among others: share biotechnological information using the Internet; and the, Principles of Scientific Writing; dealing with the definitions and history of scientific writing, format of scientific writing, and the use of informational graphics in the design of effective scientific script.

On the other hand, the Department of Mass Communication at the University of Nigeria Nsukka offers 94 courses but only one course pertains to science communication: Specialized Reporting, which is intended to provide instruction in the technique of reporting specialized subjects such as agriculture, medicine, religion, sports, labor, the courts, and the arts. The Development Journalism course described in the manual mainly refers to the role of communication in promotion social change. We do not regard it as a science communication-based course.

In conclusion and with regards to the Research Question One, the total number of science communication-based courses in the six selected universitiesin Nigeria is a mere seventeen (17). The names are listed below:

1. Development Communication I
2. Development Communication II
3. Specialized Reporting
10. Science Communication in Society Part I
11. Science Communication in Society Part II
12. Communicating in the Sciences

4. Health Communication
5. Agricultural Communication
6. Specialized Reporting
7. Advanced Reporting
8. Science & Technology Reporting
9. Technical/Engineering Communication
13. Specialized Reporting
14. Science and Technology Reporting
15. Phyto-bioinformatics
16. principles of Scientific Writing
17. Specialized Reporting

These courses have different degrees of description depending on the university. Even the ones with same/similar titles are described differently in the different Departments/Universities hosting them. Some of these nuances have been captured in the data analysis and discussions above.

Findings and Discussions from Interviews

Research Question No. 2: What is the extent of engagement in science communication research and practice among communication and science academics in selected universities in Nigeria?

To answer this research question, six respondents representing communication scholars, and six representing science scholars in the six selected universities provided responses to ten key questions to gauge their engagement/involvement in science communication. The key areas of involvement/engagements were as follows:

1. engagement in media science activities in print, broadcast, social and new media to popularize science;
2. engagement in citizen science projects involving working with science and communication scholars and lay citizens;
3. participation in regular, formal interfaces with ordinary citizens in cafes, restaurants, public squares, markets, malls, town halls, etc. to promote public understanding of science;
4. involvement in science fairs, science exhibitions, science festivals meant for the public;
5. participation in formulating science policy, STI law-making, budgeting and funding, and provisioning for science centers and science museums;
6. engagement in efforts to promote public understanding of science, dissemination of S&T research output/findings that impact on the public and reduce misconceptions about climate

changes, atomic and nuclear energy, genetically modified crops, and artificial intelligence/robotics.

With regards to the extent to which science communication courses are embedded in the undergraduate, postgraduate, or professional programs of the six selected universities, the interview data indicate that while communication studies programs in the six universities embedded one or two courses in science communication, the science departments were generally deficient on this. However, in several communication programs, science and technology reporting were buried in specialized reporting – a practice that began in the early 1980s. The ideal situation is to offer separate courses in Health Communication, Science and Technology Reporting, Environmental/Risk Communication, and Agricultural Communication so that science communication can have ample space to thrive. The Department of Mass Communication at Bayero University provides a good example but several of those science communication courses are offered as options and not as required or compulsory courses.

On the issue of engagement in media science or science popularization activities in the print, broadcast, social/new media, the summary of the views of the interviewees shows that communication and science scholars were more likely to use the university media – campus radio/television stations, student newspapers and magazines, faculty newsletters and university blog posts and websites to engage in media science or popularize science communication. A further outcome of the interview data also shows that these science and communication scholars rarely used social media and the public media to communicate science. This means that the space for the public communication of science, technology and innovation is somewhat constricted. However, the public media are more accessible to the public; meaning that whatever current effort at communicating science apart from being inadequate is also not effective as most members of the public lack access to such information or communication.

A common theme that runs through all the interview sessions with the Heads of Department and academic leaders in the selected Departments and universities is captured in the words of the then Head of Department of Mass Communication, Nasarawa State University, Keffi thus:

> I cannot say much about science communication engagement in the public media but some activities are going on in the university media. Our students are encouraged to undertake projects, documentaries, etc. in science communication. Not much can be said about new media and the public

media platforms apart from the fact that students are showing more interest in these platforms.

Some of the other Heads of Department interviewed were also of the view that science communication activities were more likely to be done at conferences, workshops, seminars and through active research and publications in learned scholarly journals and science communication books than through the public media.

However, this result is further complicated by literature that suggests a general, bleak picture of the low status of science communication research and practice in Africa and Nigeria (Ndlovu, Joubert & Boshoff, 2016) and the confirmation by Guenther and Joubert's (2017) systematic and bibliographic study of research papers published in three major science communication journals – *Science Communication*, *Public Understanding of Science*, and *Journal of Science Communication (JCOM)* from 1979 – 2016 that revealed poor science communication research output from Africa, Nigeria inclusive. In essence, this study outcome is a further highlight on the low status of science communication research, scholarship, and on the issue of engagement in media science or science popularization activities through the public and/or specialized media.

On the issue of involvement in science fairs, exhibitions, and festivals meant for the public and organized by science and communication scholars, the data show another disappointing outcome. Most of the academic leaders agreed that the engagement at this level had been poor. We, however, found out a more unsettling scenario: the engagement in science fairs, exhibitions, festivals, etc. were carried without cooperation between science and communication academics. The science scholars were involved in solo efforts, and the little done by communication scholars were also solo efforts. The HOD of Civil Engineering at the Covenant University confirmed this thus:

> We hold fairs and exhibitions every year but not with communications people; and they are not solely for the public.

While the HOD of Physics, Nasarawa State University, Keffi also stated:

> We organize exhibitions and award prizes but they are not for the public or in cooperation with communication scholars.

Science fairs, exhibitions and festivals help to involve the public in science, technology, and innovation as well raise public consciousness about the importance and utilization of STI for development purposes. However, as seen above, this aspect of science activities is still held within

the confines of academic science departments and has little or no public engagement or communication. For science communication to take roots in Nigeria, public science fairs, exhibitions, and festivals are necessary and communication experts have to get involved to disseminate their character, dimensions, and benefits.

Another vital element of engagement in science communication research and practice among communication and science academics in selected universities in Nigeria used involvement in the formulation of science/technology policy, legislation, funding and provisioning for science centers and museums as a practical indicator of same. All the HODs and academic leaders interviewed stated that the level of engagement at this level was very poor. The interview outcome indicates that in the selected institutions, there was little or no involvement of science and communication scholars in the formulation of STI policies, laws and the endowment for funding for science communication research and activities.

Policies, legislation, and funding are critical to the survival, growth, sustenance, and advancement of science, technology and innovation in society. Besides, the involvement of key stakeholders such as science and science communication scholars is crucial to success particularly in democratic settings.

Another critical index of measurement of the engagement in science communication research and practice among communication and science academics in the six universities used the scholars' involvement in efforts to promote public understanding of science; disseminate/popularize science and technology researches; and reduce misconceptions about climate change, atomic/nuclear energy, GMOs, and artificial intelligence and robotics. Most of the science scholars said they did very little or nothing in these areas while the communication scholars said some of these issues and concerns were not within the purview of their curricula delivery as academics. The views of the HOD of Communication and Multi-Media Design, American University Nigeria represents the common, expressed opinion thus:

> Our mission does not include the public understanding of science. We are not trained enough in science to be able to popularize its research outputs. We do not really engage in science and technology dissemination. On reducing climate change misconceptions; it is not our department's concern. On misconceptions about nuclear energy: science faculties may be better placed and on GMOs, we sometimes invite experts to address it.

> On Artificial Intelligence and Robotics, we leave that to the discretion of the lecturers who handle related subjects or courses.

The views above were also shared by the HOD of Mass Communication, Covenant University when he stated thus:

> It is not within our responsibility to promote public understanding of science and technology. We expect practicing journalists to do this at the related beat level. We also expect government agencies and re-orientation bodies to be deeply involved in this; not lecturers in the Department. Our primary responsibility is to teach students on how to report, produce, and carry out researches.

The HOD of Plant Science and Biotechnology, University of Nigeria Nsukka (UNN) in a related opinion notes that:

> The major means through which we promote science is through our newsletters, journals, and open access online platforms. We also concentrate our climate change communication efforts on lectures and one of our staff involved in the atomic energy commission orientates us on that occasionally. On GMOs, we manage to teach our students; and for Artificial Intelligence and Robotics, those in computer engineering are better placed to handle that.

This viewpoint pervades the science and communication scholars' reactions as expressed in the interview conducted for the purpose of this study. In essence, the information obtained from the science and communication scholars has shown that most respondents whether in the sciences or communication disciplines restricted their science communication endeavors to the lecture rooms and academic circles; to the exclusion of the public including the public media.

This is not ideal and should be discouraged. Science is for society. As Maina (2019) notes, science and technology are the bedrock of advanced societies and key drivers of strong economies. Chetty (2012) further supports this when he argues that developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic development. Science and technology also play a major and significant role in most aspects of our daily lives - economic, social, political, educational, religious, and cultural (Reddy *et al*., 2013) and they will continue to occupy outstanding positions in the scheme of things

because scientific and technological knowledge are critical for the development of any society (Kraker *et al*., 2016). Nigerian science and communication academics should key into this.

Based on these findings, it is our informed opinion that science and technology can only make sense when the values and utilities are clearly communicated to the public who make that value call. Science and technology on their own mean little or nothing until their niftiness is communicated to the appreciation of the public who make use of the end products. Therefore, if scholars are to contribute seriously to the public understanding of science, technology and innovation, they have to find ways of engaging with the public. This would help reduce misconceptions about science and perhaps help accelerate development Nigeria.

Research Question No. 3: How do communication scholars and science academics in the selected universities compare in their involvement in science communication?

The discussion above that helped to answer research question two have no doubt shown the extent of engagement in science communication research and practice among communication and science academics in the six universities in Nigeria selected for this study. However, with regard to how communication scholars and science academics compare in their involvement in science communication, the answer is the same as the narrative presented for research question two. Both sets of scholars have done poorly in most of the assessed areas and aspects of involvement or engagement. In other instances, we have seen a "not as worse" performance for the communication academics in this regard. For instance, of the 565 courses mounted by the six science departments studied, only four courses are science communication-based. This represents a disappointing 0.71% of the total course structure while the six communication departments yielded 486 courses but had 13 science communication-based courses, which represents 2.67%. This is also poor but better than the science departments.

This same scenario played out in the interviews as more communication academics were more engaged in science communication teaching, research, scholarship, and ancillary activities namely engagement in media science activities in print, broadcast, social/new media to popularize science; and engagement in citizen science projects involving working with science and communication scholars and lay citizens.

However, science academics engaged more and seemed to be slightly better in their participation in regular, formal interfaces with ordinary citizens in cafes, restaurants, markets,

malls, town halls, etc. to promote public understanding of science; involvement in science fairs, science exhibitions, science festivals meant for the public; participation in formulating science policy, STI law-making, budgeting and funding and endowment for science centers and science museums; and engagement in efforts to promote public understanding of science, dissemination of science and technology research output/findings that impact on the public; and helping to reduce misconceptions about climate changes, atomic and nuclear energy, genetically modified crops, Artificial Intelligence and Robotics.

CONCLUSION

Drawing from the findings obtained from the two data sources: content analysis and interviews, we conclude that while communication scholars were a little better than the scientists in science communication, both sets of academics were not giving science communication the needed emphasis. The qualitative data obtained from oral interviews of science and communication scholars in the six universities also generally affirmed the results obtained above that science communication courses were marginally embedded in the course content of communication students and more so for science students; and that both sets of respondents showed or were showed limited, deficient, inadequate, and discouraging involvement in science communication practices

Based on the above, we propose that science and communication scholars and their leaders commit to widening the opportunities for students to be trained in science communication considering the overarching importance of science and communication to development. Courses in health/medical/bioscience communication, science and technology communication, innovation communication, climate science communication, space science communication, emerging science communication, communication of contentions science, agricultural communication, risk communication, environmental/ecological communication, crop/soil/animal/earth science communication should be given strong considerations in any revised curricula of departments in both science/technology and communication/media.

Science and communication scholars should not concentrate their activities in teaching and individual research. They should grow their science communication skills and harness their scholarly researches toward aiding the public understand science, technology, and innovation. This

should be done through public science communication, citizen science projects/programs, media science, and virtual/online science communication, etc.

University authorities and funding organizations such as the National Universities Commission, the Tertiary Education Fund and other professional bodies covering the sciences and communication studies disciplines; and the scholars themselves should do more to encourage joint studies, joint authorship, joint programs/projects, scholar exchanges, and student exchange programs in intra-disciplinary, inter-disciplinary, trans-disciplinary and multi-disciplinary ways at the local, national and international levels. In these ways, the benefits of science/communication synergies and can easily be reaped.

Communication and science scholars should also be actively involved in local and national efforts, directed towards the formulation of STI policies and laws, prompt and timely establishment of science and technology parks, centers and museums, regular staging of STI fairs, exhibitions, expos, and festivals as well as advocacy for funding of STEM and the improvement of science and science communication infrastructure and culture.

REFERENCE

Agwu, A. E. & Amu, C. J. (2013). Framing of climate change news in four national daily newspapers in Southern Nigeria. Paper presented at the Impacts world international conference on climate change effects, May 27-30, Potsdam, Germany.

Ashwell, D. (2012). Barriers to the public communication of science: Commercial constraints versus public understanding. Prism 9 (1). Accessed from http://www.prism journal.org/fileadmin/9_1/Ashwell.pdf on 23 April 2020.

Ausiello, D. (2007). Science education and communication. *The Journal of Clinical Investigation*, 177 (10), 3128-3130.

Bakyawa, J., Devlin, M., Serwadda, D. & IJsselmuiden, C. (2013). Implementing a health research communication programme in a low resource country: Experience from Uganda's Makerere University School of Public Health. *Scholarly and Research Communication*, 4 (2), 1-20.

Batta, H. E., Ashong, A. C. & Bashir, A. S. (2013). Press coverage of climate change issues in Nigeria and implications for public participation opportunities. *Journal of Sustainable Development*, 6 (2), 56-69.

Batta, H., Ashong, A. & Obot, C. (2014). Science, nano-science and nano technology content in Nigeria's elite and popular press: Focus on training and socio-political involvement. *New Media and Mass Communication*, 31, 9-19.

Batta, H., Ekanem, I. & Udosoro, N. (2014). Techno-scientific temper of three Nigerian newspapers. *Developing Country Studies*, 4 (26), 57-67.

Batta, H. E. (2019). Interest and involvement in science communication among Nigerian communication academics. *UNIUYO Journal of Humanities*, 23 (2), 463-496.

Borchelt, R. (2012). The science communication research literature mapping project. Plenary paper presented at the 12th International Science and Technology Conference. URL: http://www.slideshare.net/OPARCI/firenze-phd.slides.

Bucchi, M. & Trench, B. (2014). *Routledge Handbook of Public Communication of Science and Technology (2nd Ed.)* Routledge.

Burns, T. W., O'Connor, D. J. & Stocklmayer, S. M. (2003). Science communication: A contemporary definition. *Public Understanding of Science*, 12 (2), 183-202.

Chetty, L. (2012 October). The role of science and technology in the developing world in the 21st Century. *Ethical Technology*. Retrieved from ieet.org/IEET2/print/6596.

Clayton, J. & Joubert, M. (2012). The need for an African science news service. Prepared on behalf of SciDev.Net for the UK National Commission of UNESCO. URL:http://www.southernscience.co.zaldownloads/african-news_service_need.pdf.

Coleman, A. (2012). Toward delivering e-health education using public internet terminals (PIT) systems in rural communities in South Africa. *Journal of Science Communication*, 11 (04), A01.

Cortassa, C. (2016). In science communication, why does the idea of a public deficit always return? The eternal recurrence of the public deficit. *Public Understanding of Science*, 25 (4), 447-459.

DeRosier, C., Sulemana, I., James, H. S., Valdivia, C., Folk, W. & Smith, R. D. (2015). A comparative analysis of media reporting of perceived risks and benefits of genetically modified crops and foods in Kenya and international newspapers. *Public Understanding of Science*, 24 (5), 563-581.

Dubow, S. (2006). *A commonwealth of knowledge: Science, sensibility and white South Africa 1820-2000*. New York, USA: Oxford University Press.

Fish, D., Allie, S., Pelaez, N. & Anderson, T. (2016). A cross cultural comparison of high school students' responses to a science centre show on the physics of sound in South Africa. *Public Understanding of Science*, 26 (7) 806-814. Doi 10. 1177/0963662516642725.

Gascoigne, T. & Metcalfe, J. (2017). The emergence of modern science communication in Australia. *Journal of Science Communication*, 16 (03), A01-18.

Gastrow, M. (2015). Science and the social media in an African context. The case of the square kilometer Array Telescope. *Science Communication*, 37 (6), 703-722.

Gidado, R. (2017). Humanising science. Paper presented at the 2nd International conference on science in Africa. Accessed from https://dailytimes.ng/2019/10/18/science-communication-key-in-promoting-food-security-in-nigeria-gidado/ on 28 December 2019.

Gould, J. (2019). The importance of science communication. Retrieved from blogs.nature/ naturejobs/2014/09/04/the-importance-of science-communication/.

Gregory, J. & Miller, S. (1998). *Science in public: Communication, culture and credibility*. Plenum Trade.

Guenther, L. & Joubert, M. (2017). Science communication as a field of research: Identifying trends, challenges and gaps by analyzing research papers. *Journal of Science Communication*, 16 (02), A02-19.

Hin, L. & Subramaniam, R. (2014). Challenges facing developing countries in communicating science to the public. In: L. Hin & R. Subramaniam (Eds.) *Communicating science to the public: Opportunities and challenges for the Asia-Pacific region* (pp. 213-222). Springer.

Inspiring Australia (2010). A national strategy for engagement with the sciences URL:https//industry.gov.au/science/inspiringAustration/documents/inspiringAustraliaRport.pdf (visited on 16th December 2019).

Karikari, T. R., Yawson, N. A. & Quansah, E. (2016). Build the future of science communication in developing countries through systematic training of young scientists. *Journal of Microbiology and Biology Education*, (December), 327-328.

Kraker, P., Dorler, D., Gutounig, R., Heigel, F., Kaier, C., Rieck, K., Simukovic, E. & Vignoli, M. (2016). The Vienna principles: A vision for scholarly communication in the 21st Century. Open Access and Scholarly Communication of the Open Access Network Australia (OANA).

Krutwich, R. (2008). Tell me a story. Engineering and Science. *Caltech Magazine*, 71 (3), 10-16.

Lucibella, M. (2009). Science journalism faces perilous times. *American Physical Society News*, (April), 18 (4), 10-18.

Lugalambi, G. M. & Nyabuga, G. W. (2011). Media coverage of science and technology in Africa. UNESCO. Accessed from https://www.unesco.org/new/fileadmin/ MULTI MEDIA/ HQ/CI/CI/pdf/official_documents/ science_tecnology_reporting_africa.pdf on 21 December 2019.

Maina, B. (2019). Inspiring a next generation science in Africa through science communication. Accessed from https://fenskavlinetwork.org/inspiring-a-next-generation-science-in-africa-through-science-communication. on 23 December 2019

Massarani, L. & DeCastro-Moreira, I. (2016). Science communication in Brazil: A historical review and considerations about the current situation. *Anaisda Academic Brasileira de Ciencias*, 88 (3), 1577-1595.

Massarani, L. (2015). Voices from other lands. *Public Understanding of Science*, 24 (1), 2-5.

Matheu, J. & Wanjala, R. (2009). The public, parasites and coffee: The Kenyan science café concept. *Trends in Parasitology*, 25 (6), 245-262.

Meribe, N. I. & Oke, B. R. (2019). Media coverage and public understanding of climate change, migration and conflicts in Nigeria. *The Nigerian Journal of Communication*, 16 (1), 139-156.

Meribe, N. I. & Oke, B. R. (2017). Climate change reporting in Nigeria: Challenges and implications for development. *The Nigerian Journal of Communication*, 14 (1), 133-162.

Ndlovu, H. Joubert, M. & Boshoff, N. (2016). Public science communication in Africa. *Science Communication*, 15 (6), A05-21.

Nyirenda, D., Makawa, T. C., Chapita, G., Mdalla, C., Nkolokosa, M., Obyrne, T., Heyderman, R., & Desmond, N. (2016). Public engagement in Malawi through a health talk radio programme 'Umoyo Nkukambirana': A mixed methods evaluation. *Public Understanding of Science*, 23 (5), 201-219.

Olson, R. (2009). *Don't be such a scientist: Talking substance in an age of style (1st Ed.)*. Island Press.

Potvin, P. & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K-12 levels: A systematic review of 12 years of educational research. *Studies in Science Education*, 50 (1), 85-129.

Raza, G., Singh, S. & Dutt, B. (2002). Public, science and cultural distance. *Science Communication*, 23 (3), 293-308.

Reddy, V., Gastrow, M., Juan, A., & Roberts, B. (2013). Public attitudes to science in South Africa. *South African Journal of Science*, 109 (12), 1-8.

Requier, F., Fournier, A., Rome, Q., & Darrouzet, E. (2020). Science communication is needed to inform risk perception and action of stakeholders. *Journal of Environmental Management, 257,* 109983.

Schafer, M. S. (2011). Sources, characteristics and effects of mass media communication on science: A review of the literature, current trends and areas for future research. *Sociology Compass*, 5 (6), 399-412.

Shineha, R., Inoue, Y., Ikka, T., Kishimoto, A. & Yashiro, Y. (2016). Gaps in attitude toward science and technology between scientists and the public: The case of stem cell research and regenerative medicine. Accessed from http://www.oecd.org/sti/066-20160723_ BLUE SKY _3 on 23 December 2019.

The Royal Society (2006). *Survey of factors affecting science communication by scientists and engineers*. The Royal Society, London.

Thomas, G. & Durant, J. (1987). Why should we promote the public understanding of science? Scientific literacy papers: *A Journal of research in Science Education and the Public*, 1, 1-14.

Trench, B. (2012). Vital and vulnerable: Science communication as a university subject. In: Science communication in the world. In B. Schiele, M. Claessens & B. Shi (Eds.) *Science communication in the world (*pp. 241-257). Springer.

Trench, B., & Bucchi, M. (2010). Science communication and emerging discipline. *Journal of Science Communication*, 09 (03), 103-119.

Tsanni, A. (2019). Analysis: Bridging the gap between science and society in Nigeria. Accessed from www.africannewspage.net/2019/10/ on December 11, 2019.