

INFORMATION SYNTHESIS: AN INDEX OF GRADUATE STUDENTS' RESEARCH PRACTICES IN THE UNIVERSITY LIBRARIES OF SOUTH EAST NIGERIA

By

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Abstract

Information synthesis is an integral part of information literacy. It is a key attribute of a good research practice and research work. Thus, this study aimed at ascertaining the level at which graduate students' information synthesis influence their research practice. One hypothesis and research question guided the study. The research adopted ex-post facto research design. The population of the study consisted of 5565 registered graduate library users in the university libraries of South East Nigeria. The sample size was 556 which was derived through a proportionate random technique. The instrument used in collecting data was a self-developed questionnaire which was duly validated and certified appropriate by experts in the field. Analysis of data was through linear regression for the hypothesis and mean and standard deviation for the research question. The findings of the study showed that information synthesis skills of graduate students in the university libraries of South East of Nigeria can adequately predict their research practices. The findings further revealed a few weak areas of the information synthesis of graduate students, which include difficulty in reading through lengthy text or article; restating ideas from other sources in own's language and inability to draw conclusions from multiple sources. The study recommended that library educators and librarians as well as the faculty members should concentrate more on areas that present more difficulty for students; and constantly expose students to information synthesis tasks.

Keywords: Information synthesis, Information literacy, Graduate students, Research practices

Introduction

Every sphere of the society today is driven by information and information related activities. Information is now a critical resource for success in all spheres including education, research and development. Information is data which have been processed and is used to solve problems and

take decisions. They are contained in book and non book resources and come in various sources which also reflect the nature of information. Students need these information for their learning and research needs. It is the growing amount of information and people's increasing dependence on it for decision making and solution that make this era to be christened 'the information society'. The amount of information and information sources have continued to expand at an unprecedented rate necessitating knowledge of information literacy. Information literacy is the ability to recognize when information is needed, the ability to locate, synthesize, evaluate, and use effectively the needed information to accomplish a task or to make decisions.

Information synthesis as a fundamental component of information literacy involves sampling ideas, reorganizing, analyzing them and drawing conclusions. New knowledge is often produced in the process. Synthesis entails writing or drawing conclusion from multiple sources and demonstrating further how the sources relate to a research topic. Scholars both in education and across disciplines agree that synthesis is a higher order skill as well as a difficult one and that students' attempts at information synthesis is inadequate (Amigo, Gonzalo, Peinado, Penas, & Verdejo, 2004; Frye, 2010). This may be the reason students write mere summaries and reviews while doing a literature review in the research process, or presenting one side of an argument and sometimes presenting opinions and tentative statements in absolute terms. Moreover, writing from multiple sources naturally presents a challenge of organizing the sources in a meaningful way and according to the purpose of writing. Information literacy intervention is therefore given to students to help them through their learning and research endeavours. The root of information literacy as an essential skill in inquiry and learning is traceable to the library instruction and bibliographic instruction movements. (Bruce, 2002).

Graduate students particularly, are a peculiar students' population in the universities and they are basically into research. It is important therefore that these students possess good research practices more so as it is assumed they have been exposed to information literacy since their undergraduate days. Research practices thus are those behaviors, attitudes, skills, processes, and standards which are consistent with good research product and quality (Obasi, 2020). Research practices of students are important predictors of the quality of research works produced by them. When good practices are upheld during research investigation and report, there is the likelihood that the outcome will be of excellent quality. If the process undertaken to reach the research goal is based on sound and standard practices, there is a chance that the outcome would be good. On the other hand, bad research practices are capable of engendering misleading information which may even be contrary to the researcher's intention.

Researches carried out in the universities are done by faculty members, graduates, and undergraduates. For graduate students, their research works and reports are communicated through seminar papers, projects, theses and dissertations. New and additional knowledge are produced as a result. These new and additional knowledge engender development in the individual fields and cumulatively for the development of societies. Quality research is therefore of essence in university education. However, the way students approach the research process, information wise, hardly portrays a deliberate and systematic attempt at achieving quality research. In a similar vein, since scholars have isolated synthesis skill among others for the reasons of it being a higher order skill, requiring critical and analytical skills, all of which are important in learning and research and have as well observed signs of inadequate information synthesis, it becomes pertinent to ask in

this study, how could information synthesis predict graduate students' research practices in the university libraries of South East Nigeria?

Statement of the Problem

Information synthesis is an important skill in learning. It is a skill that is deployed when writing from many sources or texts. This is because the ideas gotten from those sources, no matter how they differ or relate, need to be combined in a way to produce new meaning. Information synthesis is a higher order element in information literacy. In information synthesis, a researcher reads critically and thinks from different perspectives and reproduce a new meaning. Researchers are expected to apply information synthesis principles in the research process in order to achieve quality research practice and product. However, the increasing rate of unhealthy research practices and other problems associated with research among university students is worrisome. At the graduate level, faculties and institutions are inundated with instances of plagiarism, duplication of research reports and copy-pasted works. The issue of excessively long period of completing research and presenting same is common among graduate students. This has been widely observed by scholars as well as by the researcher in the course of attending graduate students' seminar and research presentations. This disturbing situation calls for a solution. Attempts have been made to address the issue such as organizing seminars and conferences on research, as well conducting studies on the likely cause of the problem, linking it such factors as funds, health, and supervisor-supervisee relationship and so on. Yet the problem persists. This may lead to low quality research thereby stifling research assets of our universities in particular, and university education in general. Research quality would be compromised and research for development may be a far cry. There have been works on information literacy generally, but none has empirically isolated information synthesis among graduate students, nor related it to graduate students' research practices. It is against this background that the researcher seeks to carry out this study to determine the influence of Information synthesis on graduate students' research practices in the university libraries of South East, Nigeria.

Hypothesis

This null hypothesis below guided the study.

There is no significant influence of information synthesis on graduate students' research practices in the university libraries of South East, Nigeria.

Research Question

What level of influence exists between graduate students' information synthesis skills and their research practices in the university libraries of South East, Nigeria?

Theoretical Framework

This study anchors its framework on two theories namely; identical elements theory and social cognitive theory.

Identical Learning Theory

This theory was propounded by Edward Thorndike and R. S. Woodworth in 1901. Thorndike and Woodworth's transfer of learning theory is based on the proposition that learning can be transferred from one context to another related context. Their theory implied that transfer of learning depends on how similar the learning task is, which is now known as theory of identical

elements. The theory of identical element is one of the first theories of learning. The basic features of this theory are shared elements, transfer of learning, and recognition and recall.

Shared Elements states that when two tasks share the same elements, transfer of learning will usually occur. The authors also propose that the greater the degree of the shared identical elements, the greater the amount of the transfer of learning thus making learning easier in the second situation. Elements here mean the features that both tasks shared. Thus, any two tasks which have shared features of a set of stimulus are potential candidates for transfer of learning.

Recognition/Recall: The critical step in the transfer process is recognition- being able to recall a previous situation and recognize when a previous problem situation or task shares familiar features with a present task or situation.

Transfer of learning: Transfer of Learning would take place when what was learned in previous situation has aided in the understanding and learning of newer task. Transfer of learning increases the speed of learning.

The implication of this theory is that when students master the skills of information synthesis and are aware of their application in information problem-solving tasks such as research and apply them, they would mostly likely engage in good research practices which would result in good research products and outputs.

The Social Cognitive Theory (SCT): This theory was formerly known as the Social Learning theory in 1977. Then it presented environment as the most important influence of human behavior. This argument was modified by Bandura in 1981 who observed the major role of cognition in encoding and performing behavior, thus, the social cognitive theory. Other constructs of the social cognition theory are self-efficacy, observational learning/modeling and reinforcement.

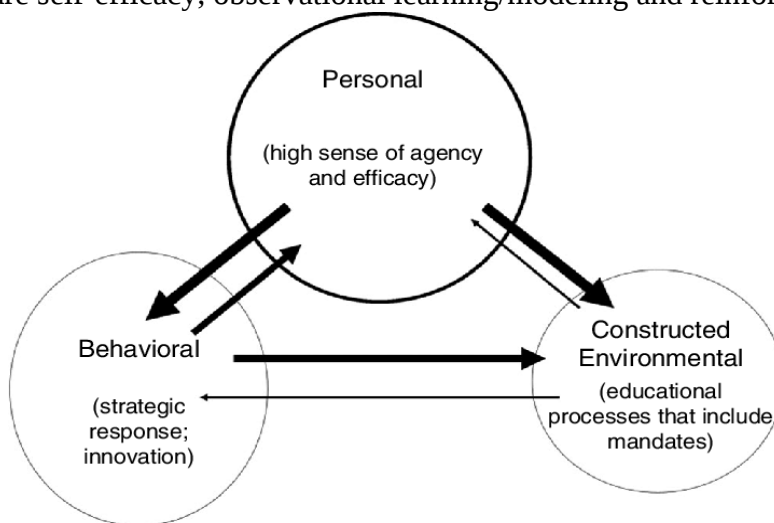


Figure 1: Bandura's Social Cognitive Theory Triadic reciprocal Causation Model
Source: Michael (2016)

Environmental Influence: Bandura proposes that people observe and imitate models they encounter in their environment. If a learner's environmental conditions are conducive by the help of necessary materials and support, the individual's confidence (self-efficacy) in taking actions is

enhanced. The learner also influences his environment just like environment influences him. Bandura calls it a bidirectional relationship.

Personal influence (Cognition): While the theory postulates the fact of learned behavior through exposure to the environment, it acknowledges the centrality of the individual person as affecting observational learning. In other words, after observing a behavior, the learner can have low or high self-efficacy towards the behavior. Observational learning is therefore not automatic. It depends on the individual's perceived ability to execute the behavior successfully.

Self-efficacy: Self-efficacy is having the confidence in the ability to take action and also persists in the action. It greatly determines an individual's change in behavior because the individual filters any expected outcome through his expectation or perception of whether or not he is able to perform the behavior in the first place. Hence, once students are equipped with skills that will facilitate the performance of a desired behavior or change, their confidence level will increase to take actions. Self-efficacy can be increased. Three methods of increasing it are: providing clear instructions, providing opportunities for skill development or training, and modeling the desired behavior.

Thus the theory relates to this study on the bases of building confidence and creating varying opportunities to demonstrate a behaviour that has been observed and learnt (information synthesis boosting confidence of engagement in research) and bringing to fore the potency of reward in increasing the propensity to undertake a task.

Literature Review

Information synthesis is closely related to determining importance. A reader identifies what is important in a text or texts, and goes through the process of organizing, recalling and recreating the information and fitting it in what is already known. Information synthesis is about organizing the different piece to create meaning. Lundstrom, Diekema, Leavy, Haderlie and Holliday (2015) see information synthesis as the process of analyzing and evaluating information from various sources, finding the connections among the information located and then bringing them together in addition with the researcher's knowledge to create something new.

Likewise, Clevenger (2011) posits that synthesis involves combining two or more theses or ideas in a meaningful way to make a point. The author notes that those ideas might be contained in more than one text; so that the reader needed to reorganize them according to themes put forth by the researcher and driven by the thesis. By these definitions, it is clear to see that synthesis does not mean summary (Gregg and Gregg, 2013), what Sparks and Deane refer to as knowledge telling, that is, summarizing articles sequentially instead of integrating them, particularly in reviewing literature. Neither does synthesis mean using many sources to write as has been observed in many write-ups and muted by scholars such as Amigo, (2004), Clevenger, (2011) Frye, (2010), and Sullivan, (2014). Rather, in addition to using and varying sources, and summarizing them, synthesis finds and explicates link between and among sources for the purpose of constructing something new. Without information synthesis therefore, new knowledge cannot be derived from large amounts of data.

Synthesis has been described as time consuming and mentally tasking (Goldschmidt as cited by Lundstrom, Diekema, Leavy, Haderlie, and Holliday, 2015), as cognitive-demanding (Amigo 2004); as an abstract activity (Sullivan, 2014). Scholars have equally seen synthesis as a higher form of educational thinking (Lundstrom *et al.*, 2015); being more difficult than appeared

(Clevenger, 2011) and even a risky endeavour which according to Flower *et al.* (as cited in Lundstrom, *et al.*) is where the reader's experience and knowledge, the text, and 'reality itself may resist synthesis'. According to the authors, the reason is because synthesis involves multiple activities such as organization, comprehension, problem-detection and problem-solving. These activities need to be well coordinated and combined in a meaningful and effective way. In the same vein, Goldman (2004) describes synthesis as requiring complex processing.

Information synthesis is not actually a new skill in writing, in research or in everyday living. People synthesize without even knowing it. Sullivan emphatically says that anyone (including students) who has written a research paper has written a synthesis. Sullivan in this assertion is likely relating synthesis to writing from many sources. Sullivan (2014) opines that writing from multiple sources is a great synthesis skill. Sullivan however cautioned that mere having multiple sources in a write-up does not translate to synthesis rather those sources must show relationship with the thesis. On the place of synthesis in the research process, Clevenger (2011:4) stated thus:

The key to writing any researched essay is to read well, to understand the main idea and developmental structure of source articles, and to identify the points of contact between the various sources and the researcher's argument. This means seeing how they agree, disagree, reinforce, subvert, explain, and contradict one another in the context of your thesis.

Similarly, Mackillop (2016: 11) opined that:

The key to effective synthesis is to collect enough data to understand the fundamental concepts. Use a variety of sources and mediums to develop your knowledge base — read articles and books, talk about your ideas with those in the know, watch what happens around you. Look for opinions that differ from your own to ensure you have considered all different perspectives. The more information you have to draw from, the easier it will be to make informed, justifiable decisions to keep your start upon track and on the road to success.

Research is a process which employs principles, skills, and practices to be done well. It is an investigation undertaken in order to discover new facts, and get additional knowledge. Research is the bedrock of scholarship. Researches carried out in the universities are done by faculty members, graduates, and undergraduates. Thus the relationship between synthesis and learning and research is well documented in literature but its mastery and application by students is doubtful. Buttressing this fact, Sparks & Deane (2015) noted that a key practice of conducting research include relevant strategies for participating in a research community and ability to gather and synthesize information from multiple sources.

Previous studies have looked at assessing information synthesis of younger student learners. Gregg & Gregg (2013) observe that students' attempt at information synthesis ends in writing summary. Sparks & Deane (2015) in their study, found out the same trend. They referred to students' understanding of synthesis as knowledge telling, that is, summarizing articles sequentially instead

of integrating the sources, especially in writing literature review. In the same vein, Amigo (2004), Clevenger (2011), Frye (2010) and Sullivan (2014) report that students often mistake the use of many sources to mean synthesis, while in essence, synthesis finds and explicates link between and among sources in addition to using and varying those sources, and summarizing them, for the purpose of constructing something new. Without information synthesis therefore, new knowledge cannot be derived from large amounts of data and information.

Related studies in which information synthesis has been reported to be low among students are (Lundstrom, *et al.*, 2015; Mateos and Soles, as cited in Lundstrom, *et al.*, 2015). In Mateos & Soles study on synthesis competence, only 50% of high school and university students who were studied could successfully synthesize. Lundstrom *et al.* used 'source' factor in determining information synthesis in students work. The researchers reported that number of sources did not necessarily correlate with a student's ability to synthesize information. The study also indicates that in some instances, treated group and control group got same score even though the former had more sources in the work than the later. Thus, proper use of source is important more that the number of source. For instance, using sources that represent many perspectives is better that one that speaks the same view.

Synthesis remains a difficult skill for students to master as posited by scholars (Howard, Serves & Rodigue 2010; Mackilllop 2016; Sparks & Deane, 2015. However, Lundstrom et al studies show that the treatment group fared better than the control group even though both groups' information synthesis was low. The treatment group had received information synthesis lesson prior to the test. Hence, studies have recommended constant exposure of students to tasks that involve information synthesis as well as instructional intervention to master synthesis skills. This present study seeks to fill the gap of examining higher level students assumed to have received information literacy as well as having being exposed to tasks that demand the deployment of information synthesis including their research. Furthermore, this study fills the gap of information synthesis and research practices of graduate students in South East Nigeria universities.

Methodology

The research design adopted for the study is ex-post facto. An ex -post facto investigation seeks to reveal possible relationships by observing an existing condition or state of affairs and searching back in time for plausible contributing factors. It is a design used in a research where the researcher has no control of the independent variable (Lammers and Badria, cited in Akinlua, 2019). Ex -post facto is appropriate for this study because the study seeks to determine the level at which information literacy of graduate students is a plausible contributory factor to their research practices; besides the researchers had no control over the independent variable. The area of the study is South East Nigeria. The population of the study comprises 5565 graduate students registered users in six university libraries in South East Nigeria. The universities are Abia State University, Uturu, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Ebonyi State University, Abakiliki, Imo State University, Owerri, Nnamdi Azikiwe University, Awka, and University of Nigeria, Nsukka. These institutions were selected because they are conventional universities and as such they have more and expanded postgraduate programmes than the specialized universities.

Sample size is 556. Proportionate sampling technique was employed to select the sample size (10%) from each of the institutions, while simple random technique was adopted to select the actual respondents in each institution. A researcher -developed questionnaire was used to collect data. The instrument was subjected to face validity and reliability testing. Following the validates' suggestions and corrections, the number of items was reduced; complex and ambiguous items were re-casted. In addition, the instrument had a reliability coefficient of .804, using Cronbach alpha. Data were analyzed with the use of Mean and Standard deviation for the research question while linear regression was used in testing the hypothesis at 0.05 level of significance.

Results

Table 1: Mean and Standard Deviation of graduate students' information synthesis skills and research practices

Information Synthesis	N	Mean	SD	Remark
I find it difficult reading through lengthy text/article during a search	556	3.35	.83	High
I do not always understand content when I read	556	2.72	.99	High
I can summarize text/article effectively	556	2.31	1.22	Low
I possess skills to organize pieces of information from many sources to create meaning	556	2.97	1.03	High
I know why I need other sources for an information need	556	3.03	.90	High
I can use sources very effectively	556	2.82	.86	High
I have expertise to find connections among different texts/sources in a way they relate to an information problem	556	2.53	1.01	High
I cannot identify gaps in knowledge after reviewing sources	556	2.83	.91	High
I can recognize patterns among information sources/ideas e.g. differences, patterns	556	2.40	.80	Low
I can restate ideas from other sources in my own language	556	2.47	.84	Low
I can draw conclusions from multiple sources	556	2.18	1.02	Low
I can detect contradictory information in an article/text which I am consulting	556	2.55	1.00	High
Grand Mean	556	2.68		

Source: Field Data

(Criterion mean- 2.50)

The result in Table 1 indicates the type of influence that existed between graduate students' information synthesis skills and their research practices in the university libraries of South East of Nigeria. Out of the twelve items that measured students' information synthesis skills, three indicated low influence, while nine indicated high influence. However, the grand mean of 2.68 indicated that graduate students' information synthesis skills has a high influence on their research practices in universities in South East Nigeria. The item "I find it difficult reading through lengthy text/article during a search" with a mean of 3.35 has the highest influence while the item "I can draw conclusions from multiple sources" with mean of 2.18 has the least influence.

Table 2: Regression Analysis of graduate students' information synthesis skill and their research practices

Sources of Variance	Sum of Squares	Df	Mean Square	F-cal.	F-cri.
Regression	25625.57	1	25625.57	286.96	3.86
Residual	49521.17	554	89.39		
Total	75146.74	555			

R = .689; $R^2 = .474$

Table 2 indicates that the calculated F-value (286.96) is greater than the critical F-value (3.86) at 1 and 554 degrees of freedom and .05 level of significance. This implies that the R^2 -value of .474 is significant. The null hypothesis therefore is rejected. Hence, information synthesis skills of graduate students in the university libraries of South East of Nigeria can adequately predict their research practices.

Discussion

The research findings showed that information synthesis ability has a significant influence on graduate students' research practices. This is because the grand mean of 2.68 meant a high influence of information synthesis on the graduate student' research practices. Also, table 2 indicated that calculated F value was greater than the critical value, resulting in the rejection of the null hypothesis. Moreover, the value of coefficient of determination (R^2) was significant. This finding corroborates the assertion of Clevenger(2011) that the key to writing any research work is information synthesis which according to him translates to reading well, understanding the central ideas of the piece, identifying the relationship, disagreement, and contradiction between the piece and the researcher's argument or thesis. The relationship of information synthesis and research has also been muted by other scholars. Sullivan (2014) averred that anyone (including students) who has written a research paper has written a synthesis. Sullivan in this assertion was likely relating synthesis to writing from many sources. Sullivan (2014) added that writing from multiple sources is a great synthesis skill. This is because the researcher needed to consult information from many sources, analyze and reorganize the information to create new meaning.

Lundstrom *et al.* (2012) findings also support the influence of information synthesis on research. The researchers' findings showed that the treated group fared better than the control group when the students were asked to synthesize a 52 paragraph piece and while assessing their final research essay. Thus, the information synthesis lesson intervention had effect on the students because there was a significant difference between the two groups. However, the level of synthesis generally was reported to be low for both groups. This is in agreement with the researcher's findings for this

variable. Among the other variables, information synthesis ranked third. Synthesis has been described as a time and resource-consuming task (Goldschmidt as cited by Lundstrom, *et al.*, 2015), as cognitive-demanding (Amigo *et al.*, 2004); as an abstract activity (Sullivan, 2014). Scholars have equally seen synthesis as a higher form of educational thinking (Lundstrom *et al.*, 2015); being more difficult than appeared (Clevenger, 2011) and even a risky endeavour which according to Flower *et al.* (as cited in Lundstrom, *et al.*) is where the reader's experience and knowledge, the text, and 'reality itself may resist synthesis'. According to the authors, the reason is because synthesis involves multiple activities such as organization, comprehension, problem-detection and problem-solving. These activities need to be well coordinated and combined in a meaningful and effective way. This means that information synthesis cannot be left to chance and serendipity, since it cannot be avoided in the research process. It needs to be learnt and mastered, thus, reinforcing the need for a vigorous information literacy programme.

The findings further revealed a few weak areas of the information synthesis of graduate students, which include difficulty in reading through lengthy text or article; restating ideas from other sources in own's language and inability to draw conclusions from multiple sources. This indicates that graduate students would have some problems in their research in these areas if they are not addressed. Scholars such as Gregg and Gregg (2013), Sullivan (2014) Sparks and Deane (2015) confirmed these areas of difficulty, stating that students normally write mere summaries when in actual sense they are expected to synthesize, that is, explicating link between and among sources for the purpose of constructing something new. This is attributed to the fact that synthesis is a highly complex mental task. It is a combination of many activities and processes which needs to be well coordinated. It also require a lot of time.

Conclusion

Based on the findings of the study, it can be concluded that for graduate students' research practices can be significantly influenced by information synthesis skills for quality research works. Thus, when information synthesis is sufficiently addressed in the information literacy programme in the university libraries and in the classroom, it is an indication that a major part of the research issues of graduate students would be taken care of. In view of this, efforts should be made by Library educators and Librarians to concentrate more on areas of information literacy that present more difficulties for students, such as reading, comprehension and synthesis skills. This should also be followed up with an effective feedback mechanism in order to monitor extent of its internalization and subsequent application to learning and research. Librarians should collaborate with faculty members by sensitizing them on the need to engage students in regular information problem solving tasks that will involve using synthesis skills, as well as varying the tasks, so that the students will be trained on analyzing and reorganizing information from multiple sources in order to construct new meanings.

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