Logic and the Nigeria Polytechnic Education System

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ABSTRACT
Many polytechnic students encounter a lot of intellectual, academic and social challenges such making of costly and regrettable mistakes, difficulty in presenting their good, sincere and genuine issues or needs due to contradictions and violations of logical principles in their reasoning, difficulty in completing and defending their project works required for graduation due to lack of clarity, precision, and consistency that deface their presentations, falling prey to the menaces of 419 fraudsters and ritual killings, and deceptions into joining secret cults. These problems and difficulties are associated with lack of knowledge of logic, a science of reasoning which equips one with logical principles, the techniques of assessing the validity and soundness of arguments, and the knowledge of the application of the fundamental rules and methods of consistency in reasoning. This paper is aimed at educating polytechnic students on knowledge of logic that will help them in intellectual, academic and social life on campus. The methodology employed in this study includes analysis, prescription, application, and speculation. The study reveals that the study of logic is very imperative to polytechnic students because it acquaints them with the knowledge, methods and principles of reasoning which will enable them to avoid the above identified challenges and also helps them in the Avoidance of Error, Identification of Common Flaws in Argument, Avoidance of Fallacies, and Clarification of Concepts. The study concluded that the study of logic is so valuable to polytechnic students that their ignorance of it leads to their colossal academic and social challenges and failure on campus. The study recommends among other things that logic should be made compulsory in all polytechnics in Nigeria.
Keywords: Deduction, Induction, Validity, Invalidity, Soundness, Fallacy, Education, Polytechnic

INTRODUCTION
Naturally, man is homologous with other animals having and exhibiting all the features and instincts that are innate in them because he belongs to the genus of animals. Hence, it is not out of place when a man exhibits instinctual characteristics of emotions and sentiments. However, man is Homo sapiens because he is endowed with higher features of reason or rationality. The rationality of man places him high above irrational animals because it makes him a thinking or reasoning being. It is the rationality of man that controls and rules his instincts. This means that man acts in accordance with reason and not in accordance with instincts. The techniques and rules of reasoning are acquired through the study of logic. Many polytechnic students do not have knowledge of logic, hence, they their decisions and actions emanate from instincts, this has made them encounter various problems such as falling prey to 419 fraudsters, deceptions into joining secret cults, victims of ritual killings, making of costly mistakes, difficulty in presenting their good, sincere and genuine issues or needs due to contradictions and violations of logical principles in their presentations, difficulty in completing and defending their project works required for graduation due to lack of clarity, precision, and consistency that deface their presentations. This is where the study of logic is very imperative to polytechnic students because it acquaints them with knowledge, techniques, and principles of reasoning. It is the intention of this paper to educate polytechnic students and the general public on the rudiment of logic. To accomplish task, the paper will embark on the following well-designed outline: Introduction, Definition of Logic, Classification of Logic, Division of Logic, Truth, Falsity, Validity, and Soundness in Arguments, Definition of Polytechnic Education, Objectives of Polytechnic Education, Objectives of Polytechnic Education, Conclusion, and Recommendation.

Definition of Logic

Logic is a branch of philosophy which has been subjected to conceptual analysis by various philosophers. Etymologically, the name Logic is derived from the Greek "LOGOS" = WORD and as a study it means the study of words in STATEMENTS, DIALOGUES, and DISCOURSES cf. Ekarika (1986 p.39) Blackburn (1996 p.221) defines logic as a general science of inference. From the philosophical dimension, Hornby (2005 p.869) sees logic as the science of thinking about or explaining the reason for something using formal methods. For Mercier (1952 p.135), logic is the reflex study of the order which needs to exist in our judgments, inferences and more elaborate reasoning processes for them to lead us to truth. Celestine Bittle quoted from Enomah in Mordi and Jike (2005 ed p. 44) sees logic as the science of those principles, laws and methods which the mind of man must follow in his thinking for secure and accurate attaining of truth. Oroka and Isiramen (1993) describe logic as the branch of philosophy concerned with the process of thinking and reasoning as well as the symbolic expression of such process in verbal or written form. Ekarika (1986 p. 40) is of the view that "Logic is that Science, which studies the proper order and arrangement of all those mental functions (processes) which lead us into the possession of knowledge and truth…Logic lays down rules and principles which the mind must follow in order to secure truth and avoid error". Similarly, Kalusi (1996 pp. 7-8) is of the opinion that that logic deals with the fundamental laws of thinking and reasoning. It studies the ideal method in the techniques of reasoning, and that it attempts to answer questions as what distinguishes a good argument from a bad one. The Encyclopaedia Americana (1978 pp. 101-1120) quoted from Okoye in Orona Oroka (2000, ed p.74) defined logic as a field of study that deals chiefly with criteria for the evaluation of arguments. Musa in Orona Oroka (2000, ed p.45) postulated that logic is the process by which arguments are classified into bad and good. While Okoye (1998) in Okoye in Orona Oroka (2000, ed p.74) is of the notion that logic is the science of valid reasoning and the systematization of reasoning.

Furthermore Nyong (1996 p.67) postulates that logic is the study of the methods and laws used to distinguish correct reasoning from reasoning that is faulty, and Copi and Cohen (1978) quoted from Enomah (2002 p.1) sees logic as the study of the methods and principles used to distinguish correct reasoning from incorrect reasoning. Okafor (1990 p.4) quoted from Nyong (1996 p. 67) says that from the intellectual or formal angle logic can be defined as the science which has for its subject-matter things as they are represented in our thought. Cohen and Nagel (1996) quoted from Enomah in Mordi and Jike (2005 ed p. 45) also defined logic as that which concerns itself with the question of the adequacy or probative value of different evidence. Bello (2000 p.1) opines that logic is the study of the principles and techniques of distinguishing good arguments from bad arguments. Enomah (2018 p. 27) says logic is the science of reasoning which uses reasoning in the process of acquisition of knowledge; it is the study of the principles and techniques of distinguishing valid from invalid arguments and from sound and unsound arguments for the purpose of attaining truth which is the yardstick and principle of knowledge. From the various definitions of logic given above logic can be seen as a science of reasoning which lays down laws, principles, and procedures that guides human thought in order to arrive at truth, the ultimate goal of discourse in both written and oral communication, and to avoid fallacies.

Classification of Logic

Logic is classified into natural logic, scientific logic, traditional or Aristotelian logic, formal logic and material logic.

Natural Logic: The first category of logic is called natural logic because it innate in man. It is universal because every body consciously or unconsciously carries it out instinctively without much difficulty. This is why one can parochially assert that everybody is a logician. Natural logic is also referred to as universal logic or common sense. However this common sense or natural logic goes beyond instincts because it requires rationality, sanity, and discipline. This is why people say that common sense is not sometimes common. Natural logic requires certain amount of valuation, comparison, conceptualization, rationalization, and judgement, but it is not formally scientific in the sense that it does not generally follow lay down logical rules and procedures, but it can lead to truth, although these truths are not products of universal laws of thought.

Scientific Logic: Logic is scientific because it is a product of specific laws of thought or thought process, and can be subjected to logical verification. Scientific logic is also regarded as such because it is acquired through conscious effort, and it is carried out consciously.

Traditional or Aristotelian Logic: Traditional logic is also called Aristotelian logic. It is named after Aristotle (384-322) because he was the one who organized the various laws and principles which he had learned as a pupil of Plato into a body of knowledge known as logic cf Nyong (1996 p.66). Aristotle is universally accepted as the first person to have organized logic as a science. Hence, traditional logic is called Aristotelian logic because Aristotle developed it. Aristotelian logic is relevant to too today because the standards are of universal value. The method of reasoning as developed by Aristotle is still relevant and of practical value.

Formal Logic: This is a part of logic that studies forms or laws of thought for the purpose of correct reasoning. Nyong (1996 p.72) opined that formal logic is that part of logic which examines the form of thought with a view to ensuring correctness of our reasoning activities. The validity of arguments in formal logic depends on its consistency not minding whether the conclusion follows from true or false premises. What is most important in formal logic is the form, that is, whether it adheres to the rules or laws of thought rather that the contents and status of the premises.

Example:

a). Every act of mercy deserves commendation
     But forgiveness is an act of mercy
     Therefore forgiveness deserves commendation

b). Every man is mortal
     But Ese is a man
     Therefore Ese is mortal

Although the above two arguments have the same form since they are both in accord or conform with the laws of thought, their subject matter or contents are different. Therefore they can be symbolized as follows:

Every p is q
But every r is p
Therefore, every r is q.

Material Logic: Material logic studies the contents of reasoning with the purpose of scrutinizing the truthfulness of thought. Propositions or statements make up an argument, and their truthfulness depends on their conformity with reality, not just on validity or structural coherence of the reasoning. Nyong (1996 p. 73) described material logic as that part of logic that investigates the content of thought with a view to determining the truth of reasoning, and that a statement or judgement is true when it conforms with fact or reality.

Example:

a). Every Archangel is mortal
     But Gabriel is an Archangel
     Therefore Gabriel is mortal

b). Every Pope is a Nigerian
     But Francis I is a Pope
     Therefore Francis I is a Nigerian

The above two arguments are structurally coherent and consistent, that is, valid. However, their propositions or statements, presented as evidence for the conclusion are faulty, that is, they are not correct since they do not correspond to reality. Material logic, therefore, considers the conformity of the contents of the argument to state of affairs in addition to its validity to determine its soundness.

Symbolic Logic: Symbolic is logic a reduction of laws of formal logic to mathematical symbols. Hence, Cohen and Nagel (1966 p.117) stated that "...the study of the logical properties of relations is the gateway to the systematic study of more complex inferences. But the more complex forms of inference cannot be studied with any care until a specially devised symbolism is introduced. Because of the prominence of such special symbols in the generalized study of logic, the latter has also been called symbolic or mathematical logic". Blackburn (1996 p. 369) says that symbolic logic is a general term, not currently much used, for the study of formal logic, and that, generally, the study of logical

form requires using particular schematic letters and variables ('symbols') to stand where terms of a particular category might occur in sentences.

Division of Logic
Logic, whatever category it may be, and depending on its type of argument, can be either deductive or inductive.
Deductive Logic: In deductive logic, the argument proceeds from universal or general propositions to a particular inference. According to Nyong (1996 p.68), in deduction, we proceed from universal or the general premise and arrive at a particular conclusion. Oroka and Isiramen (1993 p.34) also defined deduction as a process of formal reasoning in which principles are fairly established, and that a deductive argument is one that involves the claim that the conclusion follows necessarily from the premises.
Example :
      All men are mortal (Major Premise)
       Nyore is a man (Minor Premise)
       Therefore Nyore is mortal (Conclusion)

Deductive logic deals with a formulation of the rules of inference that is consistent and complex. These rules are applied to formally presented argument to determine whether or not their conclusion can be validly inferred from their premises.
Inductive Logic: In inductive logic, the conclusion follows from the premises only with a certain degree of probability. Nyong (1996 p. 69) defined inductive logic as that in which we proceed from particular premises to general or universal conclusion. He further stated that an inductive argument is one in which the claim is made that if the premises are true, it is more or less probable – not absolutely certain – that the conclusion is true, and also that in an inductive argument, if the premises are true, then it is probable that the conclusion will also be true. Brennan (1961) quoted from Oroka and Isiramen (1993 p.29) defined induction as "a mode of inference by which we proceed from observations of particular instances or cases to a generalization about all instances of the same kind". Oroka and Isiramen (1993 p.29) defined inductive argument as one in which it is claimed that the truthfulness of the premises bestows a certain degree of probability on the conclusion.
Example:
a).   John is a Deltan youth and well behaved
      Cynthia is a Deltan youth and well behaved
      Therefore all Deltan youths are well behaved

b).   Engineering students in Delta State Polytechnic, Ozoro, are very good in Mathematics
      Mass Comm students in Delta State Polytechnic, Ozoro, are very good in Mathematics
      Therefore all students in Delta State Polytechnic, Ozoro, are very good in Mathematics
c).   The world did not end by the year 1000 AD
      The world did not end by the year 2000 AD
      Therefore the world will never end

Inductive logic deals with particular instances. It is concerned with the state of affairs, and not with the form of argumentation.
Truth, Falsity, Validity, and Soundness in Arguments
Truth: Only propositions, premises or statements can be true. Propositions, premises or statements are true if they correspond to reality or state of affairs. Oroka and Isiramen (1993 p.18) asserted that the truth of statements refers to state of affairs.
Falsity: Only propositions can false. Since statements, premises and conclusions are propositions, they can only be false, and they are false if they do not correspond to reality or state of affairs.
Validity: It is only deductive arguments that can be valid or invalid. There is a necessary connection between the truth of the premises of an argument and the validity of the argument. The connection is that if an argument is valid, and if premises are true, then the conclusion has to be true. In other words, it is not possible for us to have a valid argument with true premises and a false conclusion.
Example:
      All Nigerians are Africans
      All Africans are Europeans
      Therefore all Nigerians are Europeans

This argument is valid because the conclusion follows logically from the premises, although its second premise and its conclusion are not true. It therefore follows that the conclusion is true if the premise are true. For Oroka and Isiramen (1993 p. 22), the validity of an argument is the flow of conclusion from given premises. The validity of any argument does not necessarily mean that its premises should be true. The validity depends on the logical form of the argument. In other words an argument is not valid because of the truth or falsity of the premises or conclusion.

Validity = Form but not Content
Example:
a).   All men are homo- sapiens
          All Deltans are men
          Therefore all Deltans are homo- sapiens

          All M IS P
          All Sis M
          All S is P

b).   All Egyptians are Europeans
          All Nigerians are Egyptians
          Therefore all Nigerians are Europeans

The second (b) argument is valid but none of the propositions is true.
Soundness: According to Oroka and Isiramen (1993 p. 22), for an argument to be sound it must meet two conditions, namely, the argument must be valid and the premises must be true, and that if any argument does not meet any one of the conditions, the argument is said to be unsound, i.e. it is unsound if it is invalid, and at least one of the premises is false. For Copi and Cohen (1998) quoted from Enomah (2002 p.62), when an argument is valid and its premises are true, we call it "Sound".

Soundness = Validity + Truth

An argument may be valid and not sound; an argument may be sound and valid; but an argument cannot be sound and not valid.

Example:

a)   Religion is universally acceptable (Major Premise)
          Vuduism is a religion (Minor Premise)
          Therefore *Vuduism* is universally acceptable (Conclusion)

b)   Any act of religiosity is good (Major Premise)
          Human sacrifice is an act of religiosity (Minor Premise)
          Therefore human sacrifice is good   (Conclusion)

The middle terms of these arguments are not distributed. Their major and the minor premises are also doubtful which automatically renders the conclusion to be equally doubtful. This makes the above two arguments to be unsound.

	Premises True	At Least One False Premise
Valid	Sound	Unsound
Invalid	Unsound	Unsound

Fig 1 Oroka and Isiramen (1993 p. 23)

Laws of Thought

Logic follows the universal principles of thinking. Consistency ensures that we do not affirm and deny the same proposition simultaneously which will be a fallacy of contradiction. Historically, the laws of logic were first formulated by Plato and Aristotle. They were referred to as laws of reality. Uduigwomen (1995) cited by Nyong (1996 p.73) described them as first principles or axioms, which

underlie all human thinking processes and discourses. Ekarika (1986 p.47) defines axiom as a general proposition which is incapable of proof and stands in no need of proof. For him, also they are first principles or axioms because they are the foundation of all reasoning in the sense that all consecutive thought processes and coherent arguments are simply impossible unless thy are taken for granted, and that they are laws in the sense that they form some sort of precepts or rules which must be obeyed if we want to arrive at the correct ordering of our thinking process. The laws of thought include the following:

The Law of Identity: According to Nyong (1996 p. 74), the law of identity states that "If a statement is true, then it is true". For Ekarika (1986 pp. 46-47), the law of identity states that "Everything is what it is i.e. $A = A$ or A is A. He further stated that this needs no explanation, for how can we ever raise our thoughts or open our mounts about something "A" when it is not something "A" which we are thinking or talking about. For instance a table is a table and not something else cf Ekarika (1986 p. 47).

The Law of Contradiction: The law of contradiction asserts that S cannot be both P and not P. Another way of stating it is: A proposition cannot be both true and false at the same time and place. According to Nyong (1996 p. 73), the law of contradiction states that contradictory judgement cannot both be true i.e. a statement cannot both be true and false. For him it also states that "It is impossible for the same thing to be and not be at the same time" cf Nyong (1996 p. 73). For Ekarika (1986 p. 48), the law of contradiction states that "A thing cannot both be and not be at the same time" $A = A$; A is not $\sim A$ or A is not both B and not $\sim B$. For him, this law refers both to the meaning of terms and to the mutual consistency of propositions, and that it is putting the law of identity negatively. In other words, for him, a contradiction puts negatively what identity puts positively. For instance, "A Table is a Table". We cannot say "A Table is not a Table".

The Law of Excluded Middle: The Law of excluded middle asserts that S must be either P or not P. It may also be stated that "A proposition must be either true or false at the same time. For Ekarika (1986 pp. 48-49), the law of excluded middle is that "A thing either is or is not" i.e. $A = A$ not $\sim A$. According to Nyong (1996 p. 74), Aristotle restated the law of Excluded Middle to mean, "Of two contradictory judgements, one must be true and the other false, and that "between the two members of a contradiction there is no middle term". For instance, a person is a man or woman; a boy or girl; foolish or wise cf Ekarika (1986 p. 49).

Logic and Polytechnic Education

From the above conceptual analysis of logic, the imperativeness of logic to polytechnic students has become conspicuous. Some of the invaluable characteristics of the study of logic identified by Nyong (1996 p. 71) and which are very useful to polytechnic students and to all and sundry include the following:

Avoidance of Error: A lots of mistakes students make are predicated on their unconscious drawing of conclusions from false premises of arguments presented to them by their colleagues. Upon consideration of these false conclusions students indulge on regrettable acts. But the study of logic enables students to detect false propositions in any reasoning presented to them in order to avoid engaging in any detrimental acts. Nyong (1996 p.71) says that logic helps us to avoid mistakes such as drawing conclusions by means of premises that are unrelated to the conclusions posed.

Identification of Common Flaws in Argument: Students get frustrated because they find it difficult to present their good, sincere and genuine issues or needs to their parents, school mates, school authorities, and lecturers. They cannot convince others because of their inability to present valid and sound arguments. Their arguments are full of flaws thereby making them invalid and unsound with unconvincing and false claims. Since these students cannot obtain what they want through conviction they get it by evil and antisocial means such as lies, force, charms, *yahooism*, deception, theft, cultism, prostitution, rape, etc. However, the knowledge of logic helps students to know how to formulate valid and sound argument that are convincing that enable them to obtain good and genuine needs. According to Nyong (1996 p.71) the exercise of logic helps in assessing the validity of an argument, and that without this, one may easily make an untenable claim.

 Avoidance of Fallacies: 419 fraudsters work on the intelligence of their victims because they know that their victims lack the knowledge of logical principles or tenets. Victims easily believe the sugar coated fallacious arguments or reasoning (verbal or written) of fraudsters, and promptly on act on them thereby loosing their valuable recourses or properties to 419 fraudsters. In addition people are unable to correct the views of their colleagues, children, and others because they cannot detect

fallacies in them due to their ignorance of the principles of logic. The study of logic equips polytechnic students and the general public with logical principles that help them to spot violations principles of logic in arguments, issues or matters presented for their consideration. This is in accord with the view of Nyong (1996 p.71) that with the aid of the knowledge of logic it is easy to detect any violation of logical tenets or principle which would be corrected.

Clarification of Concepts: It takes a lot of time for some polytechnic students to complete their project works required for graduation because they lack clarity, precision, consistency, and tenacity. The contents of their projects are littered or defaced with verbosity, inconsistency, contradictions, and fallacies. This slows down the pace of their projects, it makes their projects to be poor or watery, and it even makes them have low project scores. In addition students make their words or speeches to be suspicious because they are very lengthy and full of contradictions, fallacies and inconsistencies. But the understanding of the nature of logic enables students to possess the ability to be clear, consistent and precise in writing and speaking. Nyong (1996 p.71) is very clear on this when postulated that logic enables us to speak and write with clarity, precision, and tenacity, and that arguments are assessed by applying the cannons and principles of consistency in reasoning.

CONCLUSION

The paper has embarked on conceptual analysis of the nature of logic. Logic which is a branch of philosophy is the science of reasoning. Many polytechnic students encounter heinous academic and social problems and difficulties associated with lack of knowledge of logic. From the finding it is quite evident that the study of logic is so valuable to polytechnic students because it equips them with logical principles, the nuances of ascertaining the validity and soundness of arguments, and the knowledge of the application of the fundamental rules and methods of consistency in reasoning. Their ignorance of logic leads to their colossal academic and social challenges and failure on campus.

RECOMMENDATIONS

Considering the enormous benefits of imperativeness of the study of logic to polytechnic students, the paper makes the following recommendation.
1. The study of Logic should be introduced and made compulsory to all polytechnics in Nigeria.
2. Qualified lecturers should employed to teach Logic in Nigerian Polytechnics
3. Conferences on the relevance of logic should be organized by all polytechnics for their respective students.

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