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**KARL POPPER'S 'CRITICAL RATIONALISM' IN PHILOSOPHY OF SCIENCE:  
IMPLICATIONS FOR GROWTH OF KNOWLEDGE AND SCIENTIFIC PRACTICE**

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**ABSTRACT**

This study examines Karl Popper's critical rationalism in philosophy of science and its implications for the growth of knowledge and scientific practice. Science has actually improved and is still improving the condition of human existence in the universe through its discoveries, inventions, unique explanation of phenomena as well as prediction of events in the universe. Philosophy extends its rational and reflective inquiry to the method and practice of scientific investigation, and this actually is the domain of philosophy of science. Philosophers of science employ different approaches to the investigation of scientific assumptions. Karl Popper argues that 'critical rationalism' is the right approach in philosophy of science. Though critical attitude is basic in every philosophical investigation, Karl Popper's application of it in philosophy of science is quite remarkable. This study examines precisely Karl Popper's 'critical rationalism' in philosophy of science, and argues that such has led to the improvement of human knowledge and scientific practice. This improvement in the practice of science leads to more falsifiable theories and more credible scientific inventions which promote human condition of existence in the universe. With Popper's critical rationalism in philosophy of science, it becomes obvious that no scientific theory is immuned from criticism and none should be seen as a dogma. This study maintains that critical attitude improves man's understanding of the universe in which he lives, and consequently improves human condition of existence in the world.

## INTRODUCTION

Karl Popper is one of the renowned and most influential philosophers of science. He contributed immensely towards the development of philosophy of science. His ideas in philosophy of science are very interesting and thought-provoking. Popper values greatly the critical attitude in philosophy, and this explains why he adopted 'critical rationalism' as his basic approach in philosophy of science. According to Nickolas Dykes: "Popper regarded a critical attitude as the most important virtue a philosopher could possess."<sup>1</sup> He equates the rational attitude with the critical attitude. Thus, Popper insists that philosophers in general and philosophers of science in particular cannot do without such method. Thus, he argues consistently that every scientific theory, properly called, ought to be falsifiable. The fundamental questions are: What is critical rationalism? How did Karl Popper apply it in philosophy of science? Has Karl Popper's critical rationalism in philosophy of science any contribution to make towards improving human knowledge and scientific practice? This study employs basically hermeneutical method of philosophical enquiry to examine Karl Popper's critical rationalism in philosophy of science, and argues that Popper's critical attitude has contributed immensely towards the improvement of human knowledge and the practice of scientific investigations. Obviously, this study lies within the domain of philosophy of science. Hence, it seems to the researcher that the first part of this study should focus at a brief examination of the major concern of philosophy of science.

## THE DOMAIN OF PHILOSOPHY OF SCIENCE

Philosophy, as a discipline, extends its rational and reflective investigation into every aspect of reality of which science occupies a prominent position. Hence, philosophy of science is the branch of philosophy that critically examines the methods, practices and assumptions of science. Philip S. Kitcher describes it as "the study, from a philosophical perspective, of the elements of scientific inquiry".<sup>2</sup> In a similar way, Oskar Blakstad states that it has to do with "the study of assumptions, foundations and implications of science."<sup>3</sup> Philosophy of Science investigates and analyzes the practices and methods of scientific investigations. It subjects the procedures and results of scientific investigations to rational scrutiny and analysis. Hence, rational inquiry into science becomes the proper domain as well as the major concern of philosophy of science.

Science offers a systematic and unique explanation of the universe through observation and experimentation. Science has contributed immensely towards improving

human condition in the universe through its unique explanation of the universe, predictions, inventions and discoveries. It has led to man's increased understanding of the universe. For instance, before Nicholas Copernicus came up with heliocentric astronomy which made us to understand that the sun is at the centre of the universe, while the earth and other planets orbit the sun; geocentric astronomy propounded by Ptolemy was in vogue. It is obvious that Copernican revolution led to increased understanding of the universe. Science has made important predictions of environmental hazards like earthquake, volcanic eruption, desert encroachment etc, the knowledge of which prevented the destruction of human lives. Through scientific knowledge as well as its practical expression in technology, many sophisticated equipments have been manufactured in different facets of life, and these have improved human condition in the universe. Scientific ideas are enshrined in scientific theories.

The assumptions of science as well as the method of scientific investigation have attracted serious philosophical attention. Philosophers have investigated and are still investigating into scientific assumptions and the procedure of scientific research. Philosophers of science have adopted different approaches in examining the activities of science. Hence, there are different approaches in philosophy of science. Paul Fereyaband opted for anarchism in this regard. Thomas Samuel Kuhn adopted historical approach, and emphasized on the historical context of scientific discovery. He argued that history of science is of great importance in philosophy of science. However, Karl Popper argued that 'critical rationalism' ought to be the correct approach in philosophy of science. Thus, Karl Popper's critical rationalism in philosophy of science is the focus of this study. However, the fundamental question is this: what is 'critical rationalism'? The response to this pertinent question is very necessary because a good understanding of 'critical rationalism' enables one to appreciate the discussions in this study.

#### KARL POPPER'S CRITICAL RATIONALISM: AN ANALYSIS

Karl Popper's basic approach in philosophy of science is known as critical rationalism. This approach sees criticism of theories and ideologies as the major function of philosophy. Thus, philosophy is conceived as a critical activity. As was already demonstrated in this study, Karl Popper values very immensely critical attitude, and insists that every philosopher should employ such method in his investigation of reality. Karl Popper emphasizes on 'critical rationalism' which "urges us to submit our theories to severely critical tests."<sup>4</sup> It

entails examining and disclosing the weaknesses as well as the strengths of a theory or an idea. It also involves questioning every idea or theory and not adopting any theory or idea as a dogma. Thus, one has to subject one's idea or theory to severe criticisms. Critical rationalism is an effort to overthrow one's theory and those of others. With this approach, no idea or theory should be seen as final. Hence, knowledge becomes a guess work, a form of trial and error. In the words of Karl Popper:

The point is that, whenever we propose a solution to a problem, we ought to try as hard as we can to overthrow our solution, rather than defend it. Few of us, unfortunately, practice this precept; but other people, fortunately, will supply the criticism for us if we fail to supply it ourselves. Yet criticism will be fruitful only if we state our problem as clearly as we can and put our solution in a sufficiently definite form—a form in which it can be critically discussed.<sup>5</sup>

With Popper's critical attitude, no idea or theory is immuned from criticism. It subjects every system or ideology to severe criticism. Criticism becomes the central focus of Karl Popper's critical rationalism in Philosophy of science. Analyzing Karl Popper's critical attitude, Nickolas Dykes states:

A critical attitude, particularly a self-critical one, is also every bit as important as Popper thought it was, even if he did not always exercise his own. Subjecting one's pet theories to the kind of penetrating analysis Popper was so good at is the healthiest mental activity one can undertake.<sup>6</sup>

Critical rationalism is basically anti-dogmatic in nature, and it is rooted in Popper's falsifiability principle. Popper employed falsifiability criterion as a means of demarcating between science and pseudo-science. Thus, he classified Sigmund Freud's psychoanalytic theory and Karl Marx's theory of history as pseudo-science because they are unfalsifiable. Every scientific theory must be falsifiable and thus must be open to criticism. More detailed attention would be given to this in the later part of this study. Popper's critical rationalism entails one's readiness to overthrow one's theory rather than trying to defend such theory. Popper argues that one must be eager to discover the weaknesses of one's idea. In the words of Darrell P. Rowbottom: "Popper repeatedly emphasized the significance of a critical attitude, and a related method, for scientists."<sup>7</sup> Hence, this study attempts at examining the

implications of Karl Popper's critical rationalism in philosophy of science for the improvement of knowledge and scientific practice.

## KARL POPPER'S APPLICATION OF CRITICAL RATIONALISM (CRITICAL ATTITUDE) IN PHILOSOPHY OF SCIENCE

This section of the study focuses on the identification and analysis of the instances of Karl Popper's application of critical rationalistic approach in philosophy of science. Karl Popper employed this approach in his philosophy especially in his political philosophy and philosophy of science. In his political philosophy, Karl Popper criticized all forms of totalitarian, closed and dogmatic society. He criticized the ideas and theories of Plato, Marx and Hegel in this regard. Precisely, Popper criticized Plato's political theory especially his concept of justice in the state as being totalitarian and anti-humanitarian. He then advocated for an open society that is characterized by openness to criticism and anti-dogmatism. In the domain of philosophy of science, Karl Popper basically employed such approach; and this actually is the central focus of this section of the study.

Karl Popper is one of the renowned and influential philosophers of science in the contemporary era. Let us at this juncture examine some instances of Popper's application of critical approach in philosophy of science. With his basic approach enshrined in critical rationalism, Popper questioned a lot of issues in the practice of science. He criticized the use of induction in scientific investigation. Induction is basically empirical in nature. It entails making general conclusions as a result of few observed instances. Popper acknowledged the fact that inductive method has been the method of empirical sciences. In his very influential book, *The Logic of Scientific Discovery*, he states:

According to a widely accepted view—to be opposed in this book—the empirical sciences can be characterized by the fact that they use '*inductive methods*', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i.e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from *singular statements* (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to *universal statements*, such as hypotheses or theories.<sup>8</sup>

The inductive method, which has to do with moving from observed instances to general conclusion, remained unquestioned in the scientific world until the time of Karl Popper who challenged and criticized the use of inductive method in scientific investigation. He insists that induction is unjustifiable and its principle is logically inconsistent. According to him:

Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that *all* swans are white.<sup>9</sup>

From Popper's criticism of inductive method, it became fashionable to argue that inductive generalization may not be as conclusive as some scientists take it to be. However, it ought to be noted that Popper's critique of inductive method as well as its subsequent replacement with 'deductive testing of theories' has its inherent problem, the analysis of which is outside the scope of this study. Our concern here is to examine his critical as well as anti-dogmatic approach which brings about the growth of knowledge.

Critical rationalistic approach of Karl Popper is also very explicit in his rejection of logical positivists' verifiability principle, and its subsequent replacement with falsifiability principle. Logical positivists were foundational scholars in philosophy of science. They rejected metaphysics as meaningless and maintained that a statement is meaningful, and thus scientific if it can be empirically verified. Popper criticized Logical positivists' verifiability principle as the major principle of science. In the words Popper:

...positivists, in their anxiety to annihilate metaphysics, annihilate natural science along with it. For scientific laws, too, cannot be logically reduced to elementary statements of experience. If consistently applied, Wittgenstein's criterion of meaningfulness rejects as meaningless those natural laws the search for which, as Einstein says, is 'the supreme task of the physicist': they can never be accepted as genuine or legitimate statements.<sup>10</sup>

Popper's critical attitude in philosophy of science is very remarkable in his rejection of the logical positivists' verification principle. Having rejected the verifiability principle, Popper

came up with his principle of falsifiability. As was already demonstrated in this study, Popper made a distinction between science and pseudo- science; and insists that a scientific theory must be falsifiable. Hence, any theory that is not falsifiable is not a scientific theory. We have to note that a theory is falsifiable if it has inherent capability of being proved to be true or false and it has the capability of “being tested by experience.”<sup>11</sup> A falsifiable theory ought to be open to criticism and ought to be anti-dogmatic. Philosophers of science ought to be self-critical, and be conscious of the fact that a particular scientific theory may be overthrown by a more falsifiable theory. Criticism plays prominent role in this regard because it is criticism that can lead to the falsification of the existing theory. Popper is very much aware of the fact that his falsifiability principle would also be subjected to severe criticism by other scholars. Thus, he argues:

Again, the attempt might be made to turn against my own criticism of the inductivist criterion of demarcation; for it might seem that objections can be raised against falsifiability as a criterion of demarcation similar to those which I myself raised against verifiability.<sup>12</sup>

Critical rationalistic approach brings to our consciousness that no theory is immuned from criticism no matter how good and successful the theory seems to be.

In the domain of scientific progress or development, Popper’s critical rationalistic approach is very evident. Karl Popper argues that science progresses or develops by the falsification of the prevailing scientific theory by a more falsifiable theory. He made it very clear that no scientific theory could be seen as a dogma. Thus, every scientific theory is only a ‘conjecture’ which is to be held tentatively until it is refuted by another one. According to him:

On the scientific level, the tentative adoption of a new conjecture or theory may solve one or two problems, but it invariably opens up many new problems; for a new revolutionary theory functions exactly like a new and powerful sense organ. If the progress is significant then the new problems will differ from the old problems: the new problems will be on a radically different level of depth. This happened, for example, in relativity; it happened in quantum mechanics; and it happens right now most dramatically, in molecular

biology. In each of these cases, new horizons of unexpected problems were opened up by the new theory.<sup>13</sup>

Science progresses by refuting the existing theory. His idea of scientific development is against logical positivists' cumulative conception of scientific development. It cannot just be conceived as the addition of new truth to the old ones. For him, scientific discoveries are actually revolutionary, but are open to further investigations and criticisms. Popper further argues:

Thus they become objects outside ourselves: objects open to investigation. As a consequence, they are now open to criticism. Thus we can get rid of a badly fitting theory before the adoption of the theory makes us unfit to survive: by criticizing our theories we can let our theories die in our stead.

This is of course immensely important.<sup>14</sup>

It becomes obvious from Popperian perspective that we cannot do without criticism in the conception of scientific development. Hence, scientific progress depends on “a revolutionary use of trial and the elimination of error by criticism, which includes severe empirical examinations or tests; that is, attempts to probe into the possible weaknesses of theories, attempts to refute them.”<sup>15</sup> Knowledge becomes a case of trial and error. The implication of this is that scientific progress or development can be said to have no end. Informed by Popper's critical attitude, he describes scientific progress thus:

First, in order that a new theory should constitute a discovery or a step forward it should conflict with its predecessor; that is to say, it should lead to at least some conflicting results. But this means, from a logical point of view, that it should contradict its predecessor: it should overthrow it.<sup>16</sup>

This brings out very clearly the revolutionary nature of scientific progress. However, progress in science can be assessed rationally because there exists criterion for assessing competing theories. Popper's critical rationalism is against dogmatism in philosophy of science. Thus, no theory should be seen as a dogma in the course of scientific development. In fact, the critical attitude sees dogmatism as an obstacle to scientific progress. In the words of Popper:

Intolerant dogmatism, however, is one of the main obstacles to science. Indeed, we should not only keep alternative theories alive by discussing them, but we should systematically look for



new alternatives; and we should be worried whenever there are no alternatives—whenever a dominant theory becomes too exclusive.<sup>17</sup>

New ideas should be considered as very important and should be carefully nurtured even when they seem awkward. The point Popper is trying to put across is that new ideas should not be suppressed because of their newness or because they contradict the prevailing one. This is the emphasis of Karl Popper's critical rationalism in philosophy of science

Furthermore, Popper exhibited his critical and his anti-dogmatic approach in his critique of Thomas Kuhn's distinction between normal science and revolutionary science. Normal science, for Kuhn, is when the members of a scientific community pay allegiance to the prevailing paradigm, while revolutionary science is when the prevailing paradigm is questioned as a result of crisis, and subsequently replaced by a new paradigm. In criticizing Kuhn's distinction, Popper argues that "the distinction between these two kinds of enterprise is perhaps not quite as sharp as Kuhn makes it"<sup>18</sup> Obviously, Popper saw Kuhn's normal science as dogmatic, and so was not comfortable with it. This is as a result of the fact that Kuhn's normal science is against critical rationalistic approach of Karl Popper. Criticizing Kuhn's normal science, Popper argues:

I believe, and so do many others, that all teaching on the University level (and if possible below) should be training and encouragement in critical thinking. The 'normal' scientist, as described by Kuhn, has been badly taught. He has been taught in a dogmatic spirit: he is a victim of indoctrination. He has learned a technique which can be applied without asking for the reason why (especially in quantum mechanics)<sup>19</sup>

As was earlier demonstrated in this study, dogmatism impedes scientific progress and knowledge in general. This explains why Popper perceives an uncritical and dogmatic attitude as a great danger to science and civilization. Science ought to be critical in approach. In the words of Popper: "I believe that science is essentially critical; that it consists of bold conjectures, controlled by criticism, and that it may, therefore, be described as revolutionary."<sup>20</sup> It becomes obvious from Popper's specification that we cannot do without criticisms in science, and the aim of scientific progress is to "find theories which, in the light of critical discussion, get nearer to the truth."<sup>21</sup>

There are other instances of Karl Popper's application of critical rationalism in philosophy of science, but it seems to the researcher that the ones articulated above are quite enough to substantiate the claim of this study. In this discussion on Karl Popper's critical rationalism, one must not fail to make reference to Immanuel Kant, who in fact popularized and launched formally the era of 'critical philosophy' in the modern period of philosophy. Kant's critical philosophy was an attempt to discredit the efforts of the metaphysicians who employed human reason beyond the realm it can attain certain knowledge. Thus, Kant subjected human reason to severe criticisms in order to specify its limits as a cognitive faculty. Karl Popper acknowledged Kant's critical attitude in philosophy. According to Popper: "...the critical rationalism (and also the critical empiricism) which I advocate merely puts the finishing touch to Kant's own critical philosophy."<sup>22</sup> At this juncture, let us examine the implications of Popper's critical rationalism for the growth of knowledge and scientific practice.

#### IMPLICATIONS OF KARL POPPER'S CRITICAL RATIONALISM FOR THE GROWTH OF KNOWLEDGE AND SCIENTIFIC PRACTICE

Karl Popper's critical rationalism has inculcated the spirit of hard-work among scientists and philosophers of science. Thus, no scientific achievement or discovery can be seen as final. It is only a 'conjecture' in Popperian terminology which can be refuted later. This contributes immensely to the development of both speculative and practical knowledge. Critical attitude sharpens human intellect and enables man to develop his potentials. It improves one's thinking ability and keeps one's rationality fully alert. Without criticism, human knowledge remains stagnant. Thus, Karl Popper's critical attitude in philosophy of science has led to the growth of knowledge. This growth in knowledge brings about better understanding of the universe, and better utilization of natural endowments. Human condition of existence in the universe actually improves when man has good understanding of the universe. This lessens the problems man encounters in the universe. Also, it leads to the development of human potentials in every aspect of human endeavour. Attesting to this, Ben O. Ebo states:

In fact, our thoughts constitute our authentic being in our responsible decisions and in our profound significance both theoretically and practically. And so what we are as human beings is, to some extent, determined by how much we are able

to penetrate the truth of reality with our thought. Man's being is diminished or increased depending on "quantity" and "quality" of truth he possesses." <sup>23</sup>

Critical attitude enables one to attain deeper knowledge of the universe. As man possesses deeper knowledge of the universe, man functions better in the universe and makes optimum use of the universe in which he finds himself. Critical attitude plays irreplaceable role in the development of human intellect. Obviously, when the human intellect is well developed, it is ripe and ready for high quality inventions and discoveries which consequently improve human condition of existence in the universe. Critical rationalism eliminates, as much as possible, mediocrity as well as unthinking attitude. Thus, it enables man to perform his intellectual role as a rational being. This brings about intellectual satisfaction as well as fulfillment, and gives man the opportunity to be authentic to his nature as a rational being. Critical attitude enables one to develop intellectually, and enables one to acknowledge one's limitations. Popper's critical rationalism in philosophy of science enables one to be open to criticism, and anyone who is open to criticism will not see one's idea or point of view as conclusive, but rather as a contribution which is not without limitations, and which may be overthrown by another one in future.

Popper's critical rationalism in philosophy of science plays prominent role in the improvement of the practice of scientific investigation. This improvement in the practice of science leads to more credible scientific inventions which promote human condition of existence in the world. It also influences the quality of theories being propounded by scientists. Critical attitude has made scientists and philosophers of science to be more meticulous in the formulation of theories, bearing in mind that every theory or idea has to face severe criticism. It has led to the elimination of carelessly formulated theories. Furthermore, it brings to consciousness that scientific discoveries have no end. Thus, no one can claim to have a final word with regard to this. Any discovery or invention one makes remains tentative. This brings about the spirit of perseverance among scientists and philosophers of science.

## EVALUATION AND CONCLUSION

Attempts have been made in this study to examine Karl Popper's critical attitude or critical rationalism in philosophy of science and its implications for growth of knowledge and scientific practice. As it is obvious from the discussion, Popper insists that critical rationalism

is the best approach philosophers should apply in their investigations of realities. This study also analyzed some instances of Karl Popper's application of such approach in philosophy of science. The researcher quite agrees with Popper that that the critical rationalism ought to be the right approach in philosophy of science. This agrees with the nature of philosophy in general which is basically a rational enterprise. It is in the nature of philosophy to be critical in approach, and such criticality has been very influential in improving human condition of existence in different domains of human life in the universe. Criticism leads to rational explanation of the phenomena in the universe as against mythological explanation prior to the emergence of formal philosophy. Philosophers apply critical attitude in one way or the other in their philosophical investigations. However, Karl Popper's application of such is quite remarkable, and this explains why he adopted critical rationalism as his distinctive approach in philosophy of science. As it is obvious in this study, Popper's critical attitude in philosophy of science has led to the improvement of human knowledge as well as scientific practice. It might seem that Popper laid too much emphasis on the critical attitude as some would argue. Obviously, such approach is necessary for the improvement of human knowledge and scientific practice as demonstrated in this study. However, it ought to be noted that critical attitude should not be focusless. It should always be focused and aimed at improving human condition of existence in the universe.

#### ENDNOTES

<sup>1</sup>Nickolas Dykes, *Debunking Popper: A Critique of Karl Popper's Critical Rationalism*, [http://www.libertarian.co.uk/lapubs/philn/philno65.ht.\(04/01/2018\)](http://www.libertarian.co.uk/lapubs/philn/philno65.ht.(04/01/2018)).

<sup>2</sup>Philip S. Kitcher, *Philosophy of Science*, [https://www.britannica.com/topic/philosophy-of-\(30/04/18\)](https://www.britannica.com/topic/philosophy-of-(30/04/18)).

<sup>3</sup>Oskar Blakstad, *Philosophy of Science*, [https://explorable.com/philosophy-of-science,\(30/04/18\)](https://explorable.com/philosophy-of-science,(30/04/18)).

<sup>4</sup>Nickolas Dykes, *Debunking Popper: A Critique of Karl Popper's Critical Rationalism*, [http://www.libertarian.co.uk/lapubs/philn/philno65.ht.\(10/02/2018\)](http://www.libertarian.co.uk/lapubs/philn/philno65.ht.(10/02/2018))

<sup>5</sup>Karl R. Popper, *The Logic of Scientific Discovery*, (New York: Basic Books, 1959),p.16.

<sup>6</sup>Nickolas Dykes, *Debunking Popper: A Critique of Karl Popper's Critical Rationalism*, [http://www.libertarian.co.uk/lapubs/philn/philno65.ht.\(10/02/2018\)](http://www.libertarian.co.uk/lapubs/philn/philno65.ht.(10/02/2018)).

<sup>7</sup>Darrell P. Rowbottom, *Kuhn Vs Popper on Criticism and Dogmatism in Science: A Resolution at the Group Level*, <http://www.in.edu.hk/philoso./staff/rowbottom/kvP.p> (12/03/2018)

<sup>8</sup>Karl R. Popper, *The Logic of Scientific Discovery*, (New York: Basic Books, 1959),p.27.

<sup>9</sup>Ibid.

<sup>10</sup>Ibid.,p.36.

<sup>11</sup>Ibid,p.40.

<sup>12</sup>Ibid.,p.41.

<sup>13</sup>Karl Popper, 'The Rationality of Scientific Revolution' in Ian Hacking (ed.) *Scientific Revolutions*, (New York: Oxford University Press,1987) p.83.

<sup>14</sup>Ibid. p.87.

<sup>15</sup>Ibid.

<sup>16</sup>Ibid.,p.93.

<sup>17</sup>Ibid.,p.98.

<sup>18</sup>Karl Popper, 'Normal Science and its Dangers' in Imre Lakatos and Alan Musgrave (eds) *Criticism and the Growth of Knowledge*, (New York: Cambridge University Press, 1977), p.52.

<sup>19</sup>Ibid.,pp.52-53.

<sup>20</sup>Ibid.,pp.55.

<sup>21</sup>Ibid.,p.57.

<sup>22</sup>Karl Popper, 'Conjectures and Refutations' in Richard H. Popkin and Avrum Stroll (eds) *Philosophy and Contemporary Problems: A Reader*, (New York: CBS College Publishing, 1984) p.129.

<sup>23</sup>Ben. O. Eboh, *Basic Issues in Theories of Knowledge*, (Nsukka: Fulladu Publishing Company, 1995),p. 49.