AMAMIHE: Journal of Applied Philosophy, ISSN: 1597 – 0779,
Vol. 20, No. 2, 2022
Department of Philosophy, Imo State University, Owerri, Nigeria

UNDERSTANDING POPPER'S CONCEPTION OF SCIENCE THROUGH CRITICAL ANALYSIS OF HIS KEY CONCEPTS

Charles Kosolu Onebunne
Department of Philosophy,
Nnamdi Azikiwe University, Awka
ck.onebunne@unizik.edu.ng
&
Prof. Bonachristus Umeogu
Department of Philosophy,
Nnamdi Azikiwe University, Awka
DOI: 10.13140/RG.2.2.30346.95682

Abstract
Popper's conception of science has been greeted by a number of controversies ranging from his cancelling out of induction as method in science to his propagation of falsificationism as a method of demarcating science from non-science. Consequently, some scholars felt that Popper has attacked the traditional method in science so much so that Popper's conception of science was viewed as an aberration in science. It is in the light of this that this study seeks to employ the method of analysis to bring to the fore, some key concepts in Popper's conception of science as a way of showing the rationality behind the choice of falsificationism as a method in science. The study finds out that Popper chose falsification because, for him, falsification gives science a solid foundation which he believes that induction cannot guarantee. The study also reveals that Popper believes that falsificationism brings about qualitative progress in science as against quantitative growth that is associated with induction in terms of induction's accumulation of evidence. This study finally recommends that Popper's conception of science be approached phenomenologically as that would guarantee a better understanding of his conception science.
Keywords: Critical Analysis, Popper, Science, Falsification

Introduction

Understanding Popper's view of science as a problem solving endeavor as well as a progressive enterprise is key in understanding his conception of science. This underscores the importance of critical analysis of key concepts that featured in Popper's Philosophy of Science as this will aid a proper understanding of the whole corpus of Popper's conception of science. Science has been defined as "very clearly a conscious artifact of mankind, with well-documented historical origins,

with a definable scope and content, and with recognizable professional practitioners and exponents"[1]. This definition is very apt, especially in its reference to science possessing a definable scope and content. It is very apt because of its relatedness to Popper's theory of falsification where Popper seeks to clearly present the scope and content of what is science as against non-science or pseudo-science, as the case may be.

Again, we can also say that science is a systematic enterprise wherein knowledge is built and organized in the form of testable explanations and predictions about the universe. This definition is also very ad rem to Popper's conception of science; the definition holds that science is an enterprise that builds and organizes knowledge. This simply points to the fact that science not only grows but grows in a systematic way. Of course, in Popper's parlance this systematic way is falsification. The definition under review also sees science as having to do with testable explanations and predictions about the universe.

This is also in line with Popper's view on science; the terms - explanations and predictions featured prominently in Popper's conception of science. However, Popper used satisfactory explanations in place of explanations and used conjectures in place of predictions. Indeed, Popper's aim and goal of science is satisfactory explanations about the universe. It is forming these satisfactory explanations that led Popper to finding means of constructing scientific theories. In forming scientific theories, Popper rejected inductivism on the ground that it does not offer a satisfactory and objective explanation.

Coming to the growth or progress of science, Popper maintains that "within the field of science, we have a criterion of progress."[2] This progress, for him, is progress from problems to problems. Thus, for Popper, "science starts from problems, and not from observation; though observations may give rise to a problem, especially if they are unexpected; that is to say, if they clash with our expectations or theories."[3]

He further posited that:

> We may say that most lasting contributions to the growth of scientific knowledge that a theory can make are the new problems which it raises, so that we are led back to the view of science and the growth of knowledge as always starting from, and always ending with problems -problems of ever increasing depth, and an ever increasing fertility in suggesting new problems.[4]

When Popper speaks of science starting from problems, he means that problems are the igniting force of science. That is to say that those problems give rise to scientific theories. That explains why he presented satisfactory explanations as the aim of science. These satisfactory explanations are here looked upon as scientific solutions to problems which science sees as its aim to solve. For Popper, these satisfactory explanations or solutions do not come in a straight line; rather they come in some sort of dialectic manner.

For him, science progresses by means of conjectures and refutations; we make bold conjectures that are as testable as possible and unfailingly find them wanting so that they are refuted and new conjectures are formulated. This way, hypotheses are counted as scientific only if they are falsifiable. That is why Popper explicates that "in science, more often than not, scientists put forward statements and conduct step by step testing. Thus, in the field of empirical sciences, more particularly, he (the scientist) constructs hypotheses or systems of theories, and tests them against experience by observation and experiment."[5]

Rationality of Science in the views of Popper, Kuhn, Feyerabend and Lakatos

In his *The Structure of Scientific Revolutions,* Kuhn speaks of Normal science as a puzzle-solving enterprise; he looks at normal science as an enterprise that seeks to solve a puzzle (problem) in the field of knowledge. It is of great interest to note that what Kuhn refers to as 'Normal Science' is what Popper strictly calls 'Science' as against pseudo-science. Popper appropriately demarcates both through falsification which enables an empirical or scientific system be refuted by experience. Just like Popper holds that there is a criterion of progress in science, Kuhn also holds that progress in science is not a simple line that leads to the truth. Instead, it is a more progress away from less adequate conceptions to more and better conceptions about the world. It is in that way that new theories are built upon previous ones. Kuhn, accordingly, cited The *Copernican Revolution* as example of revolution in science.

In fact, the crux of Kuhn's position is that scientific progress comes by means of revolution. This revolution comes by way of what Kuhn calls paradigm shift. In the work of Kuhn, paradigm could be seen as an exemplar, which is the very best among examples. It can also be seen as a model, a pattern or a template. Examples of such paradigms in science are: laws, theories, applications, experiments, etc. In the progress of science, each paradigm becomes the first port of call before a superior paradigm takes over. Thus, "Normal science is characterized by a

paradigm, which legitimates puzzles and problems on which the community works."[6]

Of course, Kuhn holds that paradigm change has a procedure: "What is the process by which a new candidate for paradigm replaces its predecessor? Any new interpretation of nature, whether a discovery or a theory, emerges first in the mind of one or a few individuals".[7] This is very similar to Popper's idea of rationality of science or what he (Popper) refers to as critical rationality in science. Recall that the aim of science according to Popper is satisfactory explanation about problems of the universe. What Popper refers to as explanation is what Kuhn calls interpretation which according to him (Kuhn) emerges first in the mind of one or a few individuals. This interpretation which starts first in the mind of a few individuals according to Kuhn is what Popper calls bold conjecture or critical rationality.

Thus, according to Popper, "the scientist constructs a hypothesis or systems of theories, and tests them against experience by observation and experiment"[8]. This process is called falsification in science in the language of Popper and revolution in the language of Kuhn. However, it is pertinent to note that the two concepts are tilting towards one goal which is to bring out the best in science. Therefore, both Popper and Kuhn have a similar conception of science. This conception is viewed as purist vision of science.

In the history of the Philosophy of science, we find also other important contributions that portray science in a very different way. In his book *Against Method*, Paul Feyerabend attacked the rationalist account of scientific method which eulogizes the search for a system of rules that should guide scientists in generating scientific theories. For him, therefore, science does not have a specific method so that any tradition that can lead to knowledge should be encouraged and adopted in science. As a matter of fact, he argued for proliferation of theories as a means of making progress in science.

Little wonder he opines that "variety of opinions is necessary for objective knowledge".[9] For him, relying on method inhibits progress in science. Just like Popper, Feyerabend rejected induction as a method in science on the assumption that "induction is insufficient because it is bound to eliminate ideas simply because they do not fit into the framework of some older cosmology, but proliferation of theories leads to development of counter induction which is both a fact and is needed much more in the game of science".[10]

Again, like Popper, Feyerabend holds that the task of science is to give us a correct account of the world. This is what Popper calls satisfactory explanation about the world. Therefore, both Popper and Feyerabend believe that science has aim and a goal which is to provide a correct account or satisfactory explanation about the world. However, their point of difference lies in the method of reaching to the aim of science; while Popper had propounded falsification as a method in science, Feyerabend submits that science has no method. Instead, he (Feyerabend) projects "subjective wishes" of individuals as a way forward for growth and progress in science. These subjective wishes make it possible for different individuals to exhibit freedom in the scientific enterprise. However, an analytic look at the subjective wish of Feyerabend will reveal a point of convergence with Popper's idea of conjecture; in conjecture the individual has freedom to make a guess. However, at this level of conjecture, science is not yet born just as it is in the subjective wish of Feyerabend. That is to say that science comes to being when the conjecture of Popper assumes an objective status and also when the subjective wish of Feyerabend translates to objectivity.

On his own part, Imre Lakatos, could be regarded as one of the philosophers of science who, through his methodology, sought to engage in rational reconstruction of science. His methodology runs in contrast to the methods put forward by his predecessors, namely: Popper, Kuhn and Feyerabend. However, it cannot be said that he did not borrow some ideas from them; he adopted both Popper's falsification and Kuhn's paradigm shift. Imre Lakatos stated in his work that:

> According to my methodology the great achievements are research programmes which can be evaluated in terms of progressive and degenerating problem shifts; and scientific revolutions consists of one research programme superseding (overtaking in progress) another. This methodology offers a new rational reconstruction of science. It is best presented by contrasting it with falsificationism and conventionalism, from both of which it borrows essential elements.[11]

In his *Methodology of Scientific Research Programmes*, he expresses a radical view of Popper's criterion of demarcation between science and non-science and argues that "the problems of methodological falsification (Popper's falsification) are: that we have no means to judge whether the theories of our successive theories decrease or increase and that methodological falsification lacks history of science"[12] Lakatos' criticism against Popper's falsification has no bearing because

the whole corpus of Popper's falsification is to demarcate science from non-science or pseudo-science.

Therefore, if falsification of a statement or systems of statements is successful, then scientific progress is made. If otherwise, there is no science. So which other means of measuring the success of a scientific theory could be better than this? On the contrary, Lakatos' position could be perceived more as a support to Popper rather than an attack. After all, he (Lakatos) posited that "a research programme is successful if it leads to a progressive problem shift and unsuccessful if it leads to a degenerating problem shift".[13] What more can be said about the similarity between Popper's Falsification and Lakatos' Methodology of Scientific Research Programme?

At this point, we recall that Popper's idea of the aim and growth of science flows in the theories of all the philosophers of science that came after him. His Falsificationism aims to perfect the explanatory powers of systems of statements about the universe in such a way that we can arrive at satisfactory explanations about the universe which is his aim of science. Thus, falsification makes it possible for the aim of science to be well achieved which is for better scientific theories to emerge.

Critical Analysis of Key Concepts in Popper's Conception of Science

Objectivity in Science

There is no doubt that science is an objective enterprise. This is so because it is public knowledge as against individual knowledge or information. Consequently, it is essential that in science, that the information about the object of study is accurate and reliable and therefore as objective as possible. The talk of science being objective is science not being influenced by human emotions, biases and prejudices. It is good to mention this because science being an empirical endeavor emanates from observations. Observations, in themselves are done by means of human senses such as senses of vision, taste, hearing, smell etc. Because our senses may differ from person to person, there is every indication that scientific objectivity is not guaranteed were science to rely on human senses alone.

For Karl Popper, the question of objectivity in science must not be swept under the carpet. This is so because, as has earlier been mentioned, science takes off from observations which are done by the senses. Thus, what we have at this level could be likened to personal feelings or personal convictions. However, science is not the same as personal conviction because personal convictions are not sufficient to justify a statement. Therefore, scientific statements or theories should not be

accepted based on personal convictions as they are at variance with scientific objectivity. Expatiating on this in his *Logic of Scientific Discovery*, Popper notes that:

> Even the fact, for me so firmly established that I am experiencing this feeling of conviction, cannot appear within the field of objective science except in the form of a psychological hypothesis which, of course, calls for inter-subjective testing: from the conjecture that I have this feeling of conviction the psychologist may deduce, with the help of psychological and other theories, certain prediction about my behaviour, and these may be confirmed or refuted in the course of experimental test.[14]

The implication of the above postulation of Karl Popper is that no matter the level of one's feeling of conviction about a particular statement or statements, it cannot constitute the ground for its acceptability and justifiability as scientific statement or statements. This is because such a statement lacks merit when placed in the scale of scientific objectivity. For scientific statements to be objective means that they have to pass through inter-subjective testing. For Popper, "inter-subjective testing is an aspect of all the all-embracing idea of inter-subjective criticism or what may be called mutual rational control by critical discussions"[15]. This way Popper believes that the talk of objectivity of scientific statements lies in the fact that they can be inter-subjectively tested.

At this point may it be stressed that the question of inter-subjective testing of theories as Popper would have it has its root in falsification. In itself, falsification aims at bringing about objectivity of scientific statements or theories. Thus, Popper's insistence on testing is designed to highlight the necessity that should greet every scientific statement to be capable of being tested so that there will not be any statement in the terrain of science that is accepted as true on the basis of sounding convincingly true but without appropriate testing.

In Philosophy of Science, objectivity is understood as the concept of truth that is independent of individual subjectivity, bias, prejudice, judgment, etc. Therefore, something is considered to be objective when its judgment is based on observable phenomena that is uninfluenced by emotions or personal prejudices. It is in the same vein that Popper underscores objectivity in science as that which "indicates that scientific knowledge should be justifiable, independently of anybody's whim: a justification is objective if in principle it can be tested and understood by anybody".[16] Therefore, objectivity is science simply means that scientific statements exist independently of individuals' perceptions or conceptions. Scientific statements are not to be distorted by emotions or personal bias. Here we

see that science is demarcated from non-science based on objectivity and subjectivity. Thus, whereas science thrives in objectivity, non-science is enshrouded in subjectivity.

For clarity sake, may it be highlighted that subjectivity refers to what is belonging to, proceeding from or relating to or emanating from a person's emotions, prejudice, sentiments, etc. This explains why subjective information usually consists of judgments, assumptions, beliefs, suspicion, rumour, etc. As a corollary, subjective information can vary from person to person and so it can be far away from the truth. On the contrary, objective information does not vary and it is close to the truth. Based on the foregoing, some statements of religion, suit Sayers, diviners, astrologers, etc, are not to be counted as scientific on the basis of them lacking in objectivity.

Therefore, it is here succinctly clear that the talk of scientific progress is the talk of search for objectivity. Thus, without objectivity, there is no science. That explains why Karl Popper expressed that scientific knowledge should be independent of any body's whims, prejudice, bias and perception. Scientific knowledge is equal to objective knowledge even though for Popper it may emanate from individual's perceptions or perspectives in the form of conjectures but it is not to stop at the level of conjecture. For Popper, conjectures are made and falsified for the sole purpose of scientific progress which in turn is the search for scientific objectivity. However, when conjectures are made and they do not pass falsifiability test, they are jettisoned on the ground of not being scientific. Thus, in Popper's Philosophy, falsification aims towards scientific objectivity just as scientific objectivity is a product or outcome of falsification.

Conjectures and Explanations

The two major issues of attention in Popper's Philosophy of Science are his rejection of induction as a method in science and propounding of falsification in science. For him "all human knowledge is fallible and conjectural … a product of the method of trial and error".[17] In Popper's submission, scientists bring forth bold conjectures for trials and then carry out systematic falsification of those conjectures. In popper's argument, for a proposition, statement or hypothesis to be counted as scientific it must be found to be at the risk of making some predictions. This is what popper calls bold conjectures. Furthering his submission, he succinctly states that "statements or systems of statements, convey information about the empirical would only if they are capable of clashing with experience; or

more precisely, only if they can be systematically tested, that is to say, if they can be subjected to tests which might result in their refutation.[18]

In Popper's understanding of science, the duty of the scientist is to make a conjecture and try to refute it. For him therefore, making conjectures and falsifying them should be the real route of science. Therefore, scientific statements or propositions should be exposed to the risk of being falsified by way of subjecting them to severe tests. Popper explains that the greater the severity of the various tests, that the proposition has successfully endured the higher the degree of carroboration".[19] What this implies in Popper's parlance is that well tested theories can as well remain merely provisional and therefore, can be rejected following an experimental result that runs contrary to its predictions or conjectures. About this, Popper's remark is that "scientific theories are either falsified or forever remain hypothesis or conjectures".[20]

In popper's philosophy of science, conjecture and explanations or rather better explanations are intertwined. This is so because he believes that our desire for knowledge is linked to our desire for getting solutions to some problems. Thus, in the quest for knowledge for problem solving explanation are needed and indeed not just explanations but better explanations at every point in time. However, in the process of looking for explanation sometimes we ordinarily pose some forms of explanations which might have come by way of hazarding a guess or speculation. This is what Popper termed bold conjecture. But the already made explanation as the case may be could be inadequate to deal with the problem solving, hence the need for better explanations that surpass what are currently at hand. More still, these better explanations can still be expected to birth better and better explanations. In analyzing Popper, Danny Frederick in his article – *Karl Popper: Conjectures and Refutations*, reeled out some conditions of better explanations by stating that an explanation is better than another if:

i. It is falsifiable while the other is not.
ii. It explains what the other explains and some other things better.
iii. It provides a unified solution to problems that were explained in different ways by the other.
iv. It generates surprising falsifiable predictions that are not derivable from the other and those predictions survive testing.
v. It corrects the other, that is, it shows that some falsifiable predictions of the other that were thought to be successful were actually not successful and it explains why they seemed successful.

This is a thorough representation of Popper's evolution of better explanations that emanate from conjectures. This is so because in Popper, we learn that for us to get better explanations we should expound conjectures and then subject them to criticism. When this is done, poorer explanations should be jettisoned in favour of better explanations.

Theory of Verisimilitude

Etymologically, the term - *verisimilitude* is a derivation of Latin term – *verisimilitude.* Dissection of the term takes us further to the origin which are 'verus' - 'true' and 'smilis' – 'like'. The 'veri' in 'verisimilitude' is the genitive case of 'verus'. Thus we now have 'veri' and 'similis' which are 'of true' and 'like' respectively. Therefore, the concept of verisimilitude would translate to English as 'truthlikeness'. This is not different from its Greek equivalent – 'eoikotos' which in English means – 'like the truth'.

In this section, this study will consider the concept of verisimilitude in Karl Popper's Philosophy of Science. It may sound contrasting to state that Popper believes that science does not ultimately seek after unraveling of truth. At best, it is the position of Karl Popper, after all, his theory of verisimilitude suggests that science in its move to explain reality as it relates to truth, can only try to come near to the truth. That simply means that science in its endeavor can only achieve truthlikeness. However, this does not take away the objective nature of science. After all, Popper's theory of falsification stipulates that the search for the truth is an ever continuous exercise. This implies that no theory in science can actually claim finality.

And for Popper, that spells progress in science. In explaining out the nexus between verisimilitude and objectivity, Popper portrays that:

> The status of truth, in the objective sense, as correspondence to the facts, and its role as a regulative principle, may be compared to that of a mountain peak wrapped in clouds… A climber may not merely have difficulties in getting there – he may not know when he gets there, because he may be unable to distinguish, in the clouds, between the main summit and a subsidiary peak… yet this does not affect the objective existence of the summit; and if the climber tells us 'I doubt whether I reached the actual summit', then he does, by implication, recognize the objective existence of the summit … the very idea of error or of doubt (in its normal straight forward sense) implies the idea of an objective truth which we may fail to reach. [21]

The above outlined expatiation of Popper reveals how arduous and enduring the trajectory of truth could be. In his theory of conjecture, we see how the search for truth begins from opinion (bold conjecture). As a matter of fact, Popper is not the first to offer this kind of explanation with regard to quest or search for truth. In his own right, Plato stated that "we, for the most time, live in the twilight zone between knowledge and ingoronce."[22] In a similar vein, Plato was quoted as having put forward the following lines below:

> It's wisdom judging things correctly without being able to give a reason … surely you see that this is not the same as knowing – for how could knowledge be unreasoning? And it's not ignorance either – for how could what it's the truth be ignorance? Correct judgment, of course has this character: it is in between understanding and ignorance.[23]

What the above lives portray is that there is no absolute or final truth in any understanding of the truth content of any concept.

On his own part, Popper is of the opinion that whatever the case, that we must not remain static. Instead, we must make progress because it is that way that scientific progress is assured. Therefore, for there to be progress in scientific knowledge, the scientist must critically engage in testing of already available theories in order to decipher a greater nearness or closeness to truth. This nearness to truth simply implies acceptance at any point in time of a scientific theory with greater explanatory power. This is so because Popper believes that every scientific theory is a response to a scientific problem which in turn is linked with discovery of an explanation. The theory of verisimilitude brings out the non-finality and fallibility of scientific theories. But Popper did not want to give in. That is why with his theory of verisimilitude he sounds very much hopeful that scientists can still get closer to the objective truth so much so that scientific progress is very much possible. Shedding light on this, Popper postulates thus:

> Looking at the progress of scientific knowledge, many people have been moved to say that even though we do not know how near to or how far from the truth we are, we can, and often do approach more and more closely to the truth… I myself have sometimes said such things, but always with a twinge of bad conscience … But as long as we speak as clearly as we can, yet do not pretend that what we are saying is clearer than it is … there is no harm whatever in occasional vagueness, or in voicing every now and then our feelings and general intuitive impressions about things.[24]

The above position of Popper leads us to understand verisimilitude as an approximation to truth which means that every sincere search for truth portends getting closer to the truth.

Observation in Science

There is no gain saying the fact that Popper believes so much in the objectivity of science. This explains why he distinguished objective science from our ordinary knowledge. Interestingly, Popper did not debunk the claim that it is only observation that can offer us knowledge of facts. He however, asserted that knowledge of facts is not sufficient to justify nor establish the truth content of any proposal. Of course, he could not have believed otherwise given the fact that he has dismissed induction as a mean means through which science could grow. Induction, as it were, is about accumulation of experiences and basing on that to draw conclusions about future events. Because observation goes hand in hand with the process of induction, Popper believes that it (observation) cannot be a base for scientific growth.

Popper's position about observation stems from the contention of some physicists who hold that Newton's theories especially his theory regarding celestial mechanics, can be derived inductively from observation. Newton's theory is regarded by them (the physicists) as an accurate prediction of the orbits of all the planets, including their derivations from Kepler's ellipses as well as the orbits of all their satellites.

However, Popper rejected the supposition that Newton's theory was derived from observation. For popper, Newtonian theory differs from observation statement in its entirety. He argued that observations are inexact but that Newtonian theory contains entirely exact statement. Here, we observe that Popper's logic for rejection of observation in science is that observations are less exact while theories are more exact and more precise.

For Popper therefore, it is logically untenable that something more exact and precise could be derived from something less exact. Expatiating on this, Popper made reference to Newtonian theory saying that "Newton's theory not only accurately predicted the orbits of all the planets, including their derivations from Kepler's ellipses, and also the orbits of all their satellites".[25] Popper argued that observation could not have led to the conclusion or claims of the theory since the theory bears claims that are yet to be known by just observation. Popper analyzed the theory asserting that "the claim of the theory is that is applies in all possible

circumstances, not only to the planets, mars or jupiter, or even to the satellites in the solar system, but to all planetary motion and to all solar system".[26]

Thus for Popper, based on the above analyzed postulation, observation could not have led to the entire claims of the theory and indeed other scientific theories in that fashion. With the rejection of observation in science, popper holds tenaciously that it is the falsification that leads to scientific progress.

Conclusion

According to Popper, falsification helps in the growth of knowledge. However, it is good to state here that falsification can take on other nomenclatural formulations. But this does not change the purpose it (falsification) is designed to serve.

In relation to this, Ferit Uslu stated that:

> Nowadays testability is used instead of Popper's falsifiability as a broader concept by most of the Philosophers of science and it is regarded as one of the necessary features of being scientific. Testability means that a scientific knowledge achieved by that method can be checked publicly (independently from the ones who put forward that knowledge and by the methods which are not depending on individual inclinations).[27]

The above postulation opens up an important aspect or feature of science as public knowledge as against private knowledge which is at the whims of individuals' inclinations and subjectiveness. Therefore, science as a public knowledge is subject to falsification which means that it must be made to pass the test of testability or criticism if it must tilt towards objectivity which is a feature of scientific knowledge. This process is vital in scientific growth since growth of knowledge is occasioned by criticism which is necessary because of the fallibility of human mind.

Thus falsification in science is necessitated by the unavoidability of the fallibility of the human mind which if not well checkmated will continue to constitute a cog in the wheel of scientific progress.

Finally, this study reiterates that Popper's falsification seeks to demarcate science from non-science such as dogmatism, superstition, religious beliefs, myths conventionalism, etc. Thus, falsification makes science to stand out as a progressive enterprise even as it purifies and refines scientific theories. That having been said, we can also and always view science as a problem-solving enterprise. So if science is viewed in that light, will it be sufficiently rational to

allow scientific theories to be stagnant when there are enormous reasons to call for improvement? The reasonable answer is No. This is because change, growth and progress are part of life. So if falsification is considered to be a part way to progress in science, why would scientists not adopt it in their enterprise? It is therefore, by means of falsification, testability, criticism, revision, (or whatever name one wishes to adopt) that better theories will supersede good theories and those better theories will still give way for best theories, where applicable. This process is simply dialectic of scientific progress. This approach to science was well described by Park Seungbae when he demonstrated the trajectory of growth of knowledge among ancient Philosophers. Seungbae has this to say:

> Presocratic philosophers in ancient Greece proposed various hypotheses about the fundamental building blocks of the universe. For example, Tales, Anaximander, Pythagoras and Democritus contended that everything is made out of water, boundless, numbers and atoms, respectively. Their hope was to understand physical objects like trees, apples, stones, and so on by instigating their physical compositions… According to Popper, Presocratics initiated science by being engaged in a series of conjectures and refutations over the basic stuff of the unvierise.[28]

Looking at above lines, what more can one say in terms of striving to lay bare the import of Popper's falsification and the process of progress in science. That can be considered to be the closest and simplest analysis and explication of Popper's concept of falsification and scientific progress.

References

1. E.D. Klempe, R. Hollinger & D.W. Rudge (Eds), *Introductory Readings in the Philosophy of Science, 3rd edition* (New York: Prometheus Books, 1998). p.18.
2. K.R. Popper, *Conjectures and Refutation: The Growth of Scientific Knowledge, (*London: Routledge and Kegan Paul, 1963), p.218.
3. Ibid., p. 222.
4. Ibid.
5. K.R. Popper, *The Logic of Scientific Discovery,* (London: Routledge Classics, 2002), p.3.
6. T.S. Kuhn, *The Structure of Scientific Revolutions,* 4th edition, with Introduction by Ian Hacking, (Chicago: The University of Chicago Press, 2012), p.16.
7. Ibid., p. 140.
8. K.R. Popper, *The Logic of Scientific Discovery*, p.3.

9. W.H. Newton-Smith, *The Rationality of Science*, (London: Routledge & Kegan Paul, 1981), p. 132.
10. Ibid., p.137.
11. I. Lakatos, *Falsification and the Method of Scientific Research Programmes*, quoted in *Criticism and the Growth of knowledge*, (London: Cambridge University Press, 1970), p.91.
12. J. Warrall & Currie, *Imre Lakatos: The Mythology of Scientific Research Programmes, Philosophical Papers.* Vol. 1, (London: Cambridge University Press, 1995), p.110.
13. I. Lakatos, Op. Cit., p. 91.
14. K.R. Popper, *The Logic of Scientific Discovery,* p. 46.
15. Ibid., p.44
16. Ibid.
17. K.R. Popper, *Conjectures and Refutations: The Growth of Scientific knowledge,* 2nd edition, (New York: Basic Books, 1965). p.116.
18. K.R. Popper, *The Logic of Scientific Discovery,* trans. J. Freed E.L. Freed, (New York: Basic Books 1959), pp. 313 – 314.
19. Ibid, p. 267.
20. P.A. Schilpp, "Autobiography of Karl Popper: Theory of knowledge", in *The Philosophy of Karl Popper,* P.A. Schilpp, (ed), vol. 1.p.62, Open Court, La sale, IL.
21. K.R. Popper, *Conjectures and Refutations:* pp.306 – 307.
22. Quoted in S. Gattei, Karl Popper's Philosophy of Science (New York: Rutledge Publishers, 2009), p. 77.
23. Plato, "Symposium", in John M. Cooper (ed), *Plato: Complete Works,* (Indianapolis: Hackett publishing Company, 1977), p. 485.
24. K.R. Popper, *Conjectures and Refutations,* p.313.
25. Ibid., p. 185.
26. Ibid., p. 186.
27. F. Uslu, "How can we Demarcate Science from Non-science?" *Advances in Education Research, vol. 19, 2013 International Conference on Social Science and Health (ICSSH 2013)*, Los Angeles, edited by Garry Lees, p. 287.
28. P. Seungbae, "To Be Scientific is to be Interactive" *European Journal of Science and Theology,* 12 (2016), p.79.
29. Kanu, Ikechukwu A., "Igwebuike philosophy of science and technology". *Nnadiebube Journal of Education. Vol. 5. No. 4, 2020, pp. 64-74;* Kanu, Ikechukwu A., "Igwebuike and the Question of Superiority in the Scientific Community of Knowledge". *Journal of African Studies and Sustainable Development*. Vol. 1. No.

1. 2018, pp. 131-138; Kanu, Ikechukwu A., "Genetic Engineering and the Quest for a Perfect Society: Religion and Science in Dialogue". *AMAMIHE: Journal of Applied Philosophy.* Vol. 10. No. 1. 2012, pp. 63-70.