



## KARL POPPER'S CRITIQUE OF THOMAS KUHN'S CONCEPT OF NORMAL SCIENCE: AN EVALUATION

Anetoh Bonaventure Chike (Ph.D)

Department of Philosophy and Religious Studies, Tansian University, Umunya, Nigeria

Email: anetohbonaventure@yahoo.com

### Cite this article:

Anetoh Bonaventure Chike (2021), Karl Popper's Critique of Thomas Kuhn's Concept of Normal Science: An Evaluation. African Journal of Social Sciences and Humanities Research 4(3), 105-115. DOI: 10.52589/AJSSHR-NROPSRCB.

### Manuscript History

Received: 6 June 2021

Accepted: 3 July 2021

Published: 12 July 2021

### Copyright © 2020 The Author(s).

This is an Open Access article distributed under the terms of Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0), which permits anyone to share, use, reproduce and redistribute in any medium, provided the original author and source are credited.

**ABSTRACT:** *This article focuses on an evaluation of Karl Popper's critique of Thomas Kuhn's concept of normal science. Kuhn describes normal science as paradigm-based research in which scientists conduct their research within the theoretical and conceptual provisions of the accepted paradigm. His idea of normal science is very controversial, and as such was criticized by many philosophers of science, especially Karl Popper. The basic questions are: What actually does Kuhn mean by normal science? What are the major occupations of scientists during normal scientific research? What are the major criticisms Popper made against Kuhn's normal science? Is Popper right in his assessment of Kuhn's idea of normal science? This article, employing analytical and critical methods of inquiry, examines Popper's critique of Kuhn's normal science. The researcher observes that Popper's major problems with Kuhn's idea revolve around the issues of uncriticality and dogmatism. However, this article argues that Kuhnian normal scientists seem not to be as 'dogmatic' and 'not-too-critical' as Popper claims. Popper's fundamental problem in his assessment of Kuhnian normal science is that he assessed Kuhn's normal science in isolation without taking adequate cognizance of its proper context. Nevertheless, Popper's non-dogmatic approach to the scientific investigation could be said to be very necessary for the development of science in general.*

**KEYWORDS:** Kuhn, Popper, Normal, Science, Criticism



## INTRODUCTION

Thomas Kuhn and Karl Popper are among the major scholars in the philosophy of science in the contemporary era. Both of them are very outstanding as far as the discipline is concerned. This is as a result of their remarkable contributions in the discipline. Kuhn made a remarkable distinction between 'normal science' and 'revolutionary science'. Normal science entails the usual scientific research of scientists, guided by the accepted or prevailing scientific paradigm which is not questioned by the members of a particular scientific community during normal scientific research. However, the accepted paradigm is questioned during revolutionary science. Kuhn's idea of normal science elicited different reactions from different scholars. Some scholars admired Kuhn's idea, while some others were not comfortable with his idea and thus criticized him severely. Among the scholars that criticized Kuhn's idea of normal science is Karl Popper, who gave a detailed as well as a scholarly critique of Kuhn's idea. Obviously, Popper is not satisfied with Kuhn's account of normal science.

The fundamental questions that are scholarly, very necessary and imperative in this study are: What actually does 'normal science' mean? What are the activities of scientists during the period of normal science? What are the major problems Karl Popper had with Kuhn's account of normal science? What are the major points of Popper's criticisms against Kuhn's normal science? Can Popper be said to be fair to Kuhn in his assessment of Kuhn's idea of normal science? These questions are the major issues that form the focus of this article, and thus are to be given critical as well as detailed attention.

This article is divided into three major sections. The first section focuses on Thomas Kuhn's view of normal science and the activities of scientists during normal scientific research. The second section examines Karl Popper's critique of Kuhn's normal science. The third section centres on the evaluation as well as the conclusion of the article.

### Thomas Kuhn's View of Normal Science

It is scholarly necessary at this juncture to examine Thomas Kuhn's view of normal science. This places Karl Popper's critique of Kuhnian normal science into its proper perspective. 'Normal Science' is one of the remarkable innovations of Kuhn in contemporary philosophy of science. With Kuhn's idea, it becomes very fashionable to talk of 'normal science' in contemporary philosophy of science. He employed the term in the context of his idea of a scientific revolution but insisted that science develops through revolution. Normal science has to do with the practice of science when it is not going through any revolutionary change. It is completely opposed to revolutionary science which questions the normal practice of scientific research.

The question that is very necessary at this juncture is this: What actually does Kuhn mean by normal science? The response to this question is of great importance as it remains part of the fundamental issues that form the focus of this article. Normal science is the usual day-to-day activities of scientists. It is a cumulative enterprise based on the accepted beliefs of scientists in a particular scientific community. It is opposed to revolutionary science which is a non-cumulative as well as discontinuous enterprise. According to Kuhn (1970a):

...normal science, is the generally cumulative process by which the accepted beliefs of a scientific community are fleshed out, articulated, and extended. It is what scientists are trained to do, and the main



tradition in English-speaking philosophy of science derives from the examination of the exemplary works in which that training is embodied. (p.250)

Normal science focuses on the accepted beliefs of a given scientific community which form the paradigm for scientific research. Kuhn conceives it as the normal condition of scientific research in which scientists are trained to engage in. It is the usual activities of scientists, and such activities are based on past scientific achievements which are models for scientific investigation. Thus, it is obvious from Kuhn's stipulation that it is past scientific achievements that guide the conduct of normal science. Kuhn cites Aristotle's *Physica*, Newton's *Principia*, Lavoisier's *Chemistry* etc. as vivid examples of past scientific achievements. Such past scientific achievements are models for scientific research, and as such scientists conduct their research within their theoretical and conceptual provisions. They are the accepted examples of actual scientific practice, which guide scientists in the conduct of scientific research during the period of normal science.

Normal science is research within a scientific framework. In fact, it is paradigm-based research. A paradigm, for Kuhn (1970b), is an accepted model or pattern of scientific research. It is the accepted paradigm that guides the conduct of normal scientific research. The paradigm seems to be sacrosanct in normal scientific research. During normal scientific research, an effort is geared towards defending and extending the provisions and the assumptions of the paradigm. It becomes obvious from Kuhn's stipulations that normal scientific research articulates further the accepted paradigm, and resolves some of its residual ambiguities. In normal scientific research, scientists engage in what Kuhn calls 'mop-up operations. Hence, every research during normal science revolves around the provisions of the prevailing paradigm.

From the foregoing, it becomes very clear that normal scientific research is not geared at propounding new theories. It only focuses on making the accepted paradigm more precise and clear by the elimination of ambiguities associated with it. However, normal scientific research discloses many more rules, and these provide more information about the paradigm. This implies that normal science is a cumulative enterprise. Due to the fact that normal science does not challenge the accepted paradigm, its area of investigation is always narrow. Such allows scientists to focus attention on some esoteric problems, and this gives the opportunity for detailed research.

Also, Kuhn maintains that normal science involves partially making predictions within the provisions of the accepted paradigm. Such predictions cannot contradict the stipulations of the accepted paradigm. They depend on it. Also, they grow from it and do not try to depart from it. However, despite such predictions, normal science does not basically aim at producing conceptual or phenomenal novelties.

### **Normal Science and Puzzle-Solving**

There is a strong relationship between Kuhn's normal science and puzzle-solving. In fact, the fundamental aspect of Kuhn's account of normal science is what he describes as 'puzzle-solving'. This is a result of the fact that puzzle-solving occupies a central position in normal scientific research. The question that quickly comes to mind at this juncture is this: What does Kuhn mean by Puzzles? Certainly, a proper understanding of what a puzzle is all about enables one to appreciate the relationship between normal science and puzzle-solving. According to



Kuhn (1970b): “Puzzles are, in the entire standard meaning here employed, that special category of problems that can serve to test ingenuity or skill in solution.” (p. 36) Puzzles test the expertise of scientists in normal scientific research. Practitioners of normal science concentrate on solving puzzles within the conceptual framework of the prevailing paradigm. This makes it possible for them to focus on some hidden problems. At this point of scientific research, the basic challenges of the scientists are how to solve puzzles that are associated with the accepted paradigm. Essentially, Kuhn seems to have thought that scientists would not be pushed to tackle the hidden puzzles without a firm belief in the accepted paradigm (Rowbottom, 2011). However, Kuhn insists that the failure to arrive at a solution during puzzle-solving activity discredits the scientist and not the paradigm. This is a result of the fact that normal science makes effort to bring facts and the paradigm into an agreement. From the foregoing, it becomes certain that normal science is a cumulative enterprise that occupies itself with puzzle-solving within the conceptual and theoretical frameworks of the accepted paradigm.

### **Anomaly and Crisis in Normal Scientific Research**

As was already demonstrated in this article, Kuhn argues that normal science is not meant to question the accepted paradigm and does not aim at propounding new theories. However, he argues that novelty cannot be permanently suppressed in normal scientific research. This implies that normal science can be effective in giving rise to novelty. This position is quite very surprising judging from Kuhn’s previous ideas. It seems to contradict Kuhn’s earlier view on the practice of normal scientific research. Nevertheless, Kuhn insists that it is possible because normal science enables scientists to focus on some specific areas. Such restricted attention can disclose an anomaly in the prevailing or accepted paradigm. The anomaly arises when there are puzzles that cannot be resolved with the theoretical provisions of the accepted paradigm. It ought to be noted that an anomaly can appear only against the provisions of the prevailing paradigm. The more precise that a paradigm is, the more it provides a sensitive indicator of anomaly. At this point of an anomaly in normal scientific research, scientists try to explore the area of the anomaly to know whether it can be resolved with the assumptions of the accepted paradigm. However, when anomalies accumulate, there exists a ‘crisis’ in the scientific community. It ought to be noted that the crisis shatters the rules of normal scientific research. Elaborating this further, Kuhn (1965) states:

When, for these reasons or others like them, an anomaly comes to seem more than just another puzzle of normal science, the transition to crisis and to extraordinary science has begun. The anomaly itself now comes to be more generally recognized as such by the profession. More and more attention is devoted to it by more and more of the field’s most eminent men. If it continues to resist, as it usually does not, many of them may come to view its resolution as the subject matter of their discipline...But with continuing resistance, more and more of the attacks upon it will have involved some minor or not so minor articulation of the paradigm, no two of them quite alike, each partially successful, but none sufficiently so to be accepted as a paradigm by the group. Through this proliferation of divergent articulations (more and more frequently they will come to be described as ad hoc adjustments), the rules of normal science become increasingly blurred. (p.85)



The breakdown of the normal puzzle-solving activity is a prelude to, and also an essential ingredient of 'crisis'. Without such anomaly and its eventual accumulation, one cannot talk of a crisis in normal scientific research. Crisis, if not well managed, can necessitate revolutionary science. In order to substantiate this point, Kuhn demonstrates that crisis preceded the emergence of Lavoisier's oxygen theory of combustion, and crisis in physics preceded the emergence of relativity theory. Also, the crisis was evident in Leibniz's criticism of Newton's retention of the classic conception of absolute space. The scientist that experiences a crisis then tries to produce theories that can give rise to a new paradigm if successful, or maybe surrendered if unsuccessful. The serious point to be noted about the crisis is that it loosens the rules of the dominant theory, and also provides the data needed for the arrival of another theory. This implies that 'crisis' is a necessary pre-requisite for a scientific revolution. Crisis makes the scientists lose faith in the paradigm, and consider alternatives. Thus, the crisis can necessitate the rejection of the dominant paradigm. Obviously, the rejection of the paradigm goes along with the acceptance of an alternative one. Kuhn insists that there is no research without counter-instances. Hence, he investigated the various kinds of responses that can be given to 'crisis' by scientists, and how such a crisis may be finally resolved. He argues that crises can lead to scientific revolution through which a new paradigm erupts, but insists that not all crises lead to the eruption of a new theory or paradigm. Crisis, for him, can end in any of these ways: Firstly, normal science may at times be able to tackle and resolve the crisis. Secondly, the crisis may resist every novel approach. At this point, the problem is postponed to future time with more sophisticated equipment. Thirdly, the crisis may lead to the eruption of a new theory or paradigm. (Kuhn, 1970b, p.84) This brings out clearly the idea that it is not all crises that end up in the abandonment of the accepted theory or paradigm. However, Kuhn is highly interested in the eruption of new scientific theories or paradigms. When a new paradigm is accepted, the practice of scientific investigation alters its perceptual worldview. Certainly, the reception of another paradigm has devastating consequences for scientific practice. The eventual reception of another paradigm is what Kuhn describes as 'scientific revolution', and the detailed analysis of it is outside the scope of this article.

Thus far, the researcher has examined Kuhn's account of normal science and the intricacies in normal scientific research. It is scholarly pertinent at this juncture to examine Karl Popper's critique of Kuhnian normal science in order to ascertain the objectivity and fairness of such critique.

### **Examining Karl Popper's Critique of Kuhn's Normal Science**

Kuhn's idea of normal science is actually very controversial. It elicited different and conflicting reactions from different philosophers of science. Some philosophers of science admired Kuhn's idea of normal science and commended him for such innovation in the contemporary philosophy of science. On the contrary, some philosophers of science disliked Kuhn's idea and thus subjected it to severe criticism. Among the scholars that criticized Kuhn's idea of normal science is Karl Popper.

Karl Popper is an outstanding scholar in the contemporary philosophy of science. He felt very uncomfortable with Kuhn's concept of normal science. This necessitated his severe criticisms of Kuhn's account of normal science. However, though Popper criticized Kuhnian normal science, he admits that what Kuhn calls normal science does exist. According to him:



‘Normal’ science, in Kuhn’s sense, exists. It is the activity of the non-revolutionary, or more precisely, the not-too-critical professional: of the science student who accepts the ruling dogma of the day; who does not wish to challenge it; and who accepts a new revolutionary theory only if almost everybody else is ready to accept it—if it becomes fashionable by a kind of bandwagon effect...You may say, perhaps, that in so describing Kuhn’s ‘normal’ science, I am implicitly and surreptitiously criticizing him. I shall therefore state again that what Kuhn has described does exist, and it must be taken into account by historians of science. (Popper, 1970, p.52)

Implied in Popper’s admittance of the existence of Kuhn’s normal science is his critique of Kuhn’s normal science as not-too-critical as well as dogmatic exercise. One can easily observe why Popper used such words as ‘not-too-critical’ and ‘dogmatic’ to describe Kuhnian normal science. This can be attributed to the total acceptance as well as unquestioning attitude to the accepted paradigm in normal scientific research. Popper is not comfortable with such an attitude.

Popper conceives Kuhn’s normal science as a problem to science, and this is as a result of its dogmatic and non-critical nature. He insists strongly that scientists ought to be critical and undogmatic in their approach to issues. What is necessary for Popper is the elimination of error by subjecting our theories to criticism. In his words:

The proper answer to my question “How can we hope to detect and eliminate error?” is I believe, “By *criticizing* the theories or guesses of others and –if we can train ourselves to do so—by *criticizing* our own theories or guesses.” (The latter point is highly desirable, but not indispensable: for if we fail to criticize our own theories, there may be others to do it for us.) (Popper, 1984, p. 128)

Every scientific endeavour, for him, is only a conjecture and should be subjected to severe tests. The target of scientists is not to defend a theory, but rather to refute it. From this perspective, the total acceptance of the prevailing paradigm during the period of normal science as Kuhn claims is quite out of place. Thus, Popper argues that Kuhn’s ‘normal’ scientist is a person one should be sorry for because he has been wrongly taught in a dogmatic spirit. According to Popper (1970):

The ‘normal’ scientist, as described by Kuhn, has been badly taught... As a consequence, he has become what may be called an applied scientist, in contradistinction to what I should call a pure scientist. He is, as Kuhn puts it, content to solve ‘puzzles’. The choice of this term seems to indicate that Kuhn wishes to stress that it is not a really fundamental problem which the ‘normal’ scientist is prepared to tackle: it is, rather, a routine problem, a problem of applying what one has learned: Kuhn describes it as a problem in which a dominant theory (which he calls a ‘paradigm’) is applied. (p.53)

This explains why Popper is very dissatisfied with Kuhnian normal scientists. Accepting completely without questioning the prevailing theory or paradigm keeps Popper very



uncomfortable. Such a dogmatic attitude is not necessary for scientific investigations. Popper does not expect Kuhnian normal scientists to pay complete allegiance to the accepted theory during the period of normal scientific research. Obviously, he is fundamentally and generally not comfortable with an uncritical attitude in scientific research, though he affirms that such exists among trained scientists. He argues that the “method I have in mind is that of stating one’s problem clearly and of examining its various proposed solutions critically.” (Popper, 1968, p.16) Moreover, he sees a great problem to science in normalizing dogmatic attitudes in scientific research. This demonstrates why Popper is completely dissatisfied with Kuhn’s normal science. What Popper conceives as abnormal is actually what Kuhn conceives as the normal condition of science. Thus, he argues that Kuhn is mistaken when he claims that what he calls ‘normal’ science is normal. Kuhn’s description of normal science as well as revolutionary science, for Popper, may be applicable in astronomy but does not fit in some areas such as in the biological sciences.

Furthermore, Popper is of the view that scientific history does not support Kuhn’s claim that it comprises dominant theories, punctuated with revolutionary periods of ‘extraordinary’ science. Thus, Popper insists that Kuhn’s picture of scientific history is quite incorrect as it clashes with the facts.

Also, Popper notes that Kuhn denies the claim that the scientific method is normally that of conjecture and criticism, but rather affirms the prevalence of dogma over considerable periods. The view that every scientific theory is just a conjecture has been propagated and defended by Popper. Such conjecture is open to refutation, and may eventually be refuted. This is actually not in line with Kuhnian normal science. Popper also observed that Kuhn conceives the rationality of science as that which presupposes the acceptance of a common framework and that rationality depends on a common language as well as a common set of assumptions. Thus, rational discussions and criticisms between different frameworks are rather very difficult if not impossible. Popper describes Kuhn’s idea as a thesis of relativism. He argues thus:

I admit, of course, that it is much easier to discuss puzzles within an accepted common framework and to be swept along by the tide of a new ruling fashion into a new framework than to discuss fundamentals- that is, the very framework of our assumptions. But the relativistic thesis that the framework cannot be critically discussed is a thesis that can be critically discussed and which does not stand up to criticism (Popper, 1970, p.56)

Popper admits that we are sometimes caught in the framework of our theories and our languages, but insists that we can get out of such if we try to do so. This implies that critical discussion between different frameworks or theories, contrary to Kuhn’s claim, is always possible. Science, for Popper, remains a purely critical activity.

## EVALUATION

The previous section of this article articulated Popper’s critique of Kuhn’s normal science. The task at this juncture is to evaluate Popper’s critique of Kuhn’s normal science. However, it ought to be noted that Popper is not the only scholar that criticized Kuhn’s normal science. For



instance, John Watkins has a lot of reservations with regard to Kuhn's idea of normal science. In his attempt to criticize Kuhnian normal science, Watkins (1970) states:

The question I now ask is, why is Kuhn concerned with up-value Normal Science and down-value Extraordinary Science? This question is prompted by several considerations. First, Normal Science seems to me to be rather boring and unheroic compared to Extraordinary Science. Kuhn himself thinks it a mistake, but a rather natural mistake, to regard Normal Science as 'an intrinsically uninteresting enterprise, and he agrees that Normal Science is comparatively unproductive of new ideas...Second, Kuhn has reiterated that he, like Popper, rejects 'the view that science progresses by accretion', but if he were asked in what manner Normal Science progresses, he would, presumably, say that it does so in an orderly, undramatic, step by step manner, that is, it progresses by accretion. Why has Kuhn, despite his concern with the dynamic process by which scientific knowledge is acquired, come to identify science with its periods of theoretical stagnation? Third, why has the author of one excellent book on the Copernican revolution and of another more famous book on scientific revolutions generally, taken a sort of philosophical dislike to scientific revolutions? Why is he so enamoured with plodding, uncritical Normal Science? (pp. 31-32)

Watkins conceives Kuhn's normal science as boring, unheroic and uncritical enterprise characterized by theoretical stagnation. It becomes clear then that Watkins' problems with Kuhn's account of normal science are not completely different or rather very far from those of Popper, though both scholars approached Kuhn's normal science from different perspectives.

Popper's major problems with Kuhn's normal science as already demonstrated above revolve around mainly the issues of uncriticality and dogmatism. Rowbottom (2011) argues that it is not completely misleading to conceive Kuhn and Popper as two extremists on the problem of criticism in a scientific investigation. Hence, criticism within the context of normal scientific research is among the major points of controversy between Popper and Kuhn. Popper is generally known in the philosophy of science for his critical approach, and this explains why he was uncomfortable with Kuhnian 'dogmatic' and 'uncritical' normal scientists. In the words of Rowbottom (2011): "From the beginning of his career, Popper pushed the idea that a critical attitude is at the heart of the scientific persona, and that a critical method is its proper counterpart." (para. 5) Certainly, Popper's claim that science ought to be critical and less dogmatic could be said to be very necessary for the growth of scientific practice. This is as a result of the spirit of hard work which inculcates among scientists. Anetoh (2019) underscores this point thus:

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. A critical attitude sharpens human intellect and enables man





to develop his potential. 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 the philosophy of science has led to the growth of knowledge. This growth in knowledge brings about a better understanding of the universe and better utilization of natural endowments. The human condition of existence in the universe actually improves when a man has a good understanding of the universe. This lessens the problems man encounters in the universe. (p.31)

It is quite certain that scientific knowledge grows when one is less dogmatic and subjects every theory to criticism. Immanuel Kant also made use of such a method in the disciplines of Epistemology and Metaphysics when he criticized pure reason in order to identify its limits as a cognitive faculty. This brought enormous development in Epistemology.

It ought to be noted that though Popper is against dogmatism in science, he gives room for such but not in the same manner as Kuhn. It becomes necessary at this juncture to clarify the type of dogmatism Popper allows in the field of science. Popper argues thus: "... But I have always stressed the need for some dogmatism: the dogmatic scientist has an important role to play. If we give in to criticism too easily, we shall never find out where the real power of our theories lies." (Popper, 1970, p.55) The above quotation demonstrates that Popper is not completely against dogmatism in science, but his idea of dogmatism in science is not the same as that of Kuhn. Dogmatism, in the Popperian sense, can be instrumental to disclosing the actual power of one's theory. However, it does not entail total acceptance, without questioning, of a given theory as obtainable among Kuhnian normal scientists. Rowbottom (2011) analyzing the type of dogmatism Popper allows in science states that dogmatism can only be useful when one is 'very nearly right' despite contrary evidence. On his own part, Marletta (2013) argues that dogmatism does not entirely exclude criticism. Thus, he states:

Consequently, dogmatism leaves space for criticism, except when it is necessary to avoid ceaseless scientific revolutions and theory changes that threaten scientific progress. It only safeguards the normative backbone of scientific theories from scepticism, saving this structure from the possibility of empirical falsification. (Marletta, 2013, para. 34)

However, a dogmatic attitude seems to be irreconcilable with a critical attitude. This stems from the fact that it is not just easy for one to be critical in the midst of dogmatism.

It ought to be noted that Popper's critique of Kuhnian normal science could be said to be basically problematic. The fundamental problem in Popper's critique of Kuhnian normal science is that he assessed Kuhn's normal science in isolation without situating it in its proper context. Kuhn articulated his idea of normal science in the context of his idea of a scientific revolution. Had Popper placed Kuhnian normal science in its proper context, most of his criticisms of Kuhn's idea of normal science would have been ignored. Kuhn's normal science ought to be approached in connection with his revolutionary science or scientific revolution. It is just a period in scientific history that can necessitate revolutionary science. Kuhn is a historian of science and was only trying to explain the course of scientific development. It



seems that Popper did not pay adequate attention to the facts of the history of science in his assessment of Kuhn's normal science.

Furthermore, Popper accused Kuhnian normal scientists of being 'not-too-critical' and 'dogmatic'. This can be partially understood as a result of normal scientists' allegiance to the prevailing paradigm and their unquestioning attitude towards the accepted paradigm at the initial period of normal scientific research. However, it does not seem to the researcher that Kuhnian normal scientists are 'dogmatic' and 'not-too-critical' as Popper claims. If Kuhn's normal scientists are as uncritical and dogmatic as Popper suggested, then normal science can never necessitate revolutionary science. It is obvious that Kuhn made provisions for anomalies and crises in normal scientific research which can necessitate revolutionary science. A crisis cannot arise in normal scientific research if Kuhnian normal scientists are as dogmatic as Popper claims. From this perspective, Popper could be said to not have been fair to Kuhn in his assessment of Kuhnian normal science.

## CONCLUSION

An effort has been made in this article to examine Popper's critique of Kuhn's idea of normal science. Kuhn sees normal science as a cumulative activity characterized by the acceptance of the prevailing paradigm, which scientists do not question during the period of normal scientific research. Popper criticized Kuhn's normal science as being 'not-too-critical' and dogmatic. Hence, Popper is not satisfied with Kuhnian normal science. There are problems associated with Popper's critique of Kuhn's idea of normal science. Such could be traced to Popper's inability to place Kuhnian normal science into its proper context. This article argues that though there are problems and loopholes in Popper's critique of Kuhn's account of normal science as demonstrated in this study, Popper's claim that science ought to be critical and less dogmatic could be said to be very necessary for the growth of science in general. Obviously, both Popper and Kuhn contributed outstandingly towards the development of the philosophy of science and knowledge in general in the contemporary period. Both of them are very outstanding in the historical development of the philosophy of science.

## REFERENCES

- Anetoh, B. C., (2019) 'Karl Popper's 'critical rationalism' in the philosophy of science: Implications for growth of knowledge and scientific practice', *International research journal of humanities, languages and literature*, vol.6, no.5.
- Criticisms and growth of knowledge* (pp.51-57). Cambridge: Cambridge University Press.
- Criticisms and growth of knowledge*, (1968), *The logic of scientific discovery*, New York: Basic Books.
- Criticisms and growth of knowledge*, (1984), 'Conjectures and refutations'. In R. H. Popkin and A. Stroll (eds.) *Philosophy and contemporary problems: A reader* (pp. 119-132) New York: CBS College Publishing.
- Kuhn, T. S., (1965), 'Paradigm and some misinterpretations of science'. In D. Shapere (ed.) *Philosophy of science in the twentieth century*, (pp. 83-90). New York: The Macmillan company.



- 
- Kuhn, T. S., (1970a), 'Reflections on my critics'. In I. Lakatos and A. Musgrave (Eds.) *Criticisms and growth of knowledge* (pp.231-278). Cambridge: Cambridge University Press.
- Kuhn, T. S., (1970b) *The structure of scientific revolutions*. Chicago: University of Chicago Press
- Marletta, M. (2013), 'Dogmatism, learning and scientific practicals' *European journal of pragmatism and American philosophy*, v-2. Retrieved from <https://journals.openedition.org/ejpap/541>. (25-05-2020)
- Okasha, S. (2002), *Philosophy of science: A very short introduction*. Oxford: University Press.
- Popper, K. (1970) 'Normal science and its dangers. In I. Lakatos and A. Musgrave (eds.)
- Rowbottom, D. P. (2011), *Kuhn vs. Popper on Criticism and Dogmatism in Science: A Resolution at the Group Level*. Retrieved from <https://www.researchgate.net/publication/2228226> (19/05/2020)
- Watkins, J. (1970), 'Against normal science'. In I. Lakatos & A. Musgrave (eds.) *Criticisms and growth of knowledge* (pp.25-37), Cambridge: Cambridge University Press.