VIABILITY OF EMPIRICAL METHODS IN KNOWLEDGE ACQUISITION: CRITICAL ANALYSIS OF PRAGMATISM AND THE DUHEM-QUINE THESIS.

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DECLARATION AND RECOMMENDATIONS

Declaration

This thesis is my original work and has not been presented for an award of a diploma or conferment degree in any institution.

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Recommendations

This thesis has been examined, passed and submitted with our approval as University supervisors.

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DEDICATION

To my son, Stanslaus Nzioka Mosu

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ABSTRACT

Most Scholars in epistemology have always considered the tripartite conditions (Belief, Justification and Truth) to be sufficient for knowledge, however, the rise of scientific empiricism has raised doubts in certain circles about the necessity and sufficiency of these conditions. In particular, arguments have been raised to demonstrate the impossibility of ever achieving truth of things as they are (correspondence), hence, rendering knowledge by empirical methods impossible. This conclusion seems a contradiction to our claims that we indeed can know by way of these methods. As such, there was need to examine if indeed knowledge of the physical world is possible. The following were the objectives of this research: to critically examine the necessity and sufficiency of Belief, Justification and Truth as conditions for knowledge; to demonstrate science's pragmatic adoption of truth and show how it violates the truth condition; to explore the Duhem-Quine thesis and examine its implication to knowledge; and ultimately, determine the possibility of knowledge acquisition through empirical methods. The theoretical framework proposed to address this problem was the Cartesian criterion of truth which involves establishing that propositions are clear and distinct, and the relevance of establishing logical correctness in arguments. The research methodology for this study was qualitative and it involved an examination of texts relevant to the investigation. The findings of the study were that: Firstly, the tripartite conditions are individually and collectively necessary for knowledge, but collectively sufficient for knowledge; secondly, scientific investigation adopts the pragmatic conception of truth. Thirdly, the Duhem-Quine thesis presents a challenge to knowledge acquisition using empirical methods because its theories are under-determined by evidence. As such, the evidence available to researchers is never sufficient to warrant falsification of a theory. Ultimately, the research established that despite the fact that we cannot know things as they are, it is possible to have knowledge of the appearance of these things and our perspectives of them. It is also important to revise the truth condition to make reference to pragmatism and coherence as opposed to correspondence (which cannot be realized by humans). Further, the justification condition should include evidentialism and reliabilism. In conclusion, the study recommended further research examining the compatibility between 'armchair' and empirical research, and how experimental philosophy revolutionizes the role played by intentionality in knowledge acquisition.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Epistemological questions such as, "Do we know?" "Can we ever know anything at all?" and "How do we justify our claims to knowledge?" have been perennial philosophical questions that have had varied responses. Philosophers have attempted to find conclusive responses to these questions but there has never been unanimous agreement to any of the responses given (Goldman & McGrath, 2015). As such, the nature, justification and validity of human knowledge remain matters of concern to scholars in contemporary times.

Concerning the nature and origin of human knowledge, various ideologies from different schools of thought have been proposed, including; Rationalism and Empiricism, and scholars have been conflicted on which of these best explains how we obtain knowledge. According to Arrington (2019), rationalist theories of knowledge are premised on the claim that it is only through reason that we can attain knowledge. They argue that we cannot trust experience to deliver accurate information concerning the world because senses can be flawed and misrepresent reality. Some proponents of this school of thought, such as Plato and Descartes, posit that we already possess, within ourselves, knowledge in form of innate ideas which we are born with (Ezebuilo, 2020; Uzoigwe, 2022). Rationalism is anchored on three major points; firstly, that reason is the primary source of all knowledge of the world, secondly, experience is inadequate and unreliable hence, it should be treated with skepticism, and thirdly, truth about the universe can be known *apriori* because it is either self-evident to anyone with a keen mind or it is innate (Huenemann, 2014).

Despite the seemingly objectivity of the rationalistic position, the rise of science has been attributed to the contrary idea that knowledge is obtained through empirical channels and as such, we cannot entirely distrust experience. One may argue that the distrust of empiricism by rationalists is not completely justified and the claim of *apriori* knowledge fails to be adequately convincing owing to lack of consensus about

the nature of truth among various scholars of epistemology as well as the entire human race.

Empiricism, unlike Rationalism, does not ignore data obtained through experience. Rather, the former regards experience as the only rational source of our knowledge. According to Berent and Platt (2021), empiricists such as John Locke argue that, at the moment of birth, the human mind is a blank tablet (*tabu la rasa*), devoid of any information. Over time, experience writes on this empty tab and fills it with information about the world. Experience, however, is not as perfect as one would wish because our experiences are insufficient to give us absolute knowledge of the universe. Most knowledge arrived at through the senses is a product of inductive reasoning, where our experiences only give probable support to the truth of our claims. Scientific investigations are empirical because they make conclusions based on the evidence attained through the senses.

Regardless of whether a scholar is a Rationalist or Empiricist, some scholars in epistemology, such as Plato, have offered three conditions which have been considered as necessary and sufficient for knowledge. They include; belief, justification and truth (Habing, 2019). The perennial debate between Rationalists and Empiricists can be solved through examining if any or both of them meet these tripartite conditions. These conditions have persisted throughout the history of epistemology as the most acceptable criteria for knowledge. Information that meets the belief condition is one that exudes confidence, in both its proponent and recipient, that it is a valid description or explanation of a phenomenon. Believability of information is based on its logical consistency, a seemingly possible explanation of the state of affairs, and capacity for verification (Carter & Littlejohn, 2021). This is a necessary, but not a sufficient condition for knowledge.

Concerning justification, there must be sufficient reasons to warrant the acceptance of a belief as knowledge. There must necessarily be proof or a logical basis on which a belief is based. The process of arriving at the belief should be logical, based on reason, and should be sufficiently defended upon inquiry being raised concerning its validity. Conformity to the logical principles of non-contradiction, identity, sufficient

reason, is justification one can give when tasked with explaining why they hold their beliefs (Sosa, Fantl & McGrath, 2019).

Carter and Littlejohn, (2021) argue that the third necessary and sufficient condition is truth. Truth of a proposition is not demonstrated by universal acceptance by scholars. Neither is it determined by the conformity of a proposition to a set of rules or guidelines for inquiry. Instead, truth is conformity of a statement or theory with the actual state of affairs it seeks to explain. For instance, if one claims that John is ethical, it must be the case that John is a moral person. Truth of this statement will not be determined by subjective experiences or understanding of morality, but will be dependent on observing the conduct of John and comparing it with the principles of objective moral standards. Scholars have been conflicted with the nature of truth and subsequently come up with various theories to describe its nature. In this study, two theories of truth were critical in assessing the nature of knowledge; the pragmatic and correspondence theories.

The correspondence theory stipulates that the only time one makes a justified claim to truth is when their ideas (theories) conform to the actual state of affairs. This position has been held as the proper definition of truth by scholars such as Bertrand Russell and Immanuel Kant. Proponents of this theory, therefore, would not accept as true any claim that is subject to change with realization of new information or a change in point of view, or any other condition that would result in alteration of information (O'Connor, 2021). Immanuel Kant goes further to assert that our perceptions (and consequently empirical examination of ideas) cannot yield truth because perceptions and data gathered from them is subject to change, hence, we can only claim to have an understanding of a particular manner in which entities present themselves to us, not these entities as they really are (Chukwunyeaka, 2022).

Disciplines that conduct research using experimental means, such as empirical sciences, describe their findings as an accurate representation of reality based on a rigorous process of testing hypotheses and their consequences. However, these findings are informed by the evidence available to the researchers at that given time, the perspective from which the experiments and observations were done, and the

methodological approach adopted. This means that, if more information were to be availed or the point of view changed, or even the methodological approach (such as the research design) altered, then the outcome of the research would be different. In essence, experimental research of the same phenomenon at various timelines is not guaranteed to have similar outcomes. Nevertheless, scientists claim that this approach is necessary for progress of science towards attaining knowledge.

Proponents of the correspondence theory of truth would argue that scientific claims to knowledge meet the first two conditions; however, the truth condition has not been fulfilled because it presents truth as a matter of subjectivity, convention and arbitrary assignment of meaning. However, according to Chang (2019), a scientist will consider as knowledge a concept, theory or idea that has a practical value (utility), hence, according to them, science fully meets the third condition for knowledge.

The term, 'science' is derived from the Latin 'sciens' (the present participle of the word *'scire'*) which literally translates to 'to know'. This means that knowledge is the most essential component of any scientific investigation. When the question, "What is science?" is posed, the philosopher expects answers that describe basic features held by all disciplines considered scientific. The distinguishing feature of science and non-science is its methodology for attempting to understand the universe. Firstly, science uses inductive methods which involve empirical tests and/or observation. Crucial tests involving experiments are done in a controlled environment in disciplines such as Physics, Chemistry, among others. Social sciences, on the other hand, involve observation of phenomena as opposed to crucial tests. The second feature of science is the formulation of theories from the recorded data of the crucial tests or observations. Hypotheses are firstly formulated then tested, and if verified, graduated into theories (Okasha, 2002).

In the 21st century, beliefs from scientific investigations are held to be accurate and more reliable as compared to beliefs from other sources such as instinct, religion, or culture. Scientific truths such as, the earth revolves around the sun, or, water has twice as much hydrogen atoms as it has oxygen, are arrived at through an inductive scientific process. This process involves either an experiment, or an observation, or

sometimes, both, to test whether a certain theory accurately represents reality as we know and perceive it. This scientific methodology is considered more rational as compared to the unspecified and unverifiable methodology of formulating beliefs based on cultural or customary perspectives and religion.

Scientific claims to knowledge can be termed as fulfilling the belief, justification, and truth condition. Their understanding of the nature of truth, however, can be viewed as more pragmatic as compared to the more acceptable correspondence theory of truth. Scientists, just like pragmatists (such as Dewey), are skeptical that we can determine reality once and for all. Acquisition of knowledge is a process informed by data that scientists have at a precise moment, hence, when new data is found, beliefs and theories have to be adjusted to conform to this new finding (Sleeper, 2001). Despite this limitation to objective knowledge, scientists assert that claims to knowledge are still valid. This validity can be justified by the fact that objective truth cannot be dissociated with subjective experiences, habits of thought and contingent beliefs. For them, something is true if it has been proven to work and has withstood scrutiny over time.

A scientist will still pursue knowledge using empirical means because they believe that this is the only way we can understand physical phenomena. They will adopt a pragmatic approach which stipulates that our beliefs concerning the nature of the physical world are epistemically justified because, after a rigorous empirical examination and inquiry, there is no discernible evidence against admitting them as true. In some cases, the scientist will accept the belief as true if they are convinced that its acceptance will have desired outcomes that would be useful in bettering the world or answering fundamental questions (Hookway, 2002). For example, a doctor will have confidence that administering a COVID-19 vaccine to their patient is a good thing because tests (in a controlled environment) have demonstrated that it has no adverse effects on patients, and they also believe that it will improve the chances of survival for their patient compared to when the vaccine is not administered. This evidence is enough justification for the doctor to claim that the vaccine in question is a solution to the COVID-19 pandemic even when objective truth (that the vaccine has a universal healing effect) has not been realized.

One would expect truth to involve objectivity and rigidity (does not change with discovery of new information), that what is said to be true today will not cease from being so even after a century. However, this is not the case with scientific claims to truth. There is sufficient evidence for a skeptical mind to argue that, in scientific progress, there have been findings in each decade that threaten and even disapprove existent theories which have been held by the scientific community as true (Schantz, 2011). Truth, for science, is more about what works at a given time and not whether it is the actual state of affairs. This means that at any given time, we can only claim to have a theory that gives us a reasonable explanation for why things are the way we experience them (pragmatically true), however, we cannot accurately claim that this theory is objectively true. New information may be discovered and render this theory wrong (Rescher, 2005). For instance, in 2006, the International Astronomical Union (IAU) declared that the celestial body previously known as planet Pluto was no longer a planet in the proper sense of the term, but a 'dwarf planet' because it failed to meet the threefold criterion set by the body to establish whether celestial bodies are indeed planets (Howard, 2012). Many other theories such as the flat earth theory have also been refuted and abandoned by scientists after emergence of evidence that contradicts what they claim as true.

An examination of the nature of scientific inquiry and its subsequent claims to knowledge would lead us to conclude that a scientist's claim to knowledge is not synonymous with an epistemologist's claim to knowledge. The former considers scientific data to be knowledge because truth, according to them, consists in the practical value of theories or beliefs, whereas the latter is convinced that a belief or theory is true if it corresponds to the reality it claims to describe.

The insufficiency of science in knowledge acquisition can be further demonstrated by examining the key tenets of the Duhem-Quine thesis. The Duhem-Quine thesis is named after the philosophers Pierre Duhem and Willard Van Orman Quine and it casts further doubt to the possibility of acquiring certain and objective knowledge through empirical methods employed in science. It is a philosophical principle that states that it is impossible to test a single hypothesis in isolation, because any test of a

hypothesis is necessarily based on some set of background assumptions (also known as auxiliary assumptions or auxiliary hypotheses). As such that it is impossible to test the hypothesis in a way that would conclusively verify it or falsify it. This thesis states that any test of a scientific hypothesis is ultimately based on a set of interconnected assumptions, and that it is not possible to test any one of these assumptions without also testing the other assumptions (Harding, 1976; de Broglie, Vuillemin, Wiener & Duhem, 2021). Quine (2000), in his work, 'Two Dogmas of Empiricism,' radicalizes this theory by stating that any proposition can be held true, regardless of the existence of evidence to the contrary, if we make radical or drastic adjustments in its system (its auxiliary hypotheses). In this way, the Duhem-Quine thesis serves as a reminder that all scientific knowledge is based on a set of interconnected assumptions, and that any test of a scientific hypothesis is ultimately based on a set of interconnected assumptions

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This thesis is based on the claim that every single scientific hypothesis is always accompanied by auxiliary hypotheses or background hypotheses which must be tested together with it. As such, the data that result from the experimentation process will be ambiguous and not certain to explain the nature of the specific phenomenon being studied. This means that falsification of theories is not easily achieved even after the scientist has attained data that contradicts the theory because fault can be found in any of the auxiliary hypotheses, and not necessarily the main theory (Nweke & Asiegbu, 2022). If this conclusion is given, then we can accurately conclude that testing of hypotheses does not guarantee that the researcher's findings are objective representations of reality. The following example suffices to demonstrate the logic of the Duhem-Quine thesis.

Supposing we want to test the hypothesis that the problem of insecurity in Lamu County, Kenya is caused by poor security policies, we will not be able to test this assumption without examining other related assumptions. For instance, we will assume that the already existent security policies have been fully implemented, that there is no political incitement or interference, and that those who participate in raids and unprovoked attacks are not influenced by anything else but lack of proper policies, among other assumptions. The accuracy of the original hypothesis will be

confirmed only if the auxiliary hypotheses are found to be true. If, however, the researcher establishes that one of these background assumptions is false, then the main hypothesis will be falsified. Hence, to avoid falsification of the main hypothesis, the researcher may revise the auxiliary hypotheses that do not conform to the expected output. An examination of the above example implies that the main hypothesis is incapable of making any objective scientific predictions by itself, therefore, we cannot be certain that we can derive knowledge of the specific phenomenon being studied through an empirical process.

This thesis, sometimes referred to as the Duhem-Quine problem, leads to rise in scepticism concerning the possibility of ever achieving knowledge if we adopt empiricism. Under-determination of Theory by data (UTD) demonstrates this position clearly. Newton-Smith (2017) posits that, according to this theory, at no given point in our epistemological pursuit do we have sufficient information to warrant certainty of beliefs we hold concerning reality. All evidence underdetermines scientific theories as a matter of logical necessity.

If the Duhem-Quine thesis is accepted as accurate, then one may become skeptical of the possibility of attaining knowledge (in the proper sense of the term) through scientific methods. The rationalist objection to empirical methods of knowledge pursuit will seem valid at this point. One skeptical argument that may arise is that this thesis reduces scientific knowledge to be a matter of subjective judgment and the scientist's common-sense understanding (Nweke & Asiegbu, 2022). In essence, then, one is justified in arguing that modification of auxiliary hypotheses is not a matter of logical necessity, but of the scientist's will and arbitrariness.

The scientist, in making judgment on the accuracy of a theory, will examine available evidence from their experimentation. The main theory will be dependent on other theories and these theories on others, and so on and so on. Eventually, our evidence will rest on a chain of interconnected theories whose truth cannot be ascertained independently (Ivanova, 2021). This creates a problem of infinite regress. The scientist, in order to make an accurate conclusion, requires their evidence to be based on solid ground that can be independently verified but not an interlocking series of

theories which culminate in a house of cards characterized by one theory being founded on a chain of theories which are interdependent.

The conditions for knowledge presented in this section (belief, justification and truth) offer an objective criterion for establishing whether information (scientific or not) qualifies to be called knowledge. These conditions are necessary and sufficient and without them, we can never claim to know anything. An examination of the nature of scientific knowledge (which is arrived at through experimentation or/and observation), demonstrates that it meets the conditions of belief and justification. However, scientific truth is only pragmatic and cannot be rightly referred to as knowledge in the proper sense of the term. The concept of truth adopted in this paper is explained by the correspondence theory which asserts that truth consists in the conformity of an idea or theory to the actual state of affairs.

Scientists, as has been demonstrated in this section, defend their claims to knowledge by arguing that a theory is true if it has a practical value (utility) and it is relevant in scientific attempts at explaining the physical universe at the present moment. This notwithstanding, they are in consensus that empirical perceptions change over time and new data can be used to replace existent theories with others that offer more comprehensive (and at times almost accurate) explanation of the universe and at the same time, have greater prediction power. To a critical thinker, this would seem to be a fallacious understanding of the nature of knowledge because to claim that pragmatic truth constitutes knowledge, one would be contradicting themselves (knowledge is objective, and as such, cannot change with the utility of a proposition).

In the foregoing discussion, a Sceptic can raise doubts into the possibility of a scientist attaining knowledge through the empirical method because we can never be certain that our observations today will be replicated in the future. We can also never be sure that our data is representative of all phenomena of a similar kind as the one involved in the empirical study. As such, we cannot justify inductive reasoning which tends to generalize the findings attained from experimentation or observation of few instances of an occurrence to all occurrences of a similar kind. A moderate sceptic would argue that we need to refine our methodology or interpretation of data from experimentation in order for us to improve our chances of attaining knowledge. The

universal or global sceptic, on the other hand, will refute all claims of knowledge through the scientific process because they will claim that our observations are already subjective and since perception is the primary source of our knowledge, then outcomes of any perceptive processes are necessarily subjective and can be assigned meanings in an arbitrary manner.

This study focused on a rigorous assessment to these claims of knowledge by empirical scientists and sought to establish if there are sufficient grounds for admitting that pragmatism satisfies the truth condition, hence constituting knowledge. Firstly, the research was interested in critically examining the classical conditions for knowledge; belief, justification and truth. As a consequence of this, an interrogation of the conception of truth in scientific inquiry was investigated. Additionally, the study engaged in a logical assessment of whether the Duhem-Quine thesis offers sufficient grounds to warrant a philosopher of science to give in to the skeptical position that knowledge through empirical methods is unattainable. Ultimately, the research sought to evaluate the possibility of knowledge acquisition via empirical methods even with the scepticism that arises from the Duhem-Quine thesis.

1.2 Statement of the Problem

A critical assessment of empirical science's claims to knowledge demonstrates that truth is considered to have a pragmatic value. This is contrary to the conception of truth held by most epistemologists that a true proposition must correspond to the actual state of affairs. Further, the Duhem-Quine thesis makes a claim that it is impossible for crucial tests to result in knowledge because it is impossible to test any hypothesis in isolation. This study sought to explore the possibility of acquiring knowledge through empirical tests even when adoption of the pragmatic conception of truth relative to scientific inquiry contradicts the classically held correspondence conception of truth. Additionally, it sought to explore the possibility of knowledge (in the proper sense of the term) acquisition even with the Duhem-Quine thesis raising Scepticism towards the possibility of knowing anything at all.

1.3 Purpose of the Study

This study investigated the possibility of attaining knowledge through empirical scientific processes.

1.4 Objectives of the Study

The study was guided by the following objectives:

i. To critically examine whether belief, justification and truth are necessary and sufficient conditions for knowledge.
ii. To examine the conception of truth in scientific inquiry.
iii. To explore how the Duhem-Quine Thesis affects empirical science's claims to knowledge.
iv. To determine the possibility acquiring knowledge through scientific empiricism.

1.5 Research Questions

This study sought to answer the following fundamental questions:

i. Are the tripartite conditions (belief, justification and truth) necessary and sufficient for knowledge?
ii. How does scientific inquiry perceive truth?
iii. How does the Duhem-Quine Thesis affect empirical science's claims to knowledge?
iv. Can we still possess knowledge even when the accuracy of our empirical processes of seeking to know has been cast into doubt?

1.6 Significance of the Study

This study is relevant in contemporary epistemological discourses because it compels scientists to re-examine the foundations of their knowledge and critically assess the validity of their empirical methodology. It will also help researchers to avoid making unwarranted assumptions concerning their investigations if there is insufficient information to warrant categorical statements. Additionally, the study has brought in new knowledge and perspectives in the nature of knowledge, and the possibility of attaining it through empirical means. The study has introduced new insights into persistent epistemological questions such as, "What is knowledge? Can we trust the

sources of our knowledge? And how sure are we that we know anything at all?" Answering these questions has provided new theoretical grounds on which we can revise our assumptions of knowledge and its acquisition processes. Further, the research adds to the body of knowledge in Philosophy of science by introducing new perspectives on the reliability of inductive methods of investigation. Finally, it will aid in appropriately revising our belief systems by inculcating elements of evidence clear and indubitable justification) and truth in what we consider reality.

1.7 Scope of the Study

This research only focused on assessing the following concerns in Philosophy of Science and Epistemology: Firstly, the necessity and sufficiency of the classical conditions for knowledge was investigated, secondly, the researcher sought to establish if the pragmatic claims to knowledge by empirical science are valid. Thirdly, the skeptical implications for knowledge raised by the Duhem-Quine thesis were explored, and ultimately, the possibility of attaining knowledge through scientific investigation were discussed. Related concerns such as attainment of knowledge through rationalism and its validity were not addressed because the focus of this study was limited to empirical methods of inquiry specific to science.

1.8 Assumptions of the Study

The study made the following assumptions;

i. Information qualifies as knowledge if it meets the three necessary and sufficient conditions.
ii. Scientific claims to knowledge are based on their understanding of truth as pragmatic.
iii. Scientific knowledge fulfils the conditions of belief and justification, but falls short of meeting the truth condition (correspondence).
iv. The Duhem-Quine thesis raises concerns that affect claims to knowledge by empirical sciences.

1.9 Operational Definition of Terms

Belief	A necessary and sufficient condition for knowledge which involves a proposition being capable of convincing an individual to accept it; Believability denotes formulation of a conviction about something.
Epistemology	Branch of Philosophy which investigates the possibility, nature, validity and limits of human knowledge.
Inference to best explanation	A principle in reasoning that compels a researcher to select the best explanation or theory for phenomena based on available evidence.
Justification	A condition for knowledge which involves presentation of proof or evidence in support of a belief or claim
Philosophy of Science	Branch of Philosophy that examines the foundations of scientific knowledge, methods of investigation in science, and the implications of scientific knowledge.
Pragmatism	the theory that holds that truth consists in the utility of beliefs or/and their practical outcomes.
Reliabilism	The school of thought which posits that knowledge can be justified if it is a result of a reliable cognitive process
Science	Discipline that uses inductive methods (empirical tests and observation) to carry out research, and formulate theories from recorded data of crucial tests and observations.
Skepticism	The suspension of judgment concerning the accuracy of categorical claims to knowledge.
Sufficient condition for knowledge	A condition which facilitates achievement of knowledge, it guarantees the truth of a proposition or statement.

Truth	It is the actual state of affairs. In this work it will be denoted by conformity of propositions and the entity they describe.
Under-determination	The thesis that all evidence held at a particular moment is insufficient to determine which belief an individual should hold with regard to that evidence.

CHAPTER TWO

LITERATURE REVIEW

2.1 Necessary and Sufficient Conditions for Knowledge

According to Goldman and McGrath (2015), necessary and sufficient conditions for knowledge make reference to the criterion that has to be observed in order for information to be categorized as knowledge. Necessary conditions refer to the state of affairs that must be present for information or convictions to be termed knowledge, whereas sufficient conditions are the state of affairs required to make information knowledge.

In this section, the study examined the classical conditions for knowledge attributed to Plato; Belief, Justification and Truth. An examination of these three conditions enabled us to conclusively state whether they are sufficient to determine that information is knowledge. In the dialogue, *Theatetus*, Plato argues that we cannot make the case for 'true opinion' to be considered knowledge because opinions are heavily reliant on perception, and perception comes through the senses which cannot be trusted for objectivity (Brown, 2014). In the *Meno*, he argues that without certainly knowing a thing, we cannot make claims about its nature, therefore, knowledge must involve a belief that is justified and must be true (Scott, 2006).

An understanding of the necessary and sufficient conditions for knowledge was essential in this study because it helped in establishing the nature of objective knowledge, as opposed to subjective interpretation on human experiences. These conditions ensure that knowledge is understood as rigid, unchanging and accurately representing the reality it describes.

2.1.1. The Belief Condition

The belief condition in knowledge is the idea that knowledge is only possible if the individual has some sort of belief in the truth of the information. This means that

knowledge requires more than just the mere acceptance of facts and data, but also requires an individual to have a certain level of confidence in the validity of the information (Lemos, 2020). In other words, an individual must believe the information to be true in order for it to be considered knowledge. Belief entails acceptance of a proposition as actual representation of reality or facts. One cannot accept that which they do not consider an actual description of the state of affairs. Beliefs, however, may be formed even when one is not aware of the true state of affairs but assumes that their beliefs are most likely the case (O'brien, 2016). For instance, a Christian does not have knowledge that heaven or hell exist due to lack of evidence, however, they believe in the existence of both of these states because they assume that it more likely that these states exist than the assumption that they do not.

Belief, without other conditions, one can argue, can best be considered a necessary but not sufficient condition for knowledge. It is necessary because there must be information formulated in the mind after encounter or thinking about an object of knowledge. This information constitutes a belief concerning the nature of this object of knowledge. As such, one cannot dissociate belief from knowledge. Belief, by itself, is not a sufficient condition because it is not mandatory for a belief to constitute knowledge. It only helps in formulating conjecture or opinion concerning an object of knowledge and can be found not to be knowledge. However, it is a necessary condition because, without it, one cannot formulate statements or propositions on reality, whether observed or not.

2.1.2 The Justification Condition

The human mind can accommodate a myriad of information, some of which does not qualify to be termed as knowledge in the proper sense of the term. As such, it is important to have a criterion that enables one to distinguish between that which is knowledge from that which is not. Justification offers a clear criterion for making this distinction. As a condition for knowledge, justification offers reasons for acceptance of a belief as knowledge. According to Pollock (2015), a justified belief is one which has logical support which makes the belief acceptable as the true state of affairs. For instance, if one believes that today is Thursday they can claim it to be knowledge through using a calendar to demonstrate the accuracy of their conviction as well as

showing that the calendar is accurate. When one examines the evidence on which the claim is based and determine it to be accurate, they have offered justification for acceptance of the belief as knowledge.

The justification condition is the idea that in order for a belief to be considered knowledge, it must be justified. This means that the belief must be supported by evidence or strong arguments. In other words, the belief must be reasonable and it must have been reasonably arrived at (Bolisani, & Bratianu, 2018). This condition is important because without it, any belief can be considered knowledge, regardless of how far-fetched or inaccurate it might be. The justification condition ensures that only beliefs that can be defended with good reasons are accepted as knowledge. For example, one will be justified in believing that their friend is lying to them at a given time if this friend has persistently done so in the past. This justification will be supported by the fact that there is already an established pattern which may still persist in the present.

Scholars have been conflicted on the exact meaning of justification and this has led to disagreement on whether the JTB condition is an infallible criterion for knowledge. For instance, scholars such as Rene Descartes argue that justification must involve foundationalism (Okoye, 2011).

In this school of thought, a justified belief must be inferred from a previously held belief, with the latter acting as the basis for the acceptance of the former. An assessment of foundationalism leads one to infer that we may hold false beliefs and still consider them justified, hence, the JTB criterion is rendered invalid. An assessment of the various justification theories proved that there is no consensus concerning this condition, hence, there was need, as this study did, to conduct further investigation to determine the exact nature of justification, and establish if it is a necessary and sufficient condition for knowledge.

2.1.3 The Truth Condition

There is a universal agreement among epistemologists that, that which is false is incapable of being known because it is non-existent. It, therefore, follows necessarily

that knowledge must be of that which exists. One can believe in a false proposition or statement, however, they cannot know a false proposition because knowledge entails not just a belief and a justification, but also an agreement between the proposition being referred to and the actual state of affairs (Lemos, 2020). It would be a contradiction for one to claim to know something (q) and yet q is not true.

In order for one to claim that they know, belief and justification are not sufficient without truth being incorporated. For example, Jonathan believes that he will go to heaven and is justified in holding this belief because he lives a moral life. However, this claim can be false because we have not yet established that it is true that heaven exists and that being moral is a necessary requirement for admitting one in it. Jonathan's belief can at best be described as an instance of a false belief, not false truth because knowledge must constitute truth whose nature entails objectivity. This demonstration serves to demonstrate the indispensable value of the truth condition in making valid claims to knowledge.

Various theories of truth have been proposed by different scholars in epistemology. The major concern of this work was to examine the possibility of empirical knowledge given the challenges to knowledge raised in the Duhem-quine thesis, it was therefore logical to focus majorly on the two theories of truth that were of concern to this work. These are the correspondence and pragmatic theories of truth. This notwithstanding, the coherence theory was also mentioned, albeit briefly.

2.1.3.1 The Coherence Theory

The coherence theory of truth asserts that a proposition is true if it fits into an already established system of beliefs or propositions. As such, information will be assessed on its agreement with another closely related set of beliefs which have been held as true. If it is inconsistent with this body of beliefs, then it is considered false (Jenks, 2010). According to Alcoff (2018), the origin of this theory can be attributed to idealism, a school of thought whose major tenets posit that reality is depended on the mind (consciousness), not material correspondence. Idealism insists that the essence of all that is worth knowing is ideas, not their material representation. For instance, if we need to clearly understand the world in which we exist, we cannot rely on its material

presentation, but focus on the abstraction of these material beings. A notable proponent of this school of thought is Plato.

Coherence, as a theory of truth, posits that a single property of any reality being described must necessarily cohere with a whole body of information, if it is to be accepted as true. Key proponents of this position include; Baruch Spinoza, Gottlieb Fichte, Friedrich Hegel, and Francis Herbert Bradley, among others. In most cases, the validity of the entire system is also determined by coherence of the individual beliefs used to build it (Lemos, 2020).

Inconsistency would imply that there are beliefs that do not conform, hence, these particular beliefs compromise the integrity of the whole belief system. In essence, therefore, according to this theory, to say that a judgement is false or true is to point to its agreement or lack of agreement with an established system of beliefs of statements (Blackburn, 2018). For example, a Christian will believe that God intents man to be the head of the household and a woman should submit to her husband. The Christian will hold this to be a true account of God's will because it is consistent with other beliefs such as man being made from soil and woman being made from the man's ribs, God's commands in the Bible that require women to obey and submit to men, among other passages. The first belief stated here will be held to be accurate on account of its conformity to the larger set of beliefs mentioned above. Note that the statement's accuracy is not based on its assessment and verification, but through examining whether it fits into the larger set of beliefs.

One of the most significant objections to the accuracy of this theory was raised by Bertrand Russell. He argues that a contradictory set of beliefs can be demonstrated to have logical consistency within themselves, hence, true according to the principles of the coherence theory. If that happens, both sets of beliefs must be considered accurate but it is logically impossible for two contradictory beliefs to be true (Copleston, 1977).

This critique of coherence raises significant questions to the theory. One wonders how possible it is to know which proposition is true if two or more contradictory

propositions have demonstrated coherence in their claims that they are true. Does it not mean that there needs to be an objective entity or body against which these claims can be tested so that the one with a coherent structure and is found to conform to this objective entity or body is taken to be true and the rest dismissed as false (Walker, 2017)?

In a court of law, supposing the prosecution presents a coherent case for the guilt of the defendant and the defendant demonstrates their innocence with a set of coherent proof, how will the judge establish truth? Most people would propose that if no incoherence is found in any of the presentations, then the judge will be left to their own subjective opinion on the matter. If we compare these coherent theories to something else, then it means that we are engaged in seeking correspondence. Ultimately, one may conclude that coherent beliefs require correspondence to something in order to establish their truth.

2.1.3.2 The Pragmatic Theory of Truth

The Pragmatic theory of truth can be explained in two different ways. Firstly, we have Charles Sanders Peirce's claim that a proposition is true if it can be established that it has practical outcomes or bearings (Hookway, 2012), and secondly, we have William James' assertion that truth consists in a proposition's utility or usefulness (James, 2020). Truth, in this case, will be determined by what a proposition achieves as opposed to its actual truth value (its agreement with the actual state of affairs) (Capps, 2019). For instance, the proposition, "Only those who are god fearing will be wealthy," will be determined to be true if it is established that once someone becomes god fearing they become wealthy. Further, the belief that to avoid suffering and despair in life, humans have to believe in a supreme being who watches over them has been held by individuals and it acts as a motivation not to give up in life. Some beliefs, such as the ones mentioned here, can be established to be objectively false but at the same time, be useful to society or individuals that hold them. A believer will not lose hope and any challenge will be taken as a temptation by the devil, and as such, they will work hard to overcome it.

Proponents of pragmatism perceive the truth value of a proposition to include not only its validity, but also how this belief is relevant in the world. This means that it is not

enough for a belief to be accepted, but it also has to have a practical role in society such that it can be utilized to solve a problem, add to human understanding or knowledge, as well as shaping the character of those who hold the belief (Walker, 2017). According to Blackburn (2018), Peirce greatly focuses on the truth of propositions in a scientific context, whereby, a statement will be accepted if through experimentation it is found to have practical consequences. On the other hand, James argues that utility of a statement is determined by its ability to have a practical influence in the life of an individual.

Despite Pragmatists' insistence on the value of utility in determining the truth value of a statement, one may dispute this criterion of truth due to the fact that truth cannot solely be determined by analysis of the outcome of a statement. Instead, the proposition itself should be examined for objectivity before the focus is shifted to its outcomes (Capps, 2019). This critical examination is necessary because it clarifies the distinction between usefulness and truthfulness of a statement. A proposition that is useful is not necessarily true and a true statement is not necessarily useful.

The accuracy of the pragmatic claim that, truth consists in a proposition having utility, can be doubted when a proposition that is found to be true lacks any known value. James' version of pragmatism presents utility as a necessary and sufficient condition for truth, however it can be established that in some instances, truth may be realized in the absence of utility. For example, the tautologous proposition, "a circle is round" presents a true proposition whose utility cannot be established because a circle is a synonym for roundness and no new information or clarification on a particular matter has been made. As a rule, when defining terms, the *definiendum* (that which is being defined) and *definiens* (concepts used to define the definiendum) should not be synonyms, but the latter should be an explanation of the former (Copi, 2018). The above proposition has no meaningful use but is still a true account of things.

Further, a proposition may have utility but be false. It remains to be false regardless of how useful it is (Arthur, 2003). For example, a child will be compelled to be respectful and obedient when lied to that bad children are eaten by monsters in their sleep. The child will strive to act in a manner recommended by their parents to avoid

this fate; however, this threat is based on falsity. Despite it having significant utility to society in instilling moral values, the statement remains false and cannot be justified as truthful under any logical circumstance. According to Rescher and Vinci (1975), a belief is not true on account of its usefulness; rather it is useful because it is true. Satisfaction does not mean that truth has been achieved. If a belief succeeds in bringing change in society, it can only be said to have accomplished this change without inferring that this impact qualifies it as knowledge.

In essence, one may conclude, the pragmatic theory presents truth not as a relation between a proposition and the reality it represents, but as the value of the proposition in addressing an issue. This, therefore, means that what is accurate is that which offers a solution to a problem or issue at hand. This conception of truth is wanting; nevertheless, pragmatists claim that if we pursue truth as an abstraction, we will never acquire it. Scientific investigation heavily relies of this conception of truth in their pursuit of knowledge because theories are confirmed as accurate or falsified depending on their ability to meet expected outcomes and make relevant predictions.

This study sought to explore the possibility of pragmatism, regardless of the objections raised by various scholars, leading to acquisition of the world. The literature reviewed with regard to the pragmatic school of thought did not offer a sufficient response to the question of whether we should completely disregard all information attained through the scientific method. The literature also failed to offer a synthesis between pragmatic truth and truth in its proper sense of the term.

2.1.3.3 The Correspondence Theory of Truth

According to Ulatowski (2015), the correspondence theory posits that a statement is true if it corresponds with the actual state of affairs. Statements, according to this theory, are evaluated to determine if they concur with the physical entities or events they purport to describe. As such, there is need to empirically test the accuracy of these propositions. If they are found not to correspond to the phenomenon they claim to describe, then these statements will be considered false. According to Glanzberg (2018), this is an ancient theory that can be traced to thinkers such as Aristotle, Thomas Aquinas, Baruch Spinoza, Gottfried Leibniz, David Hume, Bertrand Russell

and Ludwig Wittgenstein, among others. They all have a similar opinion that the truth of a statement is determined by its agreement with a part or whole of the universe it represents, and false when it does not.

Russell argues that truth and falsity are properties relative to beliefs; nevertheless, they are also inherent in extrinsic objects of our knowledge. A mind is only justified in holding a belief that has found correspondence in objects that it talks about (Russell, 1912). For instance, it can only be true that all monkeys are animals if this claim agrees with our observation or experience of the same. If we experience properties that define mammals in all monkeys, then the statement is true; however, if at least one monkey fails to have these properties, then the statement fails to correspond to the observed state of affairs. In essence, a statement is only true if there is a corresponding state of affairs in the universe.

In the contemporary world, correspondence has been adopted as the most suitable criterion of truth, especially in the empirical sciences. Theories are formulated and tested to establish their truth (Walker, 2018). A scientist will consider their theory true if after experimentations, their findings conform to the tenets of the theory. If there is lack of conformity, then the theory is deemed false or the empirical testing process is said to be flawed (Lynch, Wyatt, Kim & Kellen, 2021). This is a clear demonstration of the indispensability of the correspondence theory in search of scientific facts.

Logical positivists, led by Moritz Schlick, argue that the truth of any proposition is determined by its conformity to the verification principle. This principle was formulated by members of the Vienna circle and it holds that a proposition that is incapable of being empirically verified is meaningless and should not be uttered because it does not contribute to the body of knowledge (Schlick, 1936). Direct observation or experience is an indispensable element of this criterion of knowledge. The proponents of this school of thought consequently argue that metaphysical propositions are meaningless (Justus, 2021). For example, the statement Charles is tall is verifiable and can be empirically tested, however, the proposition, ‘God is good’ is meaningless because we cannot empirically establish its truth value.

The correspondence theory may seem appropriate as a criterion of truth; however it raises important epistemological concerns for some scholars. For instance, formulation of propositions depends on our level of knowledge and circumstances during our perception of reality. These situations may lead to formulation of false statements which will be in conformity with our experiences (which may also be flawed). If this happens, we cannot objectively claim to have knowledge because our flawed perceptions can only lead to falsity.

Immanuel Kant's argument that we can only describe *phenomena* (reality as we perceive it) and not *noumena* (reality as it is) is a clear demonstration that correspondence as a theory of truth is defective in as much as it is widely accepted in contemporary science (Kant, 1953).

In response to this claim, we may argue that the actual state of affairs is not represented by *phenomena*, but *noumena*, hence, claims that a proposition is true based on its conformity to phenomena would be fallacious. We can argue with certainty that the proposition corresponds to phenomena, but not the thing in itself. For example, when we define a human being as a rational animal, we can claim this statement to be true on account of how we perceive the human being, however, the non-perceivable elements will not be accounted for in this definition. Therefore, this proposition only represents the appearance of man, and not his nature in itself. We can conclude that the correspondence theory holds that truth is constant and not subject to falsification or refutation.

A critical reflection on the validity of the Correspondence theory demonstrated that there are still unclear explanations on how this theory can be trusted to give us truth. One of the unanswered questions is, "if truth involves correspondence, how do we verify that an idea in our mind corresponds with reality when we cannot be able to perceive this reality?" This research aimed at addressing this question in order to establish the reliability or lack thereof of the correspondence theory.

2.2 Critique of JTB as the Criterion for Knowledge

Despite consensus among many epistemologists that knowledge consists in belief, justification and truth, some scholars have either rejected this criterion or added other conditions to these three. In this section, the views of Edmund Gettier, the most notable scholar to reject the validity of JTB, were examined.

2.2.1 The Gettier Problem (Counter-Examples) and Its Critique

Edmund Gettier, in his 1963 paper, "Is Justified True Belief Knowledge?" critiques the tripartite definition of knowledge (JTB). He claims that having justified true beliefs does not necessarily mean that one has knowledge (Hetherington, 2018). He presents examples to demonstrate this point. Imagine two strangers, Smith and Jones, meet during a job interview. Smith watches Jones put exactly 10 coins into his pocket as proceeds for the job interview. Later the president of the company congratulates Jones for getting the job and Smith believes that Jones will get the job. Smith, therefore, concludes that the individual who has 10 coins in his pocket will get the job. This belief is justified because Smith has evidence that Jones put the coins in his pocket. Assuming Jones doesn't get the job but the person who does (Smith) unknowingly has 10 coins in his pocket. Smith's belief is true to this effect. Smith cannot be said to have knowledge despite the fact that he has a belief, has justification for his belief, and his idea is true (Gettier, 1963). This example, according to Gettier, is sufficient proof that not all information that satisfies the JTB condition can be considered knowledge.

A second example to fortify Gettier's thesis can be seen in Bertrand Russell's demonstration of how one may think they know something but are not sufficiently justified to belief it. Supposing Smith wonders what time it is and glances at a clock which tells him that it is three o'clock. Assuming that it is exactly three o'clock but the clock is broken, does Smith have knowledge that it is three o'clock? This is a justified true belief but does not qualify to be considered knowledge (Hetherington, 2018).

According to Xu (2019), a critical examination of both Gettier's and Russell's' examples results in the conclusion that their critique of JTB is based on the

Justification condition. Their arguments imply that one may have insufficient justification for their beliefs, hence, not acquire knowledge. For instance, in the counter examples, Smith's beliefs are based on false premises/ fallible information, hence there is a possibility that the JTB can be considered defective. Lehrer (1979) makes a similar argument by positing that, despite this seemingly valid critique, one may defend the JTB criterion by arguing that the nature of justification must be infallible and based on indubitable evidence.

Any belief based on false or fallible information cannot be justified. Justification must involve infallible support to our beliefs and these beliefs must necessarily be true (consistent with the actual state of affairs). It cannot have errors or falsehood. Additionally, justification must involve the presence of adequate evidence to warrant acceptance of a belief (Anderson & Hetherington, 2018). The Gettier counter examples, one may therefore infer, do not provide adequate evidence for one to make a conclusion. In the Gettier cases, the justification is not strong enough to warrant a conclusion that one has enough information to accept a belief (Moti, 2017).

Mizrahi (2016) argues that, Gettier's examples do not have a universal significance because they are founded on a wrong belief that a false proposition can be used as justification for other propositions. The evidence presented in Gettier's examples are false, and consequently, any propositions founded on this false evidence are false as well. Knowledge requires that all evidence must be true, therefore, Gettier's counter examples are misleading.

Further, Gettier's cases and his subsequent conclusion that JTB is insufficient is misleading because he only demonstrates cases of semantic failure, not epistemic failure as he alludes. In the first case, Smith is convinced that the person who gets the job has 10 coins in his pocket. It is important to note that he has in mind the coins in Jones 'pocket, not the ones in his (Smith's) pocket. Gettier presents a case of ambiguity, which makes his cases unable to meet the justification condition. This reference failure by Smith is caused by the ambiguous designator, 'coins,' that has been confused by Gettier (Mizrahi, 2016).

In the second Russell case, the term time can also be considered an ambiguous designator because Smith intends to make reference to the time according to the standard time zone while in fact he makes reference to the time displayed on the clock. Failure to distinguish the proper sense and reference of the term, 'time' leads one to conclude the Gettier cases as authentic demonstrations of the insufficiency of JTB (Hetherington, 2018).

An assessment of Gettier's counter- examples, their implications to the validity of JTB, as well as various responses to these counter-examples led the researcher to infer that there is still unexplored questions regarding the three conditions. Firstly, each scholar makes a subjective interpretation of what the justification condition means. For some (such as Gettier & Russell), justification implies having a reason to believe that a certain case qualifies as a true belief. Others (such as Mizrahi (2016), Xu (2019), Anderson & Hetherington, (2018), Lehrer (1979) and Moti (2017)), consider justification to involve infallible proof that is not dependent on the subjective experience or views of the perceiver. In this case, nevertheless, there was need for an extensive examination of the classical conditions for knowledge to establish exactly the nature of justification that is valid in our pursuit of knowledge.

2.3 Conception of Truth in Scientific Inquiry

2.3.1 The Problem of Knowledge Acquisition in Philosophy of Science

One may ask questions such as; what is the scientific method? How does it contribute to human knowledge? And how reliable is this method to acquiring knowledge? These are the questions the researcher attempted to address in this section. It was important to establish how this methodology informs our knowledge processes, and how various scholars perceive the rise and advancement scientific knowledge, as well as its validity.

According to Haack (1976), the scientific method is an inductive approach to knowledge acquisition which is characterised by observation of phenomena, formulation of possible explanations for it, testing of these explanations and ultimately making a conclusion based on whether the expected outcomes have been

realized. If expected outcomes are realized, then the explanation is accepted as a valid theory.

In order to establish the nature of truth in scientific inquire, it was important to examine the works of notable philosophers of science who have been held as authorities in this discussion. They include; Karl Popper and Thomas Kuhn. Both of them sought to establish the knowledge acquisition processes particular to empirical studies as well as account for changes in the use of the term knowledge.

2.3.2 Karl Popper's Assessment of Empirical Science's Claims to Knowledge

Popper was one of the most influential philosophers of science in the 20th century. His book, 'The Logic of Scientific Discovery' will be of major interest in this research because it focuses on the criterion of knowledge in empirical science. He raises skeptical concerns on the validity of information that arises from experimentation and interpretation of these findings in science by arguing that there is lack of certainty. We can only establish certainty in the weaker sense, but have insufficient grounds for claiming epistemic certainty. Popper argues that despite claims of accuracy of the scientific method common in science, we can never prove the accuracy of their findings because science is exclusively based on an inductive approach (Popper, 2015).

Popper proposes an abandonment of the inductivist approach of science in favour of empirical falsification, which, he claims, is more appropriate in offering a logical explanation of phenomena in the physical world. It would be a waste of time trying to prove a theory in the empirical sciences because we can never gather enough data to affirm its accuracy, instead, we should adopt a method of seeking to prove it wrong and make provisional conclusions based on the limitation to knowledge characteristic of the human condition (Popper, 2002).

2.3.2.1 Popper's Response to the Problem of Induction

The problem of induction can be defined as the dilemma that arises when we seek to establish how a scientist or scholar formulates general scientific theories from observation of limited instances of a phenomenon (Salmon, 2017). In other words, this problem arises when we question how a single instance or few observations of an

occurrence can be logically used to make generalizations about all events or phenomena of a similar kind. The question arises, is the principle of induction justified in its approach to understanding phenomena?

The goal of science is to observe nature, formulate explanations for it, and predict the course of events in the future. This can only be achieved through formulation of principles derived from a careful observation of extended beings (physical entities). In the contemporary world, this task has been undertaken by scientists who are responsible for most theories on the universe and how it works. Popper seeks to rid science of the 'embarrassment' resulting from using inductivist approaches because these approaches can never result in any epistemological certainty (Maxwell, 2017). Supposing a scientist is conducting a study to determine the nature of Swans and in his research, the scientist discovers that all Swans he observes are white. He ultimately commits the fallacy of hasty generalization by arguing that since all Swans observed are white, then all Swans are white. This conclusion is a logical consequence of inductive reasoning. This notwithstanding, Popper argues that, we are not justified in generalizing the observation of limited instances of White Swans because, as mentioned earlier in this work, absolute certainty is an essential requirement for knowledge (Popper, 2015).

Popper wonders why reasonable people would easily accept the unverified claim that all observed instances of a thing will always conform to unobserved or future events of the same thing. It would seem a contradiction of the central tenet on which science is founded; verification before making epistemological claims (Popper & Schilpp, 1974). This occurrence, Hume posits, can be attributed to our customs or habits which are formed after repeated experiences of a similar nature. We become conditioned to a particular thing because it has occurred repeatedly and we form a habit of assuming that it will always occur in a similar manner. Popper concurs with Hume's critique of induction and concludes that this methodology is logically invalid as well as unjustified (Parusniková, 2019).

One would agree with Popper's critique of induction because knowledge requires absolute certainty of claims and it would be imprudent to claim knowledge of the state

of affairs of entities or events yet to be experienced or observed. Further, one may justifiably reject the accuracy of empirical science's inductive method because of the aforementioned shortcoming. Popper (2015) argues that induction cannot guarantee scientific knowledge because it emanates from individual experiences and cannot be verified. How then, can we pursue scientific knowledge if the already existent method cannot furnish us with conclusive proof of its theories? The section that follows presented Popper's falsificationism as a response to this question.

2.3.2.2 Falsification as Criterion of Knowledge

Formulation of theories is the first process a scientific investigation must engage in. One cannot just gather data or observing phenomena without a guiding statement or theory in mind because they are already engaged in a process of affirming or denying an idea in mind. Popper (2002) gives his own experience in a classroom with his students to demonstrate this point. When asked to pick their pens and start writing, the students wondered what the topic of discussion was. This is a clear demonstration that investigation must be guided by a theory (Sun &Wen, 2018). According to Sfetcu (2019), Popper posits that a scientific theory must meet the following criteria;

i. It must be logically consistent. This means that it should never be tautologous. A tautology only gives an impression of adding knowledge but does not.
ii. It must be inter-subjectively testable. This means that it should be capable of being examined by anyone who wishes to do it and same information be reproduced through the prescribed manner.
iii. It should be falsifiable. This criterion means that a scientific claim must be capable of being proven false, whether in actuality or in principle. One may give an example to demonstrate this. The claim, "Kenya can become a middle-income county by 2025 if corruption is eliminated" is falsifiable because even when not verifiable in fact, it is a possible state of affairs that can be empirically tested if it occurs. However, the claim, "God hates the corrupt" is not falsifiable because it is logically impossible to observe it (the nature of God as an abstract being makes it impossible for humans to know him/her/them).

If a theory runs the risk of being refuted or proved wrong, then it is falsifiable, thereby making it a scientific theory. It should be formulated in such a manner that if tested, some aspects of it have a possibility of being falsified. The tests or experiments involves should only be aimed at proving it wrong, not affirming it. If it withstands these rigorous and critical tests, it can be held as a valid explanation of phenomena until such a time when it will be proved to be false. Its survival at any point should never be taken as absolute proof that it accurately represents the phenomenon it describes. It can only be said to be corroborated, awaiting further tests. These tests will persist for as long as the theory is being used to explain reality (Derksen, 2019).

Popper, we may argue, removes claims of certainty from empirical scientific processes and introduces a normative methodology of how science should pursue knowledge. Popper's work is also a clear demonstration of the shortcomings of the scientific method of induction which only offers provisional information concerning the phenomenon it investigates. One is inclined to agree with Popper that the conventional methods of research do not offer an appropriate response to the persistent problem of addressing subjectivity and relativity in knowledge.

If the Popperian response to the three central epistemological questions stated in the introductory section of this paper holds, one can conclude that humans are incapable of ever attaining knowledge of the external world and attempts to pursue knowledge will only end in conjectures that can be refuted at any given moment. However, an inductivist may refute the Popperian claim that the inductive approach of science is not reliable. They may posit the argument that induction has worked in many occasions in the past and its predictions have been proven accurate (Morrison, 2011). If this is the case, then, this method cannot be wholly condemned as incapable of attaining accurate data for science.

This defence, we may argue, is not sufficient and cannot be held to be valid. The inductivist bases their argument on an inductive approach, which is still in need of justification. They are arguing that something is valid because it has been valid in the past. This is not evidence but a tautologous attempt to convince us into accepting their

claim. At best, the inductivist is engaged in circular reasoning, and no proof of the validity of induction has been offered.

Another response to Popperian rejection of induction is the probabilistic argument. According to this argument, we cannot, with certainty, argue that induction is incapable of giving us knowledge because adoption of cautious generalization can provide information that is probably true. Therefore, it is the position of this argument that we may be justified in claiming something to be probably true instead of claiming certainty (Okasha, 2003). For instance, instead of saying that the sun will rise tomorrow, one may justifiably say that the sun will probably rise tomorrow. Proponents of this school of thought assume that Popperian skepticism will be sufficiently addressed by this position.

The above position affirms that the inductive method is defective and does not offer a way of remedying its weakness. This means that, if the method is faulty, no amount of probabilistic claim will point us towards the truth because claiming that something is probably the case also implies that it probably is not the case. This, therefore, makes the probabilistic argument circular as well. This position does not offer a convincing refutation of Popper's critique of induction.

In conclusion, Popper's understanding of science is informed by his distrust of the method of inductive reasoning and his need to ensure accuracy and certainty in scientific knowledge. Induction, scholars agree, cannot be guaranteed to give us knowledge because it is based on probable relationships between or among phenomena. As such, at any given time, evidence available to us will lead us to conclude that we can only be partially certain that we have knowledge. Popperian account of falsification also demonstrates that theories held at a given time can only be said to have relevance and meaning at that time, but can later be shown to be inaccurate. Hence, scientific claims to knowledge are not justified if we consider knowledge to be objective. However, a pragmatist can claim to have an understanding of the workings of the universe at that given time because the evidence available points to this conclusion.

The literature reviewed in this section pointed to the following conclusions: firstly, the inductive method cannot be relied upon to derive knowledge of the universe, and secondly, Popper's assumption that falsification can lead to knowledge acquisition (albeit temporarily) is a contradiction because falsification is dependent on induction. This research, therefore, sought to establish whether there are unexplored elements of the inductive method that would result in acquisition of knowledge concerning the universe.

In the section that follows, the research aimed at examining Kuhn's account of science and the status of scientific knowledge. Kuhn reacts to popper's critique of induction and falsificationism as a solution to the epistemological concerns raised in earlier sections of this work.

2.3.3 Thomas Kuhn's Account of Scientific Knowledge

Kuhn introduces a radical view of how science progresses. He abandons the conventional assumption that science is characterized by introduction of new knowledge to old knowledge and a subsequent accumulation of facts. This conventional view presents science as involving addition of information into an already existing body of facts and this presupposes correction of errors where necessary. He also disputes Popper's normative account of science which stipulates the methodology that science ought to adopt to guarantee progress. Kuhn presents a descriptive account of science and claims that description precedes explanation in scientific research. The task of science, according to him, is not to explain, but describe reality as it is perceived (Anand, Larson & Mahoney, 2020).

2.3.3.1 Kuhn's Structure of Scientific Revolutions

Kuhn seeks to clarify that scientific progress is evolutionary and as such, a theoretical structure serves its purpose for a specific period of time and is wholly abandoned when a new more competent and acceptable theory is adopted in its place (Kaiser, 2016). He also introduces the concept of paradigm to explain how one theory serves its purpose and is systematically dropped in favour of another. His work, '*The Structure of Scientific Revolutions*' (2012) clearly explains this position on the nature of scientific theories and their roles in knowledge acquisition.

Kuhn begins by arguing that both Logical positivists and Popper missed an essential aspect in their claims on the nature and development of science. This component is what he refers to as a 'paradigm'. A paradigm is a model, an exemplary one, which is dominant for a period of time and offers a theoretical foundation, assumptions, and operating guide for scientific research during this time (Kuhn, 2012). The structure behind the paradigm is not critiqued or examined for certainty but is simply accepted as accurate. A scientist's responsibility is therefore to work with the given framework and attempt to refine theories developed from this paradigm. Further, a paradigm will dictate the nature of scientific investigations at a given time, the nature or type of questions scientists ask, and the criterion for seeking answers to the questions raised (Kuhn, 1996).

Concerning establishment of paradigm, Kuhn (2012) argues that there exist a period where there are multiple theories and schools of thought which conflict and without agreement on any scientific truths. He calls this period, 'prescience'. Every scholar has their point of view, methodology as well as interest. Lack of consensus on acceptable knowledge, methodology and object of study are characteristics of this period and as a consequence, little scientific progress is made.

However, over a period of time, one of these schools triumphs over the rest and is accepted as the paradigm. Consequently, scientific progress is guaranteed at a consistent or sturdy phase. When a paradigm is created, the period in which it dictates the theoretical foundation of research, and introduces universal standards of legitimate investigation, is referred to as 'normal science'. Kuhn posits that the distinguishing feature of science and pseudo-science is existence of a paradigm (Kuhn, 1996). If Kuhn's theory of science is accepted as true, then one can conclude that social sciences in the contemporary age lack a paradigm, hence, pseudo-sciences.

During the period of normal science, scientists embark on creating conformity between the paradigm and nature or reality under investigation. It is a puzzling venture which involves theoretical as well as empirical or experimental tests. If a scientist, following the theoretical framework and standards of the paradigm is incapable of solving puzzles, they are to blame for this failure. The paradigm cannot

be said to be inadequate, but the scientist is (Richards & Daston, 2019). Unlike Popper who argued that an incident that is observed to contradict a theory falsifies the theory, Kuhn claims that this incident or occurrence is an anomaly. Arabatzis (2016) asserts that anomalies are to be expected in every paradigm and should be tolerated because they do not necessarily imply a defect in the paradigm. Scientists in this paradigm have confidence that these anomalies may seem to be contradictions of the theory but can be explained over a period of time.

An accumulation of many anomalies is, however, not a cause for alarm or this as a sign of inadequacy in the paradigm. It is possible to have several anomalies in normal science; however, they can result into a theoretical crisis in special circumstances (Kuhn, 1996). Kuhn explains that anomalies are ignored because if scientists focus their attention on trying to make them conform to the theory, very little scientific investigation will be done, hence no discovery of knowledge.

Kuhn (1996) argues that science is not built on existing knowledge because once a paradigm has been abandoned, its theoretical foundations, standards, methodology and core principles are dropped as well. This means that the new paradigm will introduce a completely new set of these theories, standards, methodologies and principles in order to seek an understanding of nature's puzzles. Preston (2008) makes Kuhn say that this is a scientific revolution because it involves a whole paradigm shift. The new paradigm is not in place because there are reasons that are logically compelling, but due to sociological and psychological reasons. The new theory is better placed to explain reality in manner that seems closer to objectivity.

A critical examination of Kuhn's theory can lead one to conclude that his view of science is that truth at any given time is a matter of opinion and the most populous ideas are utilized until they cease being useful (Hughes, 2010).

We may claim that Kuhn adopts the theory of truth as a pragmatic value of information. As long as information is useful in a particular context, then it can be regarded as truth. Once an idea loses utility, it is abandoned for another which serves the purpose of describing reality, albeit for a limited period of time. As such, it makes

scientific knowledge possible because it meets the three necessary and sufficient conditions (belief, justification and truth).

Kuhnian pragmatic appeal can be seen in his refusal to pursue reality as it is, instead, he focuses on how scientific knowledge is built through an assessment of the ability of theories to explain and solve a specific problem at a given time. He makes no claims to objective understanding of reality because he proposes a complete abandonment of a paradigm in favour of a new one if the latter fails to explain and predict reality in a competent manner. The maintenance of a paradigm, therefore, is dependent on its relevance at that given moment.

Popper and Kuhn demonstrated that objective truth is not achievable in scientific research because their arguments imply that knowledge is constituted by theories which accurately predict scientific observations at a given time. A change in theory is a common occurrence in science and previously held theories will be rendered false if they are replaced by others which explain reality better and in a more predictive manner. They also present arguments that can be used to support the assertion that objective truth is not achievable using empirical investigations. This notwithstanding, their works point to the possibility of attaining pragmatic truth (knowledge that has utility) which can be used to explain the nature of the universe as perceived by humans as well as make generalizations concerning that which is observed. This finding presents a challenge to our epistemological pursuit because a logical assessment of the above claims can only lead to one conclusion; pragmatic truth does not qualify as knowledge in the strict sense of the term because epistemic certainty is lacking and objective truth is not dependent on the usefulness or lack thereof of a proposition.

2.4 The Duhem-Quine Thesis and Its Implications for Empirical Knowledge

This section examines the works of the Frenchman Pierre Duhem and American scholar of logic, Willard Van Oman Quine, on the nature of scientific knowledge and how it is assessed for accuracy. Their work has become a major turning point in philosophy of science as well as epistemology because it compels scholars to re-examine their claims to scientific knowledge. Once the Duhem-Quine thesis is

demonstrated, we will also examine its implications to scientific pursuit of knowledge common in contemporary empirical science.

2.4.1 The Duhem-Quine Thesis

The Duhem-Quine thesis is also referred to as the Duhem-Quine Problem and it makes reference to the relationship that exists between a theory and observed reality in experimental sciences. The thesis can be summarized as follows; it is not possible to empirically test a scientific hypothesis in isolation because such a test would require a simultaneous test of auxiliary hypotheses (Liu & Adams, 2019). Auxiliary hypotheses are background assumptions behind every principal theory and it would be impossible to ignore them in any rational scientific test (DeWitt, 2018).

By itself, a single hypothesis cannot competently make scientific predictions because it is insufficient. It attains a predictive power when background assumptions are incorporated in it because they help scientists make predictions on the principal theory. A bundle of hypotheses (the main theory and its auxiliary assumptions) may be tested to establish how they represent the nature of the universe and if found to be faulty, abandoned or falsified. However, the main theory cannot be falsified in isolation because it cannot be removed from the bundle in any scientific investigation (Fairweather, 2012). This means that all scientific investigations must always involve a bundle of hypotheses.

If anomalies are detected in the bundle of hypotheses, a scientist will not conclude that the principal theory has been falsified, but they will seek to investigate for flaws in the auxiliary hypotheses and adjust them accordingly. A general law in isolation is insufficient to imply a singular proposition and subsequently, when experiments are done to test this singular law, many assumptions about the state of the experimental apparatus, prevailing conditions, and other relevant factors will be involved (Massey, 2011). Consequently, these assumptions will necessitate an introduction of more laws governing them and when the experiment is done, the results, if contrary to the scientist's expectations, will not necessarily imply the falsification of the general law, but possibly, of one or more of the auxiliary assumptions. The theory under

examination, therefore, may never be refuted even when experimental outcomes point to its falsification (DeWitt, 2018).

Ultimately, we may consider the Duhem-Quine thesis to be a logical objection to the possibility of an objective criterion for affirming or falsifying singular hypotheses. This, in essence, means that any scientific experiment cannot yield meaningful information concerning the theory under investigation alone if there are not background assumptions to shape the research.

Duhem and Quine reject Popper's assertion that a good theory is denoted by its vulnerability (the possibility of being falsified) because they present a case for the impossibility of falsifying any scientific theory through empirical means. Any attempt to falsify a hypothesis will be rendered futile because the scientist can always find fault in one of the auxiliary assumptions and revise it as appropriate (Massimi & Pritchard, 2014). Duhem's critique is aimed at physics in particular; however, Quine's theory is more radical and encompasses empirical sciences and all other disciplines that seek knowledge in their totality.

2.5.2 Implications of the Duhem-Quine Thesis for Empirical Scientific Investigations

The Duhem-Quine thesis, if accepted, will have significant implications to science, to an extent that one may take scepticism to its logical conclusion; that it is impossible for humans to know anything at all. This section investigates various implications of this thesis in various areas of empirical study. We will seek to critically assess literature on how, if the theory is accurate, scientific claims to knowledge will be impacted.

2.4.2.1 Under-determination of Scientific investigation

One of the most significant consequences of the Duhem-Quine thesis is that scientific theory will be underdetermined by evidence. Under-determination is a property of the relationship that exists between a scientific theory and observable facts (Turnbull, 2018). There are two general meanings when we argue that evidence underdetermines a theory; firstly, the evidence available is incapable of proving the accuracy of a theory, and secondly, the available evidence is insufficient to make the theory

probable. One may refer to the former as deductive Under-determination and the latter as inductive Under-determination. Both have a significant implication to scientific research; that our acceptance and subsequent conviction in a theory is never sufficiently supported by evidence available to us at a given time (Newton-Smith, 2017).

Holistic Under-determination arises when we acknowledge the impossibility of having a crucial experiment (one with a single hypothesis and all investigations are limited to it only). A scientist will always seek to find a way of modifying background assumptions and still hold the theory true despite encountering instances of contradictions (McMaster, R., & Novarese, 2016).

Empirical tests are limited because they can only offer finite knowledge of reality at a given time. It is impossible for these experiments to offer conclusive explanation of reality because they can only describe the entity or occurrence at present; it is not possible to have objective knowledge of past or future occurrences. As a consequence, scientists will not be justified in making generalizations of the findings of this experimental process (Park, 2018).

A skeptical individual would argue that the Duhem-Quine thesis makes knowledge of any kind impossible because for all kinds of knowledge, humans depend primarily on experience. Under-determination has unpleasant consequences for scientific theories because their affirmation or falsification will be done, not based on logical processes, but arbitrarily. Abandonment of a theory will depend on the scientist's ability to modify the auxiliary hypotheses, but not the accuracy or falsity of the theory itself. The implication of this is that scientific knowledge based on such theories is at best conjecture and can only be said to have a pragmatic value, and not objectively true.

2.4.3 Possibility of attaining knowledge against the Skepticism raised by the Duhem-Quine Thesis

A rejection of the possibility of acquiring knowledge through empirical means would deal a disastrous blow to any attempt by scientists to explain the essence of the universe. In this section, we will examine if indeed this thesis eliminates any

possibility of knowing, and if that is not the case, then how we can attain knowledge if our methodology is not adequate.

Instrumentalism has been proposed as a justification of the possibility of acquiring knowledge through these empirical tests. An instrumentalist argues that when we assume theories as truth bearers, we make a conceptual mistake which will lead us to argue that the theories are not accurate. Instead, they argue, a theory should be viewed as a principle or technique utilized to help a scientist conduct an investigation successfully (Leplin, 2017). As such, we can only examine the empirical adequacy of theories, not their truth. According to Longino (2013), empirical adequacy refers to a theory's ability to make accurate predictions of the observable world.

One may also claim that the Duhem-Quine thesis does not have such a significant impact on our claims to knowledge even when our theories are underdetermined by data. The egalitarian theory proposed by Quine would not validly apply in condemning all instances of falsification. In some cases, evidence available is so overwhelming that a theory should logically be falsified, regardless of how much modification can be made. It is only logical to declare a theory false instead of making arbitrary changes in its system in an attempt of saving it. Modification of a theory's auxiliary assumptions is therefore, in some cases, logically justified. Hence, a logical scholar needs to follow evidence and its implications.

Upon critical assessment of the Duhem-Quine thesis, one notices that it strives to lay emphasis on the importance of critical tests on a single hypothesis. The adjustment of this hypothesis's background assumption is what the scientist is more interested in. However, the skepticism raised by this thesis can be avoided if these critical tests were done in a larger context. Lakatosian research programmes offer such a solution. Instead of focusing on a singly hypothesis, a scientist may examine a thesis in light of its contribution to an existence research programme. If the theory is in the 'hard core' it is insulated from any modification and only its 'protective belt' can be altered to ensure that it offers adequate support to the former (Lakatos, 2015). This programme, however, is not immune from being discarded and replaced with another that is more efficient and has fewer inconsistencies between the 'hard core' and its 'protective belt.' This solution, we may argue, offers no valid explanation of how it can aid in

knowledge acquisition because it only makes reference to the Lakatosian theory of science. Abandonment of a programme in favour of another means that the first one did not have accurate explanation and prediction of the universe, hence it does not provide us with knowledge. If the same process affects its replacement, then we may as well make a similar conclusion.

An examination of the Kantian school of thought concerning human knowledge can suffice to justify the possibility of knowledge (albeit not in the proper sense of the world) and the nature of such knowledge. Kant, in his work, "*Critique of Pure Reason,*" argues that it is not possible to understand things as they are (*noumena*) because they are not perceivable through the senses. What we perceive are things as they appear to us (*phenomena*) and these are not accurate representations of the thing we perceive. Outside our thoughts, all objects of our experience are mere appearances but have not grounded in reality itself (Kant Pluhar & Kitcher, 1996). This means that the idea I have in mind about an object is not an accurate representation of the thing itself in reality, rather, my perception conforms to my mind's categories which make it possible. The existence of things (*noumena*) is not grounded on our experiences but is wholly independent of the perceiver's mind (Bird, 2013). Kant contradicts the popular transcendental realism school of thought that our perceptions are accurate representations of reality as it is because it would imply that we can actually know noumena.

The discussion on the Duhem-Quine thesis, its implications, as well as the possibility of attaining knowledge in scientific inquiry has raised pertinent issues in this discussion. Firstly, there is no consensus on whether the Duhem-Quine thesis eliminates all possibility of knowing (in the proper sense of the term) the universe and accurately describing how it operates. Skepticism, as a logical consequence of this thesis, also eliminates all possibility of us knowing anything for sure. This notwithstanding, some schools of thought would argue that the Duhem-Quine thesis does not pose any significant challenge to our claims of knowledge. For instance, Kantian epistemology does not declare that our understanding of the *phenomenal* world has been compromised; instead, it concludes that our claims to knowledge are dependent on the categories of the mind in the perceiver.

2.5 Theoretical Framework

This study focussed on the following question, "Is it possible to have knowledge (particularly, scientific knowledge)" through empirical methods employed by science? An appropriate response to this inquiry must involve a clear understanding of what knowledge involves (the necessary and sufficient conditions), the status of certainty and truth in empirical science's data, and the possibility of attaining knowledge in the strict sense of the term (as stipulated in the correspondence theory) . The school of thought which was identified as relevant for this particular task is Descartes' criterion of truth which involves clarity and distinctiveness of propositions. This section explained these theoretical foundations of objective knowledge and demonstrated how they will be utilized in an attempt to address the concerns raised in this research.

2.5.1 Rene Descartes' Foundationalist Criterion of Truth

In his work, '*The Meditations on First Philosophy*,' he demonstrates the relevance of employing systematic scepticism in our pursuit of knowledge until such a time when we establish the accuracy of our convictions about reality. In this same work, he cautions against simply accepting information, despite having trust in the source, unless rigorous investigation into the merit of the information is done in an independent and rational manner (Descartes, 2017).

This study adopted the Cartesian foundationalist theory of knowledge in interrogating if it is justifiable for a scientist or anyone to accept knowledge as constituting a theory that works for a specific period of time until it is replaced by another with more explanatory or predictive power. The research also involved investigating the challenges that arise from accepting the pragmatic theory of truth and seek to establish if this theory (and the scientific knowledge which conforms to it) can be reconciled with the nature of knowledge as an objective truth (as demonstrated by the correspondence theory).

In his third Meditation, Descartes argues that a true proposition must have two properties; clarity and distinctiveness. An idea is clear if it is self-evident in such a

manner that it cannot be logically doubted. A statement that is clear presents an accurate description of the object of interest and not even the skeptic can raise contrary views about it (Descartes, 2017). Wittgenstein, in his work, '*Tractatus Logico Philosophicus*,' makes a similar statement by arguing that whatever one can say must be said clearly, and whereof one cannot speak, they must be silent. This implies that information passed on as knowledge should not have any element of doubt within it, and if it can be doubted, then we should not present it as knowledge (Wittgenstein, 2021).

An idea is distinct if it is apparent to an attentive audience or the one that conceives it. The distinctiveness is not of perception, but conception (Descartes, 2017). Perception, according to Audi (2010), may be compromised by shortcomings of the senses, however, conception involves formulation of a concept in the mind by an abstract process which eliminates sense data and focuses on the essence of a thing. This concept will stand out from other closely related concepts because it has unique properties attained through a process of rigorous abstraction.

Clarity and distinctness should act as the criterion for evaluating all information that a scholar uses as foundation of subsequent knowledge. Descartes presents a foundationalist perspective of knowledge in which a set of knowledge is used as a base for all other knowledge that they will acquire in the course of their investigation. He argues that there must be a strong and indubitable foundation for all knowledge, regardless of its source (Descartes, 2017). To put it into perspective, one may argue that the process of acquisition and advancement of knowledge is like building a storey house which involves establishing a firm foundation on which all the floors of the building will be built. If the foundation is strong, the entire building is strong and secure; however, if the foundation is weak, the entire building is weak and should be brought down altogether. Science is foundationalist in its approach because the acceptance of a set of facts is dependent on preceding facts on which the former is based.

Clarity and distinctiveness guarantee certainty of knowledge. The concept of certainty has been commonly used in epistemological contexts and philosophers have been

conflicted on whether it is a necessary requirement for one to have when they claim to possess knowledge (Descartes, 2017). We can claim to be certain of something, but does it necessarily mean that we know? This is a question that, when answered, we can establish the importance, if any, of being certain or sure of something and if it has any significant role to play in our knowledge process.

The importance of absolute certainty can be seen in Rene Descartes' work, 'The Meditations on First Philosophy' when he argues that our claims to knowledge must undergo systematic scepticism to establish substantive grounds for holding them true. Some information may seem to be so clear but upon interrogation, it is found to be based on false grounds (Descartes, 2017). Certainty, therefore, is a necessary factor, according to Descartes, to consider when evaluating claims to knowledge.

In this study, search for clarity and distinctness of information was sought in order to establish if the foundations on which scientific theories and their justification is logically acceptable, and if this is not the case, they will be deemed false, regardless of their pragmatic value. One of the fundamental aspects of scientific research lies in its methodology. A methodology serves as a foundation on which knowledge is sought because it dictates how the scientist will gather data, the kind of data they will gather as well as other necessary epistemic conditions. Therefore, if the methodology is flawed, the outcome will be compromised. The empirical method was critically assessed to establish if it compromises truth or if its findings are consistent with objectivity.

The Foundationalist theory as well as the criterion of truth, both proposed by Descartes, was appropriate for this research because they offered an objective guide to assessing the accuracy of not only scientific methodology, but also of scientific facts that emanate from adhering to the aforementioned approach.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Study Site

The study, being library based, was carried out at Chuka University Library, situated within Chuka University, in Tharaka Nithi county. The coordinates of this site are 0.3195° S, 37.6575° E.

3.2 Research Design

The study adopted a qualitative research method which involved comprehensive in-textual analysis and subsequent interpretation of materials relevant to the study area. According to Hennink, Hutter, and Bailey (2020), qualitative research is important when a researcher seeks to understand concepts, experiences, thoughts, and phenomena in its natural setting. As such, one employs this design if they seek to acquire a wide range of information about reality. Research, in this case, involves formulation of research questions, establishing a clear purpose for the study, designing research tools such as questionnaires, interviews, identifying and studying relevant documents, among others. Data collection is relatively flexible because it allows accommodation of changes in strategy and data, depending on the topic of study and availability of new findings. Additionally, its methods of analysis may include; thematic analysis, content analysis, and grounded theory, among others.

The study opted not to adopt quantitative research design. As per Fischer, Boone, and Neumann, (2023), this method involves investigating relationships among variables by using numerical data to evaluate hypotheses. Research into the possibility of knowledge acquisition by way of empirical methods requires collection of points of views from various scholars and identifying common themes in their arguments. As such, it would be impossible to statistically determine the thoughts, points of views, or perception of various scholars concerning this objective. It was therefore imperative to adopt a research design which allowed the researcher to critically examine a wide range of opinions and theories posited by various schools of thought.

The interest of this study can be situated in two areas of philosophy: Epistemology and Philosophy of Science. Research in these branches of Philosophy is

predominantly a second-order activity, which involves library research (some would call it armchair research). A philosopher who engages in this type of investigation conducts document analysis where they critically examine texts relevant to the discussion and assess ideas raised therein by various scholars.

3.3 Data Collection

Data was collected from various libraries with consideration of its relevance to the research objectives. These libraries included both physical and virtual. Physical libraries include; Chuka University library, Tharaka University library and Kenyatta University library. These universities were chosen due to their ease of access by the researcher as well as availability of relevant literature for the study in their libraries. Virtual libraries included: digital institutional repositories and digital archives. The researcher analysed both primary texts (the original works of key scholars in the study- this includes translations as well) and secondary texts (works that have been written or/and edited by other scholars, other than the owner of the theory or idea). The texts relevant to the study included:

i. Those which discuss the nature of knowledge, including its necessary and sufficient conditions. For instance, books and journal articles relevant to the necessary and sufficient conditions for knowledge will be identified and utilized. This literature involved arguments for and against the three conditions.

ii. Those which address the pragmatic nature of scientific methodology and knowledge, and various theories on how scientific knowledge develops from one level to the next. In particular, publications in Philosophy of Science were of interest to the researcher. Books and journal articles discussing the empirical data gathering processes in empirical science, theories on the progress and evolution of scientific knowledge, and the pragmatism of science were critically examined.

iii. Those which discuss the tenets of the Duhem-Quine thesis and its implications to scientific knowledge. Particularly, original works by Scholars such as Pierre Duhem and W.V.O. Quine, books and articles by other scholars critiquing the Duhem-Quine Thesis, and works on the implications (especially Skepticism) of the Duhem-Quine Thesis, were sought.

iv. And lastly, those which address the possibility of attaining knowledge (objective knowledge) through adoption of scientific methods of inquiry. These works included but were not limited to: scholarly works arguing for the subjectivity of scientific knowledge, publications advocating for the accuracy of scientific methods and data, and those who attempt a reconciliation of the Duhem-Quine thesis' scepticism with the possibility of acquiring knowledge in the proper sense of the term.

3.4 Data Analysis

The methodology of analysing the information retrieved from the above-mentioned sources involved the following philosophical methods; the critical method, philosophical analysis and argumentation **[**which involves explication (descriptive analysis and evaluation)**]**, and synthesis.

3.4.1 The Critical method and its application

The critical method of philosophy involves an examination of propositions or ideas to establish if they have a definite meaning, ambiguous, vague, true or false, among other epistemic considerations (Meltzoff & Cooper, 2018). Marcuse (2020) affirms that the method involves a systematic manner of questioning assumptions, examining evidence or proofs advance for a belief, and assessing how components contribute to a whole. Arguments are evaluated to determine whether they are valid or invalid or in inductive cases, to establish their strength. This is an important method because it enables scholars to avoid misconceptions that arise from human limitations in our knowledge- seeking processes. The Cartesian critical method was an important influence in our investigation of the concepts of truth, and subsequently, knowledge, in this research. This method involved establishing a clear and distinct definition of phenomena such that our understanding of concepts was not be subjective, but objective.

In his work, *The Meditations on First Philosophy,* Descartes systematically questions the foundations of our knowledge, especially one that is attained through experience. Through persistent questioning, he establishes that our senses are unreliable in knowledge acquisition because of their limitations and tendency to deceive. He

concludes that we have to secure a firm foundation in reason, hence, his dictum, *cogito ergo sum* (the foundation on which all knowledge is to be built) (Descartes, 2017). This same method was applied by Immanuel Kant in his work, *Critique of Pure Reason*, to determine the possibility and limits of human knowledge. If Kantian critique was hypothetically used to assesses the Cartesian claim (or rather, assumption) that reasoning offers an indubitable channel through which knowledge can be acquired, Kant would question the validity of the claim that doubting everything can lead to a secure and firm foundation for knowledge (Gava, 2023). In his work, Kant demonstrates the insufficiency of both rationalism and empiricism in knowledge acquisition. He further casts doubt on the possibility of knowledge acquisition, regardless of how clear and distinct our ideas are, because of the limits of the human cognitive ability and processes.

The data collected in this research was subjected to a logical analysis as well as conceptual examination. Logical analysis involved assessing whether the evidence uncovered in the texts was sufficient to warrant the conclusions drawn by the authors of these texts. This process entailed seeking a necessary connection between the conclusion and the premises given. Conceptual analysis, on the other hand, involved examining the meaning of concepts used in the texts to determine their meaning. For example, when a pragmatist claims that they have knowledge of a phenomenon, is it synonymous with a proponent of correspondence making the same claim? This investigation ensured that ambiguity and vagueness were not tolerated in definitions. A common fallacy the research aimed to avoid is equivocation, which occurs when the same term is used more than once in the same argument but has various meanings. This fallacy distorts the meaning of the argument and the conclusion derived from such a process is rendered invalid. These forms of assessment guaranteed that the researcher remained objective in their pursuit of knowledge.

During this investigative process, the logical principles such as the principles of non-contradiction and the identity were utilized. The principle of non-contradiction stipulates that something cannot be and not be at the same time and in the same respect (Priest, Beall & Armour-Garb, 2006). This implies that, for instance, truth is either objective or subjective; it cannot be both because admission of this would

amount to accepting two contradictory propositions, ultimately leading to a logical contradiction. For instance, if the correspondence theory of truth is an accurate account of truth, then the pragmatic theory must be false, and vice versa. It is impossible for both to be true at the same time. In a similar manner, either, the Duhem-Quine thesis underdetermines theory by data or it does not; if the thesis is accurate, then knowledge through empirical (crucial) tests is impossible, but if it is not accurate, then we can acquire knowledge regardless of the concerns raised by the thesis.

According to Griffiths (2017), the principle of identity states that what belongs to being (an entity) necessarily belongs to it. It implies that what is predicated of something must belong to it as a matter of logical necessity. If truth is predicated of a proposition, then this proposition must possess this property This principle does not claim to know the actual nature of knowledge, but stipulates the kind of affirmative judgments (judgments that stipulate something is the case) which render information necessarily true. In order for this principle to be observed, there must be affirmation of something and coherence in data must be observed. For instance, if it is true that science does not offer any possibility of attaining truth, the evidence provided must be consistent with this conclusion. It must necessarily lead to this conclusion; otherwise, it would violate the principle of identity. The premises must be identical to the conclusion. This logical principle ensures that our inference processes have logical correctness within them.

When investigating the conditions for knowledge, for instance, the researcher used the critical method to firstly establish the meaning of knowledge and clearly distinguish it from beliefs, or common-sense convictions. In order to accomplish this, it was important to clearly lay out the distinguishing features of each of these states of mind. Criticality compelled the scholar to establish the sense in which the terms ‘knowledge’ and ‘truth’ are used in their research. Clarity established when this was done helped the researcher to avoid cases of ambiguity and vagueness when these terms were used.

Effective application of the critical method may have been hampered by lack of clarity in meaning of some of the terms or concepts used in the text. For instance, a

term may have been used in a stipulative sense in one context (subjective assignment of meaning) but lexically in another (defined in its proper and universal sense). For instance, this occurred when some critiques advanced against the necessity of belief as a condition for knowledge assumed that belief and knowledge were synonyms. To avoid confusing the different perspectives in which this term was used, the researcher ensured that each context was treated and understood differently. Critical assessment of these concepts involved a clear stipulation of how a term was used, the context in which it was used, and the meaning derived in each context.

When critically examining each objective, the researcher sought to respond to concerns such as; whether the proposed solutions were adequate to the problem being investigated, if there were better solutions not explored in the text but were available in others, and how these solutions could be implemented effectively, among others.

3.4.2 Philosophical Analysis and Argumentation and its Application

Analysis, in logic, involves breaking down complex concepts or statements with an aim of attaining smaller independent components which can be studied in isolation for better understanding (Copi, Cohen & Rodych, 2018). Analysis can also be utilized in other disciplines where a complex problem is broken down and scrutinized to identify areas of weaknesses. In philosophical analysis, a systematic approach of elimination is adopted and it involves a step-by-step critique of statements with an aim of testing their consistency, logical correctness as well as their accuracy.

Philosophical analysis was applied in this study to establish the exact meaning of concepts such as science, belief, justification, truth and knowledge, among others. For instance, when defining science, the concept was broken down into individual components which included its etymology and meaning, as well as methods of inquiry that distinguish it from any other discipline that investigates reality (such as metaphysics). The study also broke down the conditions that would make information a belief, but not necessarily knowledge to ensure that the concept of knowledge was clearly understood in the context of its necessary and sufficient conditions. Analysis, therefore, was an integral method in this study which ensured that the meaning of concepts remained clear and unambiguous.

Argumentation was also an important component of the research methodology in this research. Arguments are a necessary component to understanding. Aristotle argues that argumentation entails reasoning, the third act of the mind, which enables a philosopher to transcend from that which is known to the unknown (Miller, 2015). In other words, an argument involves using evidence to arrive at a conclusion and this conclusion involves new knowledge deduced from the premises. Arguments are valid or cogent if the conclusions drawn therein are derived from the premises (evidence) provided. A poor argument has premises and a conclusion which do not conform to each other, or have conclusions without much or any support from the premises (Copi, Cohen & Rodych, 2018). A logician should ensure that an acceptable argument has conformity between both elements. When engaging in argument analysis, the logician asks the following questions;

i. Is it an argument?
ii. What is the argument for? Or what is the conclusion?
iii. What evidence has been provided? Or what are the premises?
iv. How good is the argument? Or how strong is the support?

In responding to the first question, the researcher sought to examine if claims to knowledge presented throughout the texts under scrutiny were supported by evidence. An argument must have two components; a claim being made (conclusion) and evidence to support this claim (premises). If a claim was been made without support, then the text was disregarded because it was not an argument, hence, it could not lead to new knowledge. For instance, a claim such as, "objective truth is not synonymous with pragmatism," should be supported by evidence which demonstrates the nature of truth and a demonstration of how pragmatism falls short.

To the second question, the researcher sought to establish what the new knowledge introduced by the texts is. This involved a rigorous scrutiny of the work to identify how it was arrived at and if it was indeed new information. The third question was responded to through a critical examination of the proofs offered to support the claims made in the literature being examined. The researcher sought to understand the foundations of the claims being made and determine if they were credible. Credibility

included characteristics such as logical consistency. The last question, the researcher examined the evidential link between the premises and conclusion and establish if there was a correlation. This enabled them to determine if the argument as a whole was acceptable. At this stage, the major concern of the logician is not to establish truth, but logical correctness (the conclusion must follow from the premises).

Descriptive analysis is implied in the above-mentioned process because it involves making descriptions of the phenomenon being investigated in order to understand it clearly. One cannot make judgment on the acceptability of an argument if they do not understand it first. When this analysis was done, evaluation followed as a matter of logical necessity. Evaluation is a process that involves a rigorous assessment, comparison of ideas or schools of thought with an aim of explicating their strengths and weaknesses.

When engaged in this study, the researcher ensured that his subjective feelings or point of view did not influence their conclusions on the matter being investigated. The researcher's point of view was not an element of philosophical assessment of ideas because it would have interfered with the expected logical correctness of an argument.

3.4.3 Synthesis

This is the method that the researcher applied in the final section of this work. Synthesis involves reconciliation of seemingly diverse (opposed) ideas or schools of thought through identifying strengths of each and forming new knowledge from these points (Burch-Brown, 2021). A philosopher aims at synthesis because new ideas are born out of a dialectical process which combines diverse ideas to create new reality. Hegel, in his dialectic method, argues that despite the appearance of opposition of ideas, one can always find compatible elements in each of these ideas (Lauer, 2020). Our journey to knowledge emanates from identifying a thesis, its antithesis and merging the compatible elements of these two to form a synthesis.

In this study, the researcher sought to establish if a synthesis could be arrived at by examining if we ever claim to know despite the seemingly impossibility of scientific knowledge being objective and an inaccurate representation of reality. The classical

school of thought that held the truth condition to involve correspondence seemed opposed to the scientific method's conception of truth as pragmatic and this, one could claim, was sufficient to conclude that knowledge is impossible in scientific investigation. Additionally, adoption of the Kantian scepticism leads to the logical conclusion that humans cannot acquire knowledge of reality.

Despite the scepticism that arises in this discussion, a synthesis was found and it involved a redefinition of terms that had been strictly applied to make reference to knowledge. The study acknowledged the impossibility of knowledge of things as they are, but advocated for the possibility of understanding reality as perceived. To this effect, then, one can claim knowledge and make accurate predictions of reality as perceived based on the information available to them at the time. This acknowledgement constitutes synthesis because it admits the impossibility of knowledge of things as they are, but at the same time, admits knowledge of perceptions as presented by the senses and empirical methods.

3.5 Interplay of the methods of Data Analysis

The three methods chosen for this study were complimentary to each other. The critical method ensured that concepts, ideas, theories and judgments presented in this work were clearly defined, the context in which they are used is clear and distinct, and they have a definite meaning. This helped to avoid fallacies of ambiguity such as equivocation and amphiboly, among others. A clear and distinct understanding of these ideas aided the researcher to effectively analyse theories, their justifications as well as the evidence presented for their acceptance. Analysis involved a keen scrutiny of ideas and how they relate to each other to form a complex whole (a theory).

A justification or rejection of an idea or theory must be presented in a systematic manner; which involves presentation of arguments. Philosophical argumentation ensured that new knowledge was assessed to determine whether the scholar's conclusions were sufficiently and logically backed by premises. These premises had to be convincing enough and necessarily lead to the conclusion they purport to prove for the researcher to accept them as valid. If contrary or alternative conclusions were

drawn from the premises, then the argument presented was rejected because it lacked convincing power and could be interpreted in different ways.

The method of synthesis attempted to find a common ground in the data gathered and analysed from the various research objectives. The afore-mentioned methods facilitated formulation of new knowledge which the researcher further engaged to establish if the seemingly contradictory positions had a middle ground. This method, therefore, was essential to this research because it enabled the researcher to make an informed conclusion on whether pragmatic claims to knowledge could be compatible with the correspondence theory's claims, as well as determining the possibility of knowing, even when the Duhem-Quine thesis negated this possibility.

3.6 Ethical Considerations

This study was guided by ethical principles which guarded against violating the integrity of both the research process and its conclusion. Firstly, the researcher avoided falsification of information, manipulation of its analysis, and reporting inaccurate conclusions. Findings were checked for logical correctness and relevance to the proofs that were presented in the work.

Secondly, since this was library-based research, the greatest ethical violation would involve reporting findings that were as a result of plagiarism. The researcher ensured that the work was not copied from other scholars' works. To this effect, a plagiarism check was done during submission of the work to determine whether the above-mentioned violation occurred. Further, the researcher ensured that all citations were acknowledged through in-text citations and in the references section.

Additionally, the research proposal was presented to Chuka University's Ethics Review Board where it was approved and the researcher was authorized to proceed with the study. A research permit was also obtained from the National Commission for Science Technology and Innovation. Both of these approvals are attached in the appendices of this work as follows: Chuka University Ethics Review Board approval is in Appendix 1 while NACOSTI Research Permit is attached in Appendix 2.

CHAPTER FOUR

NECESSITY AND SUFFICIENCY OF BELIEF, JUSTIFICATION AND TRUTH AS CONDITIONS FOR KNOWLEDGE

4.1 The Concept of Knowledge

Knowledge has been understood differently by various people; knowledge by acquaintance (know of), possession of a skill (know of/*techne*), and propositional knowledge (know that) (Lemos, 2020).

Bertrand Russell's concept of knowledge by acquaintance was first introduced in his 1912 book, *The Problems of Philosophy*. He argued that there are two kinds of knowledge: knowledge by description (or knowledge of facts) and knowledge by acquaintance (or knowledge of things). Knowledge by description relies on language and is based on what we can say about something. Knowledge by acquaintance, however, is a direct awareness of something, free from any description. For example, you can know by description that the sky is blue, but you can also know by acquaintance that the sky looks blue. According to Russell (1912), knowledge by acquaintance is the basis of all knowledge and is the most important kind of knowledge. He believed that all knowledge begins with the knowledge of one's own mind, which he called "introspection". He also argued that knowledge by acquaintance was necessary for the development of scientific knowledge, as it allows us to observe and understand phenomena directly. Both of these claims to knowledge have the shortcoming of being overly dependent on the knower's subjective position. As such, they are subject to change if the knower adjusts their point of view.

Knowledge by description is a process of gaining knowledge through the use of facts, descriptions, and explanations. It is a form of learning that involves observation, experimentation, and analysis. By observing and analysing the facts, descriptions, and explanations, a person can gain an understanding of a concept or a reality (Russell, 1912). According to Eames (2013), this type of knowledge is most often found in scientific fields such as chemistry, physics, biology, and psychology. It is also used in other fields such as economics and sociology, where descriptive data is often collected to gain an understanding of a phenomenon. As per Russell (2022), knowledge by acquaintance is a type of knowledge that is gained through direct

experience, rather than through observation or reasoning. It is a type of knowledge that is not tied to any particular concept or theory, but instead comes from an individual's personal experience. Examples of knowledge by acquaintance include recognizing a familiar face, remembering a certain song, or recognizing a certain smell.

Non-propositional knowledge is knowledge that cannot be expressed as a simple statement or proposition. Examples of non-propositional knowledge include concepts, skills, instincts, intuitions, and emotions. It is knowledge that is not easily articulated in words but is instead expressed through feelings, actions, and behaviour (Russell, 2022). Propositional knowledge is knowledge that can be expressed as a proposition or statement. It is one of two types of knowledge, the other being non-propositional knowledge. Propositional knowledge is expressed through declarative sentences, which can be true or false and are used to communicate beliefs or facts (Zagzebski, 2017). Examples of propositional knowledge include factual statements such as "the Earth is round," or "the sky is blue." Our interest in this discussion will be on propositional knowledge, which categorically states the state of affairs and can either be affirmed or denied.

A critical examination of both knowledge by description and knowledge by acquaintance demonstrates involvement of subjective experiences and interpretations which result in subjective conclusions. As such, one may be compelled to argue that information gathered from these two methods is not absolute. For purposes of this study, the researcher focused on evaluating the validity of knowledge by description because it is derived through the inductive process.

4.1.1 Knowledge as Justified True Belief

The term, “knowledge” has been used in a variety of ways to denote different states of information or skill acquisition. However, knowledge in the strict sense of the term can only be validly applied in one of these ways. Firstly, knowledge has been used to describe possession of a certain skill (know how) such as driving, swimming, playing football, carpentry, etc. (Angier, 2010). Secondly, one may refer to acquaintance as knowledge and this occurs when someone is familiar with a place, or person (know

of) (Lemos, 2020). Familiarity of this kind does not necessarily require direct encounter or experience, but can be formed through third parties, e.g. you can know someone through hearing about them from some other person. According to Lemos (2020), the third kind of knowledge is phenomenal knowledge and is characterized by an individual forming an idea about something based on their experience of this thing. For instance, one can say that Jane knows the taste of ice cream because she has consumed it before. The fourth type of knowledge is propositional knowledge (know that) and it involves declarative sentences (statements) which declare that something is or is not. In other words, propositions declare something (affirm or negate) the state of affairs.

The first three types of knowledge are not knowledge in the proper sense of the term, hence, not relevant in this research. They are only experiential (and essentially subjective), cannot be argued for linguistically nor transferred verbally. Verbally sharing one's experience of ice cream tastes is not similar to how the same ice cream actually tastes. Despite the importance of experiential knowledge (demonstrated by the first three types of knowledge mentioned above), this study focused on propositional knowledge because it can be interpersonally communicated and acquired through evidence-based investigation and also argumentation.

Propositional knowledge can be defined as Justified True Belief. This definition contains within itself three components that every body of information must have in order for it to be categorized as knowledge. In essence, then, knowledge can be said to be a body of information which meets these three conditions which are regarded as necessary and sufficient (Foley 2012; Hetherington, 2016). In the absence of any of them, the body of information remains to be just that, and cannot be accepted as knowledge. Among the earliest proponents of this definition of knowledge is Plato (427-347 BCE) in his dialogue, *Theaetetus, in* which Socrates and two interlocutors (Theaetetus and Theodorus) ultimately conclude that knowledge consists in justified true beliefs (Plato, 2019). One cannot know *p* and not believe *p,* they cannot know *p* if they do not have sufficient reason(s) to hold that *p,* and they cannot know *p* if it is not true that *p.*

Justified true belief can be explained as a conviction which has been held to be true and sufficient evidence presented to support this claim. Any information that meets this standard, therefore, must be proven to be describing things as they are and at the same time proof of its accuracy is availed.

The concept of knowledge as justified true belief can be traced to Socrates 'conversation with Theaetetus concerning the nature of expertise. In the conversation, Socrates posts the question, "what is knowledge?" to Socrates, and this prompts the discussion. Three responses are given by Theaetetus, each emerging from the rejection of the preceding one.

The first response given by Theaetetus is that knowledge is perception. Socrates critiques and rejects this description of knowledge by arguing that knowledge cannot be simply equated with perception only. Perception has been proven to be fallible, and deceptive as well. In essence, acceptance of this definition would be acceptance of false beliefs as knowledge. Socrates posits that empirical observation may help to constitute knowledge, but by itself, it is insufficient to provide it. Our observations and interpretation of things are mediated by context such that different people may experience a similar experience but draw different conclusions about it. For instance, if a blacksmith emerges from his workplace and encounter a breeze, they would consider it cool while someone from a chilli cave would consider the same breeze warm. Based on these grounds, Socrates rejects this definition of knowledge (Lisi, 2020).

According to Barceló-Aspeitia and González-Varela (2023), the second definition offered by Theaetetus is that knowledge is true judgment. Theaetetus triggers an epistemological discussion with Socrates on the nature of false beliefs, if at all they exist. This definition, according to Socrates, is still incoherent because there are instances which constitute true judgment but are not knowledge. For instance, if one accidentally (without reason or proof) forms a belief about something and it is indeed true, they cannot be said to have knowledge.

For the third time, Theaetetus attempts to describe knowledge as true belief with an account (*logos*). The finding that one can have true beliefs which do not necessarily constitute knowledge leads Theaetetus to add the component of account to his description of knowledge (Lisi, 2020). Addition of the clause "with an account" points to the fact that an extra component is required in addition to true belief to make it knowledge. This component is proof or justification for holding a belief true. The belief, apart from being true, must be supported by evidence or a rational explanation which distinguishes it from mere opinion or just any other belief (Cornford, 2018). This account of knowledge has been widely accepted by scholars, not only in the ancient age of philosophy, but up to date (Lemos, 2020). This, however, does not mean that the agreement is unanimous. Some scholars have objected to it and argue that it is insufficient and to some extent, incoherent.

The discussion in the section that follows was aimed at examining whether indeed Belief, Justification, and Truth are necessary and sufficient for knowledge as posited by Plato and other subsequent epistemologists. Other scholars who have objected to this definition of knowledge citing limitations in each of the three conditions also had their arguments examined for validity in this section. Therefore, it was also essential to examine arguments for and counter arguments for Belief, Justification and Truth as conditions for knowledge.

4.2 The meaning of Necessary and sufficient conditions.

According to Mosley, Baltazar and Open Textbook Library (2019), a necessary condition denotes an implicational or conditional relationship between two statements or states of affairs in which the truth of one statement implies the truth of the other or the existence of one state of affairs implies the existence of the other. For instance, in the statement, "if *p* then *q*," *p* is a necessary condition for *q.* If *p* is true, then *q* must be true, if *p* is false, then *q* is guaranteed to be false, and if *p* does not exist, then *q* does not exist. This means that the truth value or existence of *q* is wholly dependent on the truth or existence of *p.* This example can be demonstrated as follows; if Mary is a woman, then Mary must be female. This means that if the claim that Mary is a woman is false, then the claim that she is female will be false as a matter of logical

necessity. The truth value of the statement, "Mary must be female" is wholly dependent on the truth of the statement, "Mary is a woman."

In a hypothetical proposition, a condition is sufficient if it is enough to guarantee the truth of the other part of the proposition (Rescher, 2003). For instance, in the conditional statement, 'if *p* then *q*,' confirmation that *p* is true is a sufficient condition for accepting the truth of *q*. However, knowledge that *q* is true is not enough grounds for concluding that *p* is true as well. There could be other conditions that need to be considered before making the conclusion that *p* is true. In this case, *p* is a necessary but not sufficient condition for *q*. Consider the example below;

i. If Sam works hard, he will be successful in business
ii. Sam is successful in business
iii. Therefore, Sam works hard

In the example above, it may not be true to argue that Sam's success in business has been born out of hard work. Other conditions that can result in Sam's success may include; inheritance, fraud, corruption, or even lottery winnings.

4.2.1 Necessity/ Necessary conditions

The concept of necessity can be demonstrated through an examination of two forms of valid inferences in propositional logic: *Modus Ponens* (MP) and M*odus Tollens* (MT). These are valid argument forms in logic which are attributes of conditional statements.

Modus Ponens is a Latin term for "a mode that affirms" and it consists in the use of two premises in an argument. As a form of logical argument, it asserts that if a specific state of affairs is true, then a specific conclusion necessarily follows from it (Sanfilippo, Pfeifer & Gilio, 2017; Genesereth & Kao, 2022). For instance, if the proposition, "if John is a man, then Mary is female," is true, then the conclusion "Mary is female "follows from it.

Modus ponens is the kind of logical argument that is stated in the following way:

If P then Q

P

Therefore, Q.

The above argument implies that, according to modus ponens if a specific situation (P) is true, then a specific outcome (Q) must follow. The conclusion (Q) therefore, necessarily follows from these premises. Modus ponens is a type of deductive argument that operates by drawing a conclusion from two premises.

The first premise is a conditional statement (taking the form, 'if *p* then *q*'), and the second premise is an affirmation of the antecedent of the aforementioned conditional proposition (*p*). From these premises, one will, as a matter of logical necessity, infer (as the conclusion) the consequent of the conditional proposition (*q*). According to Stern and Hartmann (2018), the validity of an argument in the form of *Modus Ponens* is intuitively flawless if it is proved that both the conditional premise and simple premise are true. This argument form demonstrates the essence of necessity because the conclusion is only accepted or true if and only if the premises are accepted or true. Stojnić (2017) and Epstein (2018) add that a valid argument is a deductive argument whose conclusion strictly follows from the premises; that means, if the premises are true, then the conclusion must be true. Consider the following example of an argument in the form of MP:

i. If Mary is a criminal, she must have committed a crime
ii. Mary is a criminal
iii. Therefore, Mary must have committed a crime

The acceptance of the conclusion is wholly dependent on the acceptance of the two premises. If one of them is found to be false, then this conclusion will be rejected because there is an unalienable relationship between the premises and the conclusion.

The *Modus Tollens* (a mode that negates) is a valid argument form closely related to the MP but has within its essence a negation of the consequent of the first statement as its second premise (Potter, 2020). This type of argument, just like the MT, has a first premise as a hypothetical proposition and its second premise as a simple proposition. The simple proposition is a negation of the consequent of the aforementioned hypothetical proposition. The conclusion inferred must, therefore, be a negation of the antecedent of the conditional premise. The MT takes the following form

i. If *p* then *q*

ii. $\sim q$

iii. $\sim p$

This argument form can be demonstrated as follows:

i. If Kenyans study ethics, they will engage in legal business practices

ii. Kenyans do not engage in legal business practices

iii. Therefore, Kenyans do not study ethics

The conclusion of the above argument states that Kenyans do not study ethics because the conditional proposition establishes that we must have *q* if we have *p*. In the case of the example given, we do not have *q* and that clearly means that we do not have *p.* The two argument forms of MP and MT demonstrate the nature of necessity as a condition. One will note that necessity does not imply truth or soundness of an argument (Epstein, 2018). A necessary condition is independent of other factors such as accuracy and precision. A necessary condition for knowledge, hence, is one without which our claims to know will not be valid.

4.2.2 Sufficiency/ Sufficient Conditions

From the preceding discussion, one may infer that a necessary condition is one without which something that is dependent on it will certainly not occur or happen. For instance, for one to be declared a bachelor, they must be male and unmarried. If they are not male and unmarried, then they do not meet the necessary conditions which would allow them to be defined as bachelors.

A sufficient condition, on the other hand, is one which guarantees the occurrence of something. It is something that is adequate something to occur or obtain. For example, admission to the university to study a course like medicine requires meeting certain qualifications from a lower level of learning. If one fails to acquire these points, they will not be admitted, regardless of their interest or zeal to pursue the course. If they meet the minimum qualifications, they give sufficient reason for admission.

Consider the following conditional proposition for demonstration; if *p* then *q. p* will be considered sufficient for *q* if and only if the truth or existence of *p* guarantees the

truth or existence of *q*. For example, being a man is a necessary condition for being a husband, but it is not sufficient. That means, by itself, being a man will not make one a husband. There must be other factors to be considered. Another example to demonstrate the sufficiency condition can be demonstrated by the fact that breathing is a necessary condition for being alive but not sufficient because we also need to eat, avoid illnesses, and avoid accidents, among others. This means that there may be several sufficient conditions that make a thing to exist or be what it is. Sufficiency, however, does not always guarantee that the consequent is true if the antecedent is true. The consequent is not a sufficient condition

4.2.3 Necessity and Sufficiency of Belief, Justification and Truth as Conditions for Knowledge

Hetherington (2016) makes it clear that necessary and sufficient conditions are ones which must be present and at the same time, enough for something to obtain. In pursuit of knowledge, epistemologists argue that belief, justification, and truth are individually necessary but collectively sufficient for knowledge to occur. This means that each condition is necessary for knowledge, but not sufficient if taken individually.

In an attempt to answer the perennial epistemological question, "what is knowledge?" scholars have identified various conditions which are considered vital if one is to categorize information as knowledge. These are conditions that give us certainty of the accuracy and validity of information in our possession. According to Lemos (2020) and Verhaegh, (2023), three conditions have been identified as the classical conditions for knowledge; belief, justification, and truth. In this sub-section, we examine their nature and critically assess if these conditions are indeed all that matters in our pursuit of knowledge. The essence of this exercise is to determine their necessity and sufficiency for knowledge.

An important question that needs to be answered before one embarks on a discussion of the necessary and sufficient conditions for knowledge is, "if we can know anything at all, what is the nature of these things that can be known?" It is essential to respond to this query because scholars have always debated about the nature of reality and the

extent to which the human mind can know it. For purposes of this study, we focus on the possibility of knowing extended reality (material beings), and specifically, knowledge attributed to scientific research and conclusions.

Justified true belief is a concept in epistemology that states that a belief is considered justified if the person holding the belief has reasonable evidence to support it. The belief must also be true, and the person must actually believe it (Verhaegh,2023). Justified true belief is important in philosophical inquiry as it is used to analyze what constitutes knowledge.

4.2.3.1 Necessity and Sufficiency of Belief

Belief has been understood differently by various people. However, we can categorize it into two; a belief in someone or something, and a belief that something is or is not the case. In the first category, a belief makes reference to having trust that something or someone will work or be useful ultimately. In this sense, we do not base our evidence or facts, rather, we depend on emotional appeals and hope that things turn out as we expect them to. This is not the sense of belief made reference to in this work. The second sense of belief is the conviction that something is true and it is usually based on evidence (Williams, 1999). The quality and quantity of evidence determine if the belief is acceptable or not. This understanding of the belief concept was the concern of this research.

The belief condition refers to a mental condition in which an individual is convinced of the truth value of a particular thing. Belief occurs when we have some conviction (could be little to absolute) that something is or is not the case. In empirical investigations, beliefs occur when one encounters a phenomenon with their senses and mentally attributes meaning to their perceptions (Schukraft, 2017). For instance, one may form the belief that thunder only occurs when there is rain because the two events occur simultaneously. This belief, may be accurate or false and no amount of conviction would justify it as accurate when it is not. According to Smithies (2019), belief arises from consciousness and subsequently, this consciousness culminates in knowledge. In absence of consciousness, we would not be aware of any object of belief, and ultimately knowledge. When one is conscious, they are aware of their surroundings, and can form beliefs base on what their senses offer them as

perceptions. Consciousness, therefore, is a necessary element of belief and knowledge because it allows one to be alive and in charge of their mental processes.

When one encounters a proposition, there are three possible reactions towards it; acceptance as true, rejection as false, or defer judgment due to lack of sufficient or convincing proof. In all of these instances, whichever belief one forms will be influenced by availability of evidence as well as how much convincing power this evidence presents. (Lemos, 2020) Nevertheless we will still formulate beliefs, whether or not there is sufficient evidence to support the claim.

Belief, therefore, can be understood as a propositional attitude that is characterized by the relationship between the proposition and the subject (the person seeking to know). This relationship ranges from firm and absolute conviction to cautious as well as tentative acceptance (Lemos 2020). One may ask, is there any level or intensity of belief that is required for knowledge to occur, and some other level which does not meet the requirement for knowledge? The answer to this, one may argue, is that belief needs to be firm because it is dependent on the evidence availed concerning the subject. This means that acceptance of belief is dependent on the justification condition. The stronger the evidence, the stronger the belief, hence, an individual would be justified in believing the accuracy of an experience strongly supported by proof.

The belief condition in knowledge asserts the idea that knowledge is not a matter of mere true belief, but rather is a matter of belief that is justified, or warranted. This means that knowledge is more than just accepting something as true—it is accepting something as true because it is supported by evidence (Peddle, 2021). In other words, knowledge is based on a rational, logical process of evaluating facts and evidence, rather than just blindly accepting something as true (Lemos, 2021). This condition is important because it helps us to distinguish between knowledge and mere opinion, and it encourages us to seek out evidence and reasoning to back up our beliefs. Belief is formed when one encounters something and a concept of the experienced thing is implanted in their mind. A belief, in this case, involves an imprint of something in the

mind of an individual that can be supported by evidence of the individual's experience.

Knowledge is a product of a conscious process. Beliefs are formed after perception or sometimes through analytical processes (Mukhopadhyay, 2019). Firstly, when one experiences an occurrence through their five senses, they formulate beliefs concerning these perceptions. For instance, when I sense heat, I form the belief that a lot of it can cause damage to my being. I will be convinced of the accuracy of this belief due to sufficient evidence gathered from various encounters with heat. Secondly, through analysis of the universe and how it works, St. Thomas Aquinas formulated a cosmology-based defence for the existence of God. Despite not being able to encounter any deity by way of the senses, Aquinas used analysis to formulate this belief. He had to be aware of the laws of the universe and formulate a belief based on this perception (Arp, 2016).

Belief is a necessary condition for knowledge because without it one would not be aware of the object of knowledge (Foley, 2012). Gettier (1966) acknowledges that knowledge acquisition begins when we form a concept of a particular entity or being and ascribe meaning to it. We believe that it is of a particular kind, and not of another due to perception available to us at that given time. Despite its necessity, belief by itself is not a sufficient condition for knowledge. We have beliefs that turn out to be true and yet cannot be considered knowledge. For instance, if I believe that my preferred presidential candidate will win the 2027 elections and it happens as I believed, it would be fallacious to say that I knew it. This is despite the fact that it happened exactly as I believed it would. Knowledge must require belief because you cannot know what you do not believe (belief must include conscious conviction that something is true), however, not every belief is knowledge (Rescher & Vinci, 1975).

Despite belief being a necessary condition for knowledge, it is not synonymous with knowledge because it is fallible while knowledge is infallible. Belief involves holding something to be true or factual based on evidential grounds available to the knower while knowing involves possession of information that is an accurate description of the actual state of affairs. A belief is subject to change or refutation but it is

impossible to refute knowledge because the latter would involve denial of things as they are, which would be fallacious.

4.2.3.1.1 Objection to Belief as a condition for Knowledge

Various scholars, such as Farkas (2015), Radford (1966, 1990), Myers-Schulz and Schwitzgebel (2013), as well as Baumann (2019), have argued that the tripartite conception of knowledge is erroneous because one of the conditions, belief, is not necessary. They attempt to present cases in which one may still argue for knowledge even in the absence of knowledge. In essence, these philosophers think that there is need to redefine knowledge and its conditions. This section presents these arguments and critically examines the validity of these scholars' objections to the belief condition.

4.2.3.1.1.1 Farkas' description of Knowledge without Belief

Farkas (2015) argues that the conventional description of knowledge contains within itself a provision of an attitude, which is belief. When one encounters a proposition, he argues, in order for them to claim that they know it, they must believe it first. This means that knowledge must always occur when one is convinced of the truth or accuracy of a proposition. He presents scenarios which can be considered knowledge processes where knowledge comes first, then belief later. If his theses are accepted, then it would mean that the JTB criterion is false.

Farkas agrees with Timothy Williamson's (2000) claim that knowledge can be broken down into independent components such as belief justification and truth. As such, it would be impossible to isolate a mental state (belief) and define it as one of the components for knowing.

According to Farkas (2015), a certain type of access to information attained and kept in an appropriate manner may be sufficient for knowledge, not necessarily involving belief. Belief is one of the ways one gains and stores information, but not the only one. Supposing two people, Inga and Otto, want to go to a museum (Museum of Modern Art- MoMA). Inga recalls the location of the museum and sets off while Otto has severe memory loss and relies on information on his notebook for directions.

Most scholars, as Clark and Chalmers (1998), in their work, *The Extended Mind*, would argue that Otto has belief that the Museum is on 53rd street because they looked it up in the notebook and were convinced of the accuracy of this location. Therefore, both Otto and Inga have belief on the accuracy of the museum's location. Farkan thinks that this conclusion is mistaken and that Otto knows the location without believing it.

Farkas (2016) argues that it is more plausible to attribute knowledge than belief to Otto because his mind is completely oblivious of any memory he may have had of the museum and he gets the information (which is factual) immediately he consults the notebook. The contents of the notebook do not constitute belief because it must be a mental state. That means that Otto acquires knowledge directly from the notebook and does not have to formulate beliefs in his mind. If he formulates the belief that the museum is on the 53rd street, it will be only after he has acquired the knowledge.

A critical assessment of Farkas' arguments led to the following conclusion; that his understanding of knowledge without belief is erroneous. Firstly, it is not logically correct to claim that Otto acquires knowledge without first forming a belief. For him to consult the notebook to establish the whereabouts of the museum, he must have had the belief that the information in the notebook was factual. Otherwise, he would not have trusted the directions. Knowledge must always involve a level of conviction that a certain proposition is accurate, otherwise, we would reject or suspend judgment on the matter. This critique is consistent with how Russell (2022), Lemos (2020), and Rescher (2003) describe the process of knowledge acquisition. The process is not random but intentional and requires an encounter with something before a belief is formed. This is a necessary phase of knowing.

One can even go further to interrogate the state under which the notebook was written. If Otto was the author of the notebook before his memory was wiped out, he had already possessed knowledge of the location of this museum. This knowledge must have involved acquisition of information (probably through the senses) on the location, formation of a belief that the 53rd street was the actual spot, and justified this belief by way of justification (observation, coherence of ideas, etc.). Therefore,

revisiting the notebook was just a reminder of what he had forgotten. If Otto had decided not to consult the notebook and look it up on the internet or consult someone else, they would still have belief that the information is accurate because they trust the source. Either way, knowledge of the museum's location must have involved formulation of conviction that it was located on 53rd street.

Additionally, claiming that knowledge comes before a belief is formed is fallacious. It is clear, to any attentive mind that knowledge is distinct from belief, but the former cannot exist without the latter. Knowledge acquisition involves conscious mental processes that seek to understand the universe in which we live. According to Audi (2010), our beliefs are formed after conscious experiences that create concepts in our mind. Justification of these ideas is also a deliberate process which involves seeking evidence to prove that our beliefs are true. In essence, therefore, one may argue that belief is indispensable (Goldman & McGrath, 2015). Mental awareness of a proposition, therefore, precedes knowledge of the proposition. For example, a mentally challenged person is usually absolved blame for wrongdoing because they lack consciousness or awareness of their actions. A sane individual, on the other hand, is fully responsible for human actions because they are fully conscious of their choices and actions. For the former to be blameworthy, they must be aware and understand what they do, but since this is not the case, they cannot be judged. Therefore, we cannot claim that they know the moral value of their actions.

Farkas, one may conclude, offers a weak justification for the claim that belief is not a necessary condition for knowledge. Assessment of his thesis does not offer clear and distinct scenarios which prove beyond reasonable doubt that knowledge is possible without involvement of a mental state that is belief.

4.2.3.1.1.2 Collin Radford's Critique of Belief

In his work, *Knowledge: by examples,* Radford (1966) presents cases where individuals correctly respond to questions through guessing the answers then later realizing that they had, at some point previously, known these answers to be true but could not recall them during the exam. In this case, someone will answer a question

correctly but not believe that they are correct at the time. Radford claims that this is an appropriate demonstration of knowledge without belief.

The following example (used by Radford) suffices to demonstrate his point. Supposing Jean is questioned on the exact date that Elizabeth I and James I died and he answers the Elizabeth I died in 1603 and James I in 1625 (which are the correct answers). Jean is not certain that these answers are correct, in fact, he is fairly certain that they are wrong and probably some other answers are the right ones. He had learnt it at some point but it was forgotten by the time of the questioning.

The question arises, "does Jean have knowledge that Elizabeth I died in 1603 and James I in 1625 at the time of answering?" Radford replies in the affirmative. Firstly, he argues, Jean did not get these answers by sheer chance, but through previous training or learning that exposed him to the dates. However, he had forgotten that he had learnt them. This means that his loss of memory can only be associated with remembering that he learnt the dates, not the dates themselves. Therefore, Jean knows that the deaths of Elizabeth I and James I occurred in 1603 and 1625 respectfully (Armstrong, 1969).

Radford's example, according to him, demonstrates that belief is not a necessary condition for knowledge. In essence, he argues, one may know without believing that he knows or their information is correct. (Radford, 1966) This is contrary to the tripartite conception of knowledge which would require one to hold a belief about something in order for them to be considered knowledgeable. Those who hold that being sure that one knows something (belief) is a necessary condition for knowledge, he argues, are mistaken. These people would argue that, if Jean claimed, "I know the date of death of both Elizabeth I and James I," he would have been incorrect and improper. However, for Radford, this statement would be correct but improper because he was not aware that he knew.

Radford (1966) argues that there is a difference between knowing something (*p*) and knowing that we know *p*. In Jean's case, he knows *p* but does not know that he knows *p*. This does not make him ignorant of *p*. If Jean had claimed to know *p*, it would have

been improper from a moral point of view (claiming to be knowledgeable while not being sure or believing that he knows) but not an epistemological one (he possesses the knowledge, whether he is conscious of it or not).

Armstrong (1969) evaluates Radford's argument and concludes that he (Radford) is mistaken in referring to Jean's case as an occurrence of knowledge without belief. In fact, Armstrong argues, if Jean has knowledge that *p,* the he also has belief that *p*. If, for instance, Jean's guess would have been the year 1306 (Elizabeth I's death) instead of 1603, one would argue that this is not a case of knowledge but that of false belief. This error would be attributed to a faulty memory trace that got the figures wrong. Scholars who advocate for the validity of JTB would disagree that it is a false belief because Jean admitted to not believing it, however, the fact that Radford thinks that if it was correct, it would constitute knowledge, it is only logical that he admits the error as a case of false belief.

The guesses that Jean gave to the questions, one can argue, are in fact driven a weak sense of belief, otherwise, he would not have uttered them. In his mind, even though he was not sure, the probable answers to the questions were 1603 and 1625 respectfully. One can compare this case with one where an individual is afraid of making a categorical declaration due to fear of failure or being wrong. Instead, they claim that they do not have certainty of the accuracy of their answer but have a faint or weak sense that it could be the right answer. When the individual gets the answer right, they will claim that they knew it all along. However, if they get it wrong, their claim that they did not know will be considered accurate.

Radford, therefore, fails to offer a compelling counter-example of possession of knowledge that excludes belief. A correct guess remains to be just that, and cannot qualify to be knowledge because it lacks an element of consciousness or awareness of the fact. If someone was taught something and they forget about it, at that particular moment, they cannot claim to know it because it is not in their consciousness. They will lack justification for holding it to be knowledge. They cannot give adequate reasons why they think their answer is valid if they fail to offer a logical explanation

for it. However, if they can recall it, they will have reason to refer to it as a justified or true belief because of the availability of evidence.

One would be justified in refuting Radford's claim that knowledge does not necessarily require belief by examining the nature of belief, and subsequently knowledge. Firstly, belief may be formed after an encounter with a phenomenon or entity, through analysis of ideas, or sometimes through well demonstrated or supported intuitions (as demonstrated by Lemos (2020)). A physical encounter will lead to formation of concepts and judgment about the experience. One will then formulate a belief out of it. For example, we may watch a video recording that shows someone breaking into a house and carrying away property. This observation will lead us to form the belief that the person breaking into the house is a thief. This belief may later be proven true or false after investigations. Secondly, a belief through analysis is formed when we examine a situation and infer something that was not immediately experienced from it. For instance, we may infer from the case above that the thief is experienced in crimes of this kind or they had knowledge of the layout of the premises. Beliefs from intuition are not logically justifiable because we do not have facts to back them up, but cannot be dismissed because they are sometimes used to make judgment (Bergman, 2021). For example, I may have a strong feeling that someone is a thief but have no proof or reason to lead me to this conclusion. This belief may later be proven to be false, nevertheless it remains to be a belief that the answers were accurate. The question should not be whether Jean actually believed that *p*, rather, it should be about the magnitude or intensity of the conviction or belief.

4.2.3.1.1.3 Myers-Schulz and Schwitzgebel's Advocacy for Knowledge without Belief

Myers-Schulz and Schwitzgebel (2013) begin by arguing that epistemologists who claim that knowledge must entail belief do not offer adequate arguments to support their conclusions. They only make assumptions and expect it to be as they imagine it. The arguments by epistemologists are heavily reliant on lack of sufficient evidence to show the irrelevance of belief, as opposed to arguments for the indispensability of belief. In their work, '*Knowing that P without Believing that P'* they offer five counter examples of cases where knowledge is attained without a corresponding belief. These

examples, they argue were designed to elicit reactions from students (not philosophers) at the University of Wisconsin. The respondents, therefore, were not clearly informed on the distinction between the various senses of the term 'to know' and the interviewer substituted the term 'belief' with 'know.' Each participant was a passer-by and was given a candy bar in exchange for filling out the questionnaire.

The first example involves a demonstration of skill or expertise without having corresponding knowledge. An individual such as a musician or chef demonstrate high proficiency levels in their work and do not necessarily hold beliefs corresponding to each of their skills or expertise. Knowledge demonstrated by these professionals may have been acquired over a period of time through experience as well as practice. In this case, these individuals may be said to have knowledge of their craft but lack corresponding beliefs. Plato's (2019) description of *techne* corresponds to this kind of expertise.

Secondly, an individual acquires information through the senses, acting on it and making informed decisions without being conscious of their activities. For example, a bus driver used to a particular route is told that the usual route will be blocked and that he has to use an alternative road. The following day, he forgets that the road is closed and keeps on driving along the same route, failing to adhere to advise given to him. This driver, the respondents argued, knows the route, even when not conscious of it. This demonstrates a level of knowledge and understanding that is not compatible with the conventional JTB criterion.

One may claim, in this case, that belief is always present in our pursuit of knowledge, regardless of whether we acknowledge it or not. In Radford's (1966) case, Jean does not acknowledge that he believes that *p*, however, it is clear that he had some belief or conviction, however limited, that *p*. Otherwise, the correct answers could not be picked from the subconscious randomly. This correctness and attribution of knowledge to Jean's answers, therefore, cannot be attributed to randomness and lack of conviction.

Myers-Schulz and Schwitzgebel (2013) present the third example in which individuals have within themselves biases or stereotypes that affect their actions. A

case of a teacher who initially assumes that students involved in athletics are less intelligent than the non-athletic ones is presented. She always engages the former in less-thought-provoking tasks and the latter in highly intellectual discussions because of this bias. However, she later finds out that intelligence does not depend on the athleticism of an individual. Nevertheless, she continuous to act discriminately with these two groups of students. This implies that even after forming a belief that intelligence is not determined by athleticism or lack thereof, the teacher still acts as if the athletic students are less intelligent. The scholars interpret this as proof that one can believe something but still act contrary to it. Majority of the respondents argued that the teacher knew but did not believe that intelligent was not a matter of being athletic or not, while a minority argued that the teacher believed and knew it.

In the fourth case, Myers-Schulz and Schwitzgebel (2013) present a scenario in which an individual may hold beliefs or attitudes which contradict each other and therefore experiences cognitive dissonance and discomfort arising from this contradiction. Nevertheless, they will act in ways that are in conflict with their consciously held beliefs and attitudes. In this example, two friends watch a horror movie in which aliens lay eggs and require in order for their eggs to hatch. One of them gets uncomfortable watching the movie and they decide to go to the movie shop to purchase a new one. As they leave, one of them fetches drinking water from the tap and the other, visible affected by the movie they just watched, knocks down the glass of water (the assumption is that he thought the water would be contaminated by alien eggs). The respondents involved were questioned on whether the individual who knocked down the glass knew that water would flow from the tap, and majority answered in the affirmative (that the individual had knowledge, while the minority argued that he believed it. This, one may conclude, is evidence that the actions of these individuals are informed by implicit knowledge domiciled in their subconscious.

The fifth example involves a man's not being convinced that the wife is cheating on him but he has not acquired sufficient evidence to be fully convinced of this fact. The wife is indeed cheating, but the man does not believe it, even when he gets subtle hints. When the respondents were asked whether the man knew his wife was cheating on him, most of them respondent in the affirmative. This, according to Schulz and

Schwitzgebel, implies the existence of implicit knowledge in the individual's subconscious.

A critical examination of the five counter-examples demonstrates that Myers-Schulz and Schwitzgebel present cases which do not adequately capture the true nature of knowledge. An obvious error in their arguments is that they introduce linguistically ambiguous terms and apply them in unconventional ways. For instance, their use of the term, 'knowledge' to substitute 'belief' is wrong and cannot be valid from an epistemological point of view. Zagzebski (2017) clearly stipulates the distinction between knowledge and belief by asserting that the latter is a component of the former and therefore, the two cannot be used synonymously. Further, one may argue that their choice of respondents is inappropriate because individuals not familiar with epistemological concepts and terms cannot be relied upon to give valid feedback on the questions posed to them. The five counter-examples are critiqued as follows:

In the first example, Myers-Schulz and Schwitzgebel (2013) understand knowledge as 'know how' as opposed to the epistemologically appropriate conception of knowledge as 'know that.' Their argument, in this counter-example, does not present a valid critique of belief because they commit the fallacy of equivocation. Copi, Cohen, and Rodych (2018) describe the fallacy of equivocation as one that occurs when one term or phrase is used in more than one occasion but in different contexts and denoting different meanings in the same argument. This fallacy results in confusion of meaning and drawing of false conclusions. In essence, Myers-Schulz and Schwitzgebel (2013) use the term knowledge in a loose sense, not its proper sense.

Concerning the second example, the scholars fail to distinguish between possession of knowledge and forgetfulness. In the first instance, the driver acquired information concerning closure of his usual route, believed it and noted that he had to use an alternative route. This means that he was already conscious of it, therefore, had belief that this information was true. Conscious belief is what led him to implant that knowledge in his mind in the first place. In the second scenario, the fact that he forgets that the usual route is closed and proceeds to drive along it does not imply that he has knowledge but is unaware of it. If at all he possesses that knowledge, then the acquisition process should be considered to determine whether he acquired this

knowledge devoid of belief. Forgetfulness is another matter altogether because it is concerned with recollection of knowledge that has already been acquired and stored in the mind. The existence of this knowledge would not have been possible if the individual was not conscious of it, but an individual can habitually operate according to their knowledge (as the driver does) and sometimes subconsciously act. This, however, does not mean that this is proof that he has knowledge without belief. Frise (2017) argues that one is justified in arguing that they hold a belief even if in the course of time they forget it. Possession of this belief and making a claim that one has it, even when they cannot trace its justification is still valid.

In the third case, the majority of the respondents assume that one's prejudices form their beliefs while knowledge is independent of these prejudices and beliefs. That is why the teacher believes that anyone can be intelligent regardless of their affiliation to athletics, however, these beliefs do not influence their actions. One may argue that the fact that the teacher acts discriminately, despite knowing that they should not act in such a manner, is not sufficient to argue that the teacher holds contrary beliefs. Belief, as demonstrated earlier in this work, denotes a condition where an individual is convinced that a proposition is an accurate representation of the state of affairs. In this counter-example, Myers-Schulz and Schwitzgebel (2013) adequately prove that the teacher acknowledges that her students are intelligent regardless of their interest in athletics. However, deep seated bias and habits that prove hard to instantly abandon still influence her actions. These authors do not offer sufficient information to prove that she was convinced of this fact or was merely uttering it. One may claim that the teacher went back to her prejudicial treatment of her students because she was still not convinced that they were all equal. Further, even if she was convinced of this fact, one may ask, "does it necessarily mean that a belief will always lead to acting in accordance with it, even when an individual possess deep seated biases?"

This counter-example, one may therefore claim, is defective because it only offers a limited scope of the belief and knowledge scenarios and the respondents involved fail to distinguish belief and knowledge and the knowledge acquisition process. For instance, if one argues that the teacher, after being presented with evidence, came to know that intelligence is not reliant on athleticism or lack thereof, then they have to

demonstrate how she was transformed from ignorance to knowledge. She must have been presented with a belief that a student's intelligence is independent of their athleticism (the belief), and evidence presented to support this belief (justification). She could only accept this belief to be true if the evidence presented was convincing. It is therefore impossible for one to acknowledge information as knowledge if at all they do not have a justified belief that turns out to be true.

Regarding the fourth example, Schulz and Schwitzgebel present a skewed example which offers limited information that is insufficient to adequately justify their claims of knowledge without belief. The respondents do not have knowledge of the distinction between beliefs and knowledge; therefore, their answers cannot be held to be accurate. Further, it is clear that the individual who knocks down the glass of water has knowledge that water flows from the tap, however, his actions were caused by a false belief that the water contained alien's eggs. This false belief is not, in any way, relevant to the initial knowledge held by the individual concerning the contents of the water. In the final example, it is clear that the distinction between belief and knowledge is not understood by the respondents, hence, making their answers invalid. Additionally, the man has no knowledge of the fact that his wife is cheating, at best, his can only be considered a belief that has not yet been verified. This fifth case, is more of a justification problem that it is belief.

The five counter-examples in Myers-Schulz and Schwitzgebel's work introduce thought provoking discussions and introduces new perspectives in the discussion of whether knowledge requires belief. They present scenarios that compel thinkers to re-examine their beliefs concerning knowledge in diverse ways, however, they also oversimplify a complex epistemological problem by making valid the responses of individuals who barely understand it. Layman's opinions do not offer relevant solutions to this problem because they apply the terms 'knowledge' and 'belief' improperly. In some cases, they even mistake them for synonyms. The lack of clear demarcation of these concepts makes it impossible to establish coherence and relevance in the responses of the respondents. The ambiguity that results during analysis of the feedback is therefore an obstacle to attainment of accurate findings and conclusions.

In conclusion, one can accurately claim that Myers-Schulz and Schwitzgebel do not succeed in demonstrating the possibility of knowledge without belief. On the contrary, their arguments prove that our knowledge must constitute within itself an element of belief or conviction. Belief, as condition for knowledge, must involve an awareness of a matter at hand (*p*), a conviction that *p* is the actual state of affairs, sufficient grounds to justify our conviction that *p*, and *p* being indeed the actual state of affairs (Foley, 2012). Further, Pollock (2015) demonstrates that the belief condition in knowledge asserts the idea that knowledge is not a matter of mere true belief, but rather is a matter of belief that is justified, or warranted. This means that knowledge is more than just accepting something as true—it is accepting something as true because it is supported by evidence. In other words, knowledge is based on a rational, logical process of evaluating facts and evidence, rather than just blindly accepting something as true. This condition is important because it helps us to distinguish between knowledge and mere opinion, and it encourages us to seek out evidence and reasoning to back up our beliefs.

4.2.3.2 Necessity and Sufficiency of Truth

Truth refers to the quality or state of being in agreement or harmony with the state of affairs, reality or nature. In a statement, in refers to the quality that makes a proposition to match with reality (Ramsey 2012; Lynch, Wyatt, Kim & Kellen, 2021). It therefore makes reference to the accuracy or correctness of information in relation to the nature of the things it defines or describes.

Truth is considered one of the necessary and sufficient conditions for knowledge. Epistemologists in support of the JTB criterion insist that in order for information to be knowledge, it must represent the actual state of affairs (Schantz, 2011). For instance, if John knows that *p* is true, then *p* is true. It is impossible that John knows that *p* is true but *p* is false because this is a case of false belief. Aristotle (2013) makes it clear when he asserts, “to say of what is, that it is, or to say of what is not, that it is not, is true.” This means that if there is a match between what is and what is said about what is, it is true. The contrary is false. Truth must be involved in our understanding of knowledge because, without it, we are likely to have

misunderstanding of phenomena. Our beliefs may be illusory which ultimately makes our conclusions to be mistaken for knowledge while in fact, they are false beliefs.

A belief is intended to describe a phenomenon as it actually and in essence, seeks to match an idea formed in the mind with the thing as it is. Falsity is a fault in beliefs. If there is a mismatch between the idea and thing perceived, then it becomes a case of a false belief, not knowledge (Williams, 1999). Knowledge must always include an agreement of things and the ideas that represent these things. When we seek knowledge, we seek to understand things as they truly are. It would be illogical to argue for knowledge in the absence of truth. Therefore, truth is a condition that is absolutely necessary for knowledge (Jenks, 2010). However, this condition is not sufficient for knowledge because we have instances of truth without knowledge. For example, gamblers can predict the correct score in games that have yet to be played. When their prediction comes true, they cannot claim to have known even though they believed it to happen in the manner they envisioned it. This true belief lacks the element of justification. This section, therefore, discusses the nature of truth as a necessary condition for knowledge.

Concerning the nature of truth, there is agreement among most scholars that it is objective, not subjective (Audi, 2010; Marchesan, 2019; Stokes, 2023; Lemos 2020). Objectivity of truth holds that a proposition is true regardless of our opinions, beliefs or points of view (Walker, 2018). This means that, if a statement is true, it remains perpetually true under all circumstances. If at any point it turns out to be true, it was never true in the first place. Subjective truth, on the other hand, is not truth in the proper sense of the term because it varies with experiences and points of view. In this research, the objective conception of truth was adopted to refer to this condition for knowledge.

Wittgenstein (2021) argues that a proposition is a picture of reality and adds that if one understands a proposition, they necessarily know the state of affairs that it represents. The elements of the picture must correspond to the object for knowledge to occur. Tarski (2021) affirms Wittgenstein's position by asserting that the truth of a statement must correspond with reality. That means, a statement is true if it expresses a corresponding state of affairs. In essence, then, when one lacks knowledge, they are

not able to express that which is true because utterance of falsehood is describing that which is not compatible with the state of affairs. For both of these scholars, knowledge cannot exist in the absence of truth.

Various scholars have attempted to describe the nature of truth using theories. These theories are not different definitions of truth, rather, they are different ways of verifying the truth of statements or propositions. Among these theories include: correspondence, coherence, pragmatism, semantic, deflationary and redundancy, among others. In this section, these theories were examined to determine which one offers a more logical and acceptable description of the nature of truth as a condition for knowledge.

4.2.3.2.1 Coherence theory of truth

This is a theory that considers truth to be the consistency of propositions or ideas in a particular system. If a statement fits into a system of established beliefs, then it is considered true, and if it does not, it is false (Alcoff, 2018; Walker, 2018). Truth is not determined by comparison of an idea with the entity it represents, but by its internal consistency and logical coherence within a system of ideas. This theory often stresses the interconnectivity of beliefs within a theory. Proponents of this theory of truth include idealists such as F.H. Bradley and J. Royce (Blackburn, 2018).

Despite its insistence on logical correctness of ideas as a criterion for truth, this theory is not considered adequate as a theory of truth due to the following reasons. Firstly, coherence is inadequate as a theory of truth because it assumes agreement of a proposition with others (Walker, 2017). In other words, accuracy of a statement is determined by its conformity to a set of other statements. However, some statements may be true but lack coherence with a set of beliefs. For example, it is either true or false that Czars (a Kenyan musician who has been missing since 2006) lives in China today. This statement could be true if he indeed is in China. If we have contrary beliefs or lack any set of beliefs that is coherent with this claim, proponents of the coherence theory will claim it to be false. A belief should not change its truth value on account of its agreement or disagreement with an established set of beliefs; instead, it should be true if it accurately represents the actual state of affairs.

Blackburn (2018) argues that, coherence implies that a statement cannot be verified to be true or false on account of isolated interrogation, it is only true or false based on how it relates with others. Proponents of this school of thought present a foundationalist defence for their position and argue that this criterion of truth is based on *apriori* judgments which cannot be compromised by shortcomings characteristic of human experiences. *Apriori* judgments arise from reasoning alone (Kant, 2005). They are not influenced by perception or the senses. A rationalist advocates for these kinds of judgments because they are convinced that reasoning deals with knowledge itself, not its subjective interpretation common in empirical methods.

Moreover, coherence leads to circular arguments which involve justifying an idea with itself or related beliefs, without anchoring evidence on an independent source (Audi, 2010). As such, it would be impossible to note inconsistency or fault in the belief. A belief cannot be accepted as true if we only seek evidence in the body of knowledge that agrees with the said belief. There must be an external criterion, such as the actual reality being described, which acts as the objective basis for comparison.

Another objection to the coherence theory is that it is possible to have different belief systems, each with its own unique system of beliefs that are coherent and yet these systems are incompatible (Lemos, 2020). For instance, religious belief systems vary and yet are internally consistent. This makes it impossible to one to determine which belief system represents objective truth and which one is subjective.

The Ethiopian calendar (whose dates are similar to the Coptic-Egyptian calendar) and the Gregorian calendar are used to track dates and years in the world today. Each of these calendars has a justification for claiming accuracy of dates it gives and it can demonstrate an internal coherence which further justifies its claims. However, the calendars give different dates and years of the current day (Kumaar, 2022). If coherence was adopted, one would justifiably argue that both calendars are accurate, despite them being conflicted in their explanation of the exact same phenomenon. This would seem to be a rejection of the principle of bivalence which states that every proposition is either true or false, but cannot be both.

Critiques of this school of thought may also raise another objection. Supposing a set of beliefs is coherent and even accepted by many people, however, there is no evidence (corresponding proof) for it. What if these beliefs are not accurate but fit well with each other? A proponent of coherence will still hold them true without investigating further if the foundations of these beliefs are valid (Blackburn, 2018). A common habit formed out of the belief that we can interact with, appease or offend ancestors in our African societies is to pour libations, invoke them when we slaughter animals for ceremonies, and adhere to their teachings and practises. The assumption behind this is that our lives will be more blessed if we appease them. This belief is passed on from generation to generation and adhered to because it is given to us by authorities we trust and do not want to question as well as being consistent with our conception of life, the afterlife and the role of ancestors in shaping the life of the living.

Further, coherence is inadequate as a theory of truth because it assumes agreement of a proposition with others. In other words, accuracy of a statement is determined by its conformity to a set of other statements. However, some statements may be true but lack coherence with a set of beliefs. For example, it is either true or false that Czars (a Kenyan musician who has been missing since 2006) lives in China today. This statement could be true if he indeed is in China. However, if we lack any set of beliefs that is coherent with this claim, proponents of the coherence theory will claim it to be false. A belief should not change its truth value on account of its agreement or disagreement with an established set of beliefs; instead, it should be true if it accurately represents the actual state of affairs.

Therefore, Blackburn (2018) argues, coherence implies that a statement cannot be verified to be true or false on account of isolated interrogation, it is only true or false based on how it relates with others. Proponents of this school of thought present a foundationalist defence for their position and argue that this criterion of truth is based on apriori judgments which cannot be compromised by shortcomings characteristic of human experiences. Apriori judgments arise from reasoning alone. They are not influenced by perception or the senses. A rationalist advocates for these kinds of

judgments because they are convinced that reasoning deals with knowledge itself, not its subjective interpretation common in empirical methods.

4.2.3.2.2 Correspondence theory of truth

According to this theory, truth is defined by how well a proposition accurately explains reality. In order to establish the truth value of a proposition, one must compare the idea in the mind with the actual entity being described (Philips-Gary, 2020). This is contrary to coherence (which examines the logical consistency of ideas) because it seeks to relate ideas with facts or objects that they describe. For instance, when I say that that John is in class, it is true if it is the case that John is in class. Despite its seemingly objectivity, some scholars have raised objections concerning its suitability as a theory of knowledge. These objections were reviewed in this section.

Wiredu (2004), in his critique of correspondence as a theory of truth, claims that correspondence only results in a tautologous explanation, not truth. He argues that language, especially the Akan, gives the same meaning to terms such as "is true" and "is the case". When we argue that truth is defined by propositions corresponding to the actual state of affairs, we are engaged in a tautologous affair that does not explain what truth is. Wiredu (2013) also claims that, being a theory of truth, correspondence is supposed to explain phenomena (a theory is supposed to offer an explanation for phenomena), but it fails to do so. We must first have a phenomenon before us before we can describe it, and once we perceive it, we can develop a working definition which will allow us to form theories concerning it. Without this background (working definition), we would not be able to theorize about anything and consequently, no scientific data can be gathered at all. A working definition serves as a neutral ground from which tests will be conducted to prove or disapprove its accuracy. Persistent investigation will lead a researcher closer and closer to the nature of reality, until ultimately, they realize truth. Wiredu, in this argument, therefore advocates for pragmatism as the best explanation for truth in science.

Wiredu's critique of correspondence is defective because he assumes that this theory's validity involves its ability to identify a phenomenon to be understood. A working definition can only work as a criterion, but not as a definition of truth.

Philips-Gary (2020) asserts that correspondence is not only a theory, but a definition of truth. When one says, “it is snowing in Tunisia right now” and it is actually snowing in Tunisia at the time that these words are said, then this statement is true. The obviousness of this conformity makes correspondence more acceptable as a definition of the actual state of affairs. It cannot, therefore, be a working definition which requires justification to be considered a theory. The correspondence theory can be definitively used to demonstrate why some beliefs have been perpetually affirmed and why others have been falsified. It offers has explanatory power, not a working definition or criterion.

Another objection to the correspondence theory can be posed when one wonders how we can confirm the truth value of statements that are abstract (O'Connor, 2023). For example, propositions that describe reality whose existence is beyond empirical verification would not be possible; hence, this theory falls short of establishing an objective criterion for knowledge of this kind. It is also prudent to point out that beings that have extension also have abstract properties incapable of being assessed empirically. Therefore, we may be skeptical in accepting that this theory can be relied upon to establish the knowledge in both physical and non-physical beings. To this critique, one may argue that application of the correspondence theory is only valid in empirical science because a link between a proposition and that to which it refers is possible. However, concerning metaphysical reality, this theory would be incapable of making accurate claims because this reality is incomprehensible through the senses. One can never establish if a proposition conforms to reality they cannot experience, hence they can never claim knowledge of such kind of reality.

The correspondence theory is, however, relevant in explanation of perceivable phenomena because it necessarily demonstrates the link between an entity and propositions used to describe this entity (Schantz, 2011; David, 2023). For instance, the proposition, “the dog is in the compound” is true because one can perceive the dog’s position in relation to the position of the compound. If the dog moves from the compound, the proposition will be false because there will be a change in the correlation between the dog’s and compound’s positions.

The validity of this theory of truth as a condition for knowledge consists in its holistic approach in understanding reality. It does not rely on evaluation of isolated statements, but seeks to justify these statements with regard to the reality they describe. Additionally, one may consider this theory to be an objective standard against which we can evaluate truth claims. Instead of relying on arbitrary and subjective criteria, an individual is able to use factual accuracy of propositions. Empirical methods of research purport to use this criterion of truth because they compare their theoretical assumptions with the phenomenon they investigate. However, this may not necessarily be the case. This concern was addressed in subsequent sections of this work.

4.2.3.2.3 Pragmatic theory

This theory posits that the truth of a proposition is determined by its practical outcomes as well as usefulness in achieving desired consequences (Rescher & Vinci, 1975; Sleeper, 2001). This theory is contrary to the coherence and correspondence theories which rely on internal consistence and relationship with reality because it focuses on the functional role of specific beliefs in human experience.

One may argue that this theory of truth is valid because it shifts from the abstract conception of truth (particularly the coherence theory) to practical application of beliefs. This theory is relevant in problem solving and decision making. In everyday occurrences, the pragmatic theory resonates with individuals because it relates with their experiences and concerns in daily affairs (Chang, 2019).

Additionally, this theory presents truth as a dynamic affair which changes with context, availability of evidence and time. This means that beliefs that may be useful in a particular context may be irrelevant in another. That does not imply that a belief that has been found to be irrelevant in a particular context is irrelevant in all others. In essence, one may argue, that our belief systems may work in the present day but be irrelevant in the future.

Peirce (1997) asserts that one day scholars, including scientists, will have a comprehensive understanding of the universe such that, that which works will be the

final answer to the question, "what is truth?" Truth, therefore, will be determined by finding out which idea or theory works best or explains reality in the best way possible (Mounce, 2002). One may interpret Peirce's claims as implying that scientific experimentation may not give us correct answers to our questions, however, persistence and further application of the experimental method will ultimately result in knowledge of truth about the physical universe.

Proponents of Pragmatism appeal against the critique that theories have utility for a limited period of time and then replaced by others which are also phased out eventually. This makes theories to only have instrumental value, instead of describing reality as it is. The central argument of this instrumentalist claim is that truth does not explain things as they are, rather, it presents the practical value of a thing. This critique concludes that truth is objective and unchanging, hence whatever theory is adopted and discarded after a period of time is not an accurate representative of reality.

In their defence, pragmatists argue that the principle of bivalence can be achieved at some point during epistemological inquiry; hence, hope of this outcome must stay alive. Prolonged inquiry, they claim, will uncover objective truth (Champagne, 2022). If we abandon scientific inquiry on the basis that the findings of this process maybe erroneous, we will have blocked the pathway of inquiry and render knowledge of the universe unattainable at any point, whether present or in the future (Haack, 1976). The truth value of our theories will be established in the long run.

In justification of pragmatism, Cherryholmes (1992) argues that this theory presents us with an intuitive appeal. If we claim that truth is abstracted from the physical universe in which we live, then we might as well claim that it is not represented by the perceptions we get from this world. This implies then, that knowledge is unattainable to humans in their physical state of being. It would also make little sense to claim that we cannot interact with the real world which is out there but far from the reach of our intellectual faculties. One may conclude that truth about the universe is not alienated from us and we can possibly achieve it through the available means of inquiry (observation and experimentation).

The pragmatic theory of truth is not considered an accurate theory of truth for this study because it presents truth as subjective, thereby undermining its objectivity. There must always be an objective reality independent of our subjective perceptions and beliefs. This theory may overlook or ignore truths which are irrelevant to humanity. It may also overlook some essential epistemic virtues such as accuracy, coherence, as well as reliability in favour of utility of propositions.

4.2.3.2.4 Deflationary Theory of truth

This school of thought takes a different turn in its explanation of truth as compared to conventional theories such as correspondence, coherence and pragmatism. The Deflationary theory posits that the error committed by the conventional schools of thought mentioned above is to assume that truth has a specific nature that can be investigated and theorized about (Blackburn, 2018). It possesses to property that can be used to distinguish it from something else. From the Deflationary theory, scholars have developed the school of thought known as the redundancy theory of truth, which is also known as the minimalist or no-truth theory.

4.2.3.2.4.1 Redundancy theory of truth

This theory was firstly articulated in 1927 by Frank Plumpton Ramsey and differs from other theories of truth because it does not attempt to describe what truth is. Instead, it asserts that truth is an illusion stemming from vagueness in human language. In any given language, a proposition must have a subject and a predicate; the former is something being explained while the latter is the explanation given for the subject (Ramsey, Rescher & Majer, 1991; Rescher, 2003). For example, in the statement, "John is tall," the subject being discussed is John while that which is being said (predicate) about john is the attribute of tallness. Ramsey argues that the predicate is redundant, that means, it is without meaning, hence our attribution of truth value to the statement is meaningless as well.

Using the above proposition for demonstration, a proponent of this school of thought would argue as follows: The statement, "John is tall" is true if and only if it is indeed true that John is tall. The two sentences state the same information and arguing that

one is true on account of another is fallacious. The complimentary statement does not add anything to the first, neither does it give evidence to warrant acceptance of the first statement. Truth, according to Ramsey (2012), is a word that can be conventionally used in some contexts but it does not make any meaningful reference in reality. It cannot conform to any being or entity in actual existence. In such a case, the predicate only serves as a tool of enabling us to make a general conclusion on the statement, instead of being an adjective which describes the subject term. When one says, "It is true that P" they do not add or deduct anything from the statement "p." Hence, the term 'truth' or 'fact' has no sense whatsoever.

Gottlob Frege presents a similar claim to the redundancy of the term 'truth' when he argues that its use in a statement does not change anything in the proposition to which it attributed. If one says, "I smell the scent of violets" and says, "It is true, I smell the scent of violets," both statements mean exactly the same thing. Therefore, inclusion of the phrase, 'it is true' is irrelevant. This problem, Ramsey thinks, is a result of the shortcomings of natural language (Frápolli, 2011).

A.J. Ayer further demonstrates the irrelevance of the term 'truth' by showing its redundancy in statements. He argues that there is no such property as truth in predicates because it lacks conformity to any being. When one claims that something is true, the natural response of a speculative philosopher is to seek knowledge of what this truth is. One assumes that it is a property of something; hence, natural curiosity will lead them to seek understanding of this thing. The philosopher will fail to obtain a satisfactory answer because the question, in the first place was illegitimate (Gower, 2015).

An objection to the validity of the redundancy theory can be expressed through the performative theory of truth. According to the latter, the value of truth is not in the concept itself, but in the individual who asserts it (Hosseinpour, 2022). For instance, when one claims that it is true that John is tall, the word 'true' is meaningless in this context, but it serves as an agreement of a person with the person who utters it. In other words, the value of truth is in the agreement or disagreement it elicits when it is uttered about a particular subject. A critical assessment of the performative theory

leads one to conclude that it does not adequately resolve the problem raised by the redundancy theory. Further, it only serves to show that truth has a definite meaning, but falls short of offering a logical explanation for its nature. At best, truth and falsity would be a matter of subjective judgment because it makes reference to the relationship (of agreement or disagreement) of concepts and the subjects they describe. As such, the performative theory of truth is inadequate as a solution to the problem of truth and its validity.

The redundancy theory fails in accounting for a common human experience called the correspondence intuition. It is a common human habit to judge the acceptability of propositions based on how they agree or conform to the facts they allege to represent. The mind automatically makes judgement of truth or falsity regarding a proposition when they compare it with the reality it supposedly explains. In the redundancy theory, however, propositions are not considered truth bearers or related to any reality whatsoever.

In this study, the redundancy theory of truth was not adopted as an appropriate theory because it categorically rejects the possibility of truth in propositions. It fails to show that a claim can be rendered true or false on the basis of comparing it with an actual situation or event, a set of beliefs, or it's utility when applied to address a particular issue. As such, this theory is irrelevant to an investigation into the possibility of attaining knowledge.

4.2.3.2.5 Semantic Theory of Truth

The most notable proponent of this school is Alfred Tarski (author of *Logic, Semantics, Metamathematics: Papers from 1923 to 1938*). The theory posits that any claim that a statement is true can only be made as a formal requirement regarding the language in which this statement is expressed. In most theories of truth, scholars are interested in describing specific properties that make a proposition true; however, the semantic theory goes further than this quest. It further seeks to establish what makes a particular truth predicate (in a proposition) a sufficient definition of truth (Field, 1972). In essence, this theory is interested in establishing criterion that theories must adhere to if they are to be considered to be adequate descriptions of truth.

Whereas conventional theories of truth were focused on distinguishing between true and false theories, Tarski (1983) was interested in distinguishing between adequate and inadequate theories of truth. Tarski attempts to formulate a new theory of truth aimed at resolving the liar's paradox or antimony of the liar. This paradox can be stated as follows: A liar declares, "I am lying". If indeed the liar is telling the truth, then they are lying, but if they are telling a lie, then they a telling the truth (Michel, 2019). If we assign a truth value to this proposition, we will fall into contradiction.

A more comprehensive example will suffice to explain this contradiction. Supposing a politician claims that all politicians are liars and it is established that the person is a politician. Is this person telling the truth or lying? If indeed they are telling the truth, then they are lying because they are a politician and must be lying. If they are lying, then their statement is true, hence they are telling the truth. Either way, analysis of this statement will always lead to contradiction. Hence we cannot with certainty assign true or false value to the statement.

Tarski (1983) argues that to avoid such contradictions, we have to separate the language that one is talking about from the one used to explain reality. The former, he calls the *object language* and the latter, *metalanguage* or *use language*. Metalanguage is the language used to express the object language. As such, it must include all components of the object language. Woleński, (2019) adds that, the truth predicate cannot be expressed in the object language because it would lead one to a paradox, such as the liar's paradox. However, the truth predicate can be expressed by the metalanguage because it includes explanations and descriptions of the object language. The demonstration that follows shows how Tarski attempts to address the question of the nature of truth.

Quoted propositions (e.g. "P") will represent the object language and non-quoted propositions (e.g. p) will represent metalanguage. Tarski introduces the concept of Material Adequacy Condition, also known as 'Convention T' to demonstrate how each viable truth theory must have the object language contained in the metalanguage or use language. This means that "p" is true if and only if p (Woleński, 2019). For

example, “Kenyans are black” if and only if Kenyans are black. The first statement, “Kenyans are black” is about the subject and predicate (Kenyans and black), but the second one is about the predicate (black). Both statements appear to be trivial because they are stated in the same language; hence, the attribution, T-sentences.

Truth, according to Tarski (1983) will be attained if and only if the translation of a proposition from the object language into the use language can be demonstrated or proven in the metalanguage. This means that, all claims made in the metalanguage must necessarily be contained in the object language. If the metalanguage has less or more claims than in the object language, then the proposition is false (Horsten & ebrary Inc., 2011). One challenge that arises in the pursuit of truth is that natural languages (such as English, German, etc.) do not provide a rich metalanguage for defining the object language. Only formal languages (like mathematical one which are open semantically, and have an infinite number of predicates) can provide the material adequacy required for truth. Hence, truth cannot be adequately formulated in our natural languages.

4.2.3.3 Objection to the Necessity and Sufficiency of Truth

Various scholars have presented arguments in support of the claim that knowledge can be attained in absence of truth. These scholars assert that knowledge, such as mathematical knowledge and formal logic is not dependent on truth for its validity and acceptance, rather, it relies on the logical correctness and deduction, not accuracy. Logical truths, for example, are usually considered accurate if they are within the framework of a particular system, regardless of whether they correspond to the world or not. One can also argue that the conception of truth as objective is wrong because all conceptions of truth held by humanity are dependent on context; social, cultural, and historical. As such, truth (in its objective sense) is not attainable, yet we always claim to possess knowledge and can prove that we actually possess it. In this section we critically examine claims of the possibility of knowledge without truth as presented by various scholars.

4.2.3.2.1 Nenad Popovic's Rejection of Truth as a condition for Knowledge

In his work, *Why Truth is not a Necessary Condition for Knowledge*, Popovic (2015) posits that epistemologists have no unanimous agreement on what describes knowledge, however, and they consider truth to be a condition that must exist for knowledge to occur. He disagrees with this point of view and seeks to introduce counter-examples that would demonstrate his point. The first example is the rigged game demonstration.

In this counter-example, PoPovic (2015) presents a case of two teams competing against each other, team A and B. An individual, S, has strong evidence to suggest that team A will win the match (through rigging) even though team B is a much strong team. Suppose that players, managers, and owners of both teams have confided in S about this matter and even shared their betting slips with him to confirm this plan. S will have sufficient evidence to claim that he knows team A will win. At the end of the match, the score is exactly as he predicted. However, sometime later, the match fixing scheme is found out and the win is awarded to team B. This means that on official records, team B is the actual winner.

According to Popovic (2015), S knew the exact score and the team that would win and we can credit knowledge to him. However, it is also false to say that team A won because the official records have it that B won. This means that S possessed knowledge of an event and it happened exactly as it did, however, the claims to truth were proven to be false. He asserts that this is a clear case of knowledge even when falsity is involved. Popovic further claims that the above example is a demonstration of future knowledge.

Knowledge of the past, according to Popovic (2015), is possible, even when truth is not involved. Suppose that a person in the audience was watching the match described in the example above. This person expected team B to win but was shocked that A won. However, he accepts the outcome and goes home with the knowledge that A won the match. This knowledge is based on the evidence of the final score line on the match day. However, a year later when the scores change, he could not claim that he

did not have knowledge at the time the results were announced (on the day of the match). This individual knew that team A had won, even when it did not.

In critique of Popovic's counter examples, one may argue that his understanding of the term knowledge is different from the objective epistemological understanding. In epistemology, knowledge is static and does not change with time or circumstances (Lemos, 2020). Popovic's assertion that S knew that team A had won and later found out that it had lost is illogical because if S knew that the team won, it would, under no circumstances, could have lost. In Popovic's examples, then, team A did not win, even when it was declared to have won.

The author of this work also confuses the use of the term 'win' in its official context and in its improper context. In its official context, a win must involve fair play and refereeing. Team A did not meet these conditions because their triumph over team were rigged. As such, they did not actually win, but S had the illusion that this was a valid win. One can validly argue, therefore, that S did not have knowledge in the first place and even when his beliefs were confirmed by the announcement after the match, they were based on a misconceived notion of what it means to win. The governing body's conditions for attributing a win were not met. Popovic commits the fallacy of four terms in which an argument uses a term in two different meanings and derives a conclusion from it. This kind of reasoning does not guarantee logical correctness.

One, therefore, can categorically state that these counter-arguments do not prove that we can have knowledge without truth. On the contrary, they demonstrate that knowledge of falsity is impossible.

4.2.3.2.2 Tolliver's advocacy for knowledge without truth

In his rejection of truth as a condition for knowledge, Tolliver (1989) argues that it may be a condition for knowledge, but not necessary and that we can have alternative conditions serving the exact same purpose as truth. Knowledge, according to him, does not relate an individual to a true proposition.

Firstly, he agrees that knowledge requires epistemic correspondence relation. This means that there must be a relation that is responsible for determining what one has knowledge of when they have knowledge, and what they lack when they do not have knowledge. For instance, when I know that peter is tall, what makes me know and when I do not know that Peter is tall, what do I lack to make me ignorant of this fact?

Tolliver's (1989) rejection of the truth condition as necessary involves rejection of the notion that we know if we have propositions that are true. Instead, we need to adopt propositional states which do not depend on representational states that link the mind to correspondence with actual states of affairs. The reliability theory of knowledge is what he proposes to replace the theory of truth. An epistemically reliable belief is one that guarantees that it produces more true beliefs as opposed to false ones. It acts like a thermometer which is working perfectly. This thermometer gives a true reading of temperature that we can be certain of but if it is defective, we cannot be certain of its readings. Hence, one will be more justified in accepting the readings of a thermometer that has been tested an determined that it is in good working condition as opposed to one that is faulty.

One may reject Tolliver's theory of knowledge without truth based on the following argument. He admits that there must be adequate evidence that can be used to determine whether one knows something or they do not have knowledge of it. His introduction of reliability does not invalidate the necessity of truth. In fact, he succeeds in demonstrating that his alternative is not a necessary and sufficient condition for knowledge. The nature of reliability is that it is more concerned with consistency and dependability of a thing as opposed to its accurate description of reality. His example of a thermometer serves to show that something can be reliable yet not accurate. One may be consistent in falsity or biasness yet still reliable. One may ask the question, "How can a consistent lie be considered knowledge?" The answer to this question is that in so far as something is a lie it cannot constitute knowledge because it misrepresents that nature of reality.

Truth, on the other hand, makes reference to the actual state of affairs or reality (Blackburn, 2018). An appropriate representation of reality is what necessarily

constitutes knowledge because it is impossible to know that which not the actual state of affairs. It would be fallacious for one to claim they know something yet it is contrary to the actual state of affairs. It would be synonymous to saying that one can know that which is not (Adams, 2024). Reliability can only be a measure of consistency and dependability of tools, theories or information, but never a substitute for truth. Reliability can contribute to truth through a consistent presentation of accurate information; however, it cannot guarantee it (Hedge, Powell & Sumner, 2018). It is valid to argue that reliability only offers trustworthiness but never accuracy.

4.2.3.2.3 Priyedarshi Jetli's Knowledge without Truth

Jetli (2008) argues that whereas he agrees that truth is inseparable from knowledge, we cannot posit that the statement *p* is true is a necessary condition in the validity of the statement *s* knows that *p* is true. According to him, there is an element of circularity around the concept of truth in the three independent elements of the JTB criterion. Consider the following statement; S knows that P is true. If this statement is to be considered knowledge, the following conditions must be met; S believes that P is true, S is justified in believing that P is true, and P is true. One may argue that the three conditions have not been met because the satisfaction of the truth condition for the proposition (P) already presupposes knowledge of P. This may lead to an infinite regress problem, hence, making the explanation circular. In the definition of truth above, there is no presupposition that S knows P, however, there is a presumption that someone else (S1) knows that P is true. S1's knowledge that P is true is based on the presupposition that someone else knows that P and so on. This will lead to an infinite chain of presuppositions of knowledge of P. Assuming one were to accept the argument above, it means that they have to accept the assertion that truth cannot exist without knowers.

As a consequence of the above chain of thinking, the knowability paradox gets generated. This paradox is understood as follows; if any true statement or proposition is known, then all true statements are knowable, but there are unknowable truths, therefore all truths are knowable (Bozza, 2020; Usberti 2023;). This conclusion seems to contradict the knowability principle because if there are unknowable truths such as

future events and mathematical truths yet to be discovered, we cannot claim that all truths are knowable (Kvanvig, 2006). It therefore means that there are truths that are without knowers and certainly, there were no truths before the existence of knowers. However, this does not mean that facts do not exist independent of our minds. Knowledge is dependent on the mind being conscious of reality and forming concepts about that which it perceives.

This knowability paradox, we may argue does not in any way demonstrate that knowledge can exist without truth. It is fallacious to claim that truth can exist without knowers because once a conscious mind becomes aware of a thing, they are capable of knowing it if and only if they understand it in its actual state. In the absence of a knower, the process of knowledge cannot exist, and in fact, truth cannot be achieved. Truth is a product of an intentional process which involves forming ideas or concepts about something and representing the nature of this reality through statements. Without both the knower and object of knowledge, therefore, truth is impossible. Introduction of this paradox to the discussion at hand, therefore, is irrelevant.

Jetli (2008) further advances another argument to show that truth should be dropped as condition for knowledge. He asserts that if we define knowledge as JTB, we imply that neither the knower nor anybody else can have knowledge that the knower knows. Some scholars have accepted that knowing that a statement is true points to the assumption that the person knows that the person knows that the statement is true. Truth, as a matter of fact, is outside the mind of the knower, therefore it is possible that whatever the person knows is true, they do not know that they know it is true.

To further justify his theory, Jetli (2008) adopts Tarski's bi-conditional to demonstrate that knowledge is not dependent on truth whatsoever. The bi-conditional states, "The statement, 'it is snowing (T)' is true if and only if it is snowing." If anyone knows T, then they believe that T is true and are justified in believing that T is true, and that T is true. Jetli (2008) accepts Tarski's assertion that T is stated in a language, however, it is not in the knower's mind. He adds that if this statement is true, then it may be known by knowers. However, the question that arises from this problem is, "how do we determine that it is true?" We can only respond to this question by positing that T

is true if and only if it is true. That means that we do not have an objective way of making that determination. We only accept the bi-conditional as true because we cannot demonstrate it.

The implication of Jetli's thesis is that we can never be justified in believing that we know something is true because truth is outside the knower and it is impossible for the knower to confirm it. In essence, he says that we can never know that we know something.

Jetli (2008) further makes the following argument; knowledge is not a state of mind, but an ability and a process towards acquisition of truth. He argues that in the process of seeking to know something, we are also seeking the truth of it. This means that truth cannot be a condition for knowing, but we can argue that the search for truth is a condition for knowledge. Jetli thinks that epistemologists acknowledge that the truth condition should be dropped as necessary for knowledge but they are reluctant to do so.

A careful consideration of Jetli's work leads to the realization that he errs in arguing that truth is outside the knower. One may argue that he may have meant that reality is outside the mind of the knower, not truth because it is impossible for a statement that describes the state of affairs to exist on its own, outside the mind of the knower. It must be domiciled in the knower, specifically, in their mind. Truth, as discussed earlier in this work, is arrived at when we are conscious of the object of knowledge and are actively seeking to understand it. That's when propositions explaining the nature of the object are formulated and communicated. It is, therefore, impossible for any truth to exist outside the knower because outside this subject, we can only have reality itself.

Additionally, when he claims that it is impossible to prove that we know that we know, Jetli is mistaken. Proof of knowledge involves demonstrating awareness of our knowledge acquisition processes, including comparing what we claim as knowledge with the actual state of affairs (Lemos, 2020). He is also mistaken in characterizing the pursuit of truth as a process that involves an independent investigation where the

mind seeks truth as an independent entity. Truth is not independent of the mind (Audi, 2010) and must be present before one can claim that they know. Jetli is wrong in this regard because his statement that truth should be dropped as a condition for knowledge implies that one can know falsity. A false statement, however, cannot be known because it does not represent any reality, hence it is impossible to know that which does not exists or that whose existence is not apparent to the mind that seeks it.

4.2.3.2.4 Necessity of Truth as a condition for knowledge

In the foregoing discussion, one may be justified in arguing that there is adequate demonstration that truth is a condition that is necessary for knowledge to occur. Truth is understood as a property in a proposition that makes it accurately describe things as they are. In other words, truth is an element of a statement or proposition which makes it compatible with the actual state of affairs. When one argues that we know something, we must demonstrate that the information in our minds is accurate, and if not, then we cannot say that we have knowledge.

False propositions are those which misrepresent the state of affairs. These propositions cannot be known because they are not compatible with things as they are (Adams, 2024). Supposing that the statement, "all men are immortal" is uttered by person (S). The statement is clearly false and does not represent the actual state of affairs. It is impossible to know it because the idea as expressed in the proposition does not agree with the state of affairs. The state of affairs it describes is non-existence, hence nothing. Nothing, is a term that is used as a negative concept (cannot be understood by itself, rather, it is a deficiency of something) and can only be understood with regard to something that exists. In essence, therefore, we cannot know falsity because we cannot be aware of that which is not the case.

Objections that have been raised by various scholars in the section above have been examined and proved insufficient in their demonstration of the dispensability of truth. We may therefore argue that truth is a necessary condition for knowledge. However, by itself, it is not sufficient for knowledge. In instances where one holds a belief that is unjustified (lacks reason to support it) but it turns out to be true, we are not justified in attributing knowledge to it because we have not consciously acquired proof that

leads us to make the conclusion. In other words, we lack logical grounds for acceptance of the belief. At best, we may call it a true belief, but not knowledge.

4.2.3.4 Necessity and Sufficiency of Justification

The justification condition for knowledge is the third of the tripartite conditions which asserts that in order for a true belief to constitute knowledge, there must be reasons that compel one to accept it (Lehrer, 1979). In other words, there must be proof or evidence that makes the belief to be considered an accurate description of reality. Pollock (2015) argues that this condition is important because it gives one a rational basis for acceptance of beliefs, not just mere luck or coincidence. The question that justification answers is, "why should one accept certain beliefs as knowledge and not others? "It distinguishes true beliefs from arbitrary and unfounded beliefs.

Justification plays a normative role because it provides rational conditions which stipulate whether we should accept or reject certain beliefs that we form. For instance, one would not be rationally justified to accept two contradictory propositions. These two beliefs would negate each other and violate the principle of non-contradiction, which is an essential logical principle present in every mind that reasons in a rational manner (Pritchard, 2023). For instance, if scientific claims to knowledge are true, then, Justification, guides the mind through the process of admitting beliefs as knowledge or rejecting them as irrational or illogical presuppositions.

Despite the necessity of justification in knowledge, the two are not synonymous. When I know something, then it must be true but when I have justification for believing something, it is not necessarily true. A reliable friend, for instance, can share information that is inaccurate and I will use the reliability and trust in this friend as justification that whatever they have shared is true. One, therefore, should not always assume that all instances of justified belief constitute knowledge.

The nature of justification and what constitutes sufficient justification for acceptance of beliefs has been a subject of discussion in epistemology. In this section, these concerns have been discussed with an aim of establishing whether indeed justification is a necessary and sufficient condition for knowledge.

4.2.3.3.1 Theories of Justification

There are various types of justification as a result of various types and sources of knowledge. Some kinds of justification do not qualify to be epistemic because they rely on luck and guesswork (Lemos, 2020). For example, practical justification is used when gambling or making bets. One is convinced that their team will win because they have belief and trust in them. In some other cases, some religious people will argue that what one professes is what they become and sometimes this belief comes true. In the following section we examined epistemic justification which seeks to relate evidence with truth. This kind of justification includes; *apriori* justification (which involves logical reasoning), experience, and testimony from other sources. Various theories of justification have been proposed as appropriate for knowledge acquisition. They include: foundationalism, coherentism, and reliabilism.

4.2.3.3.1.1 Foundationalism

Proponents of this theory of justification argue that our beliefs are justified on the basis of other beliefs. This means that a belief is justified because it is based on other beliefs that we hold. This theory portrays knowledge as a hierarchical structure whereby basic beliefs form the foundation or base upon which all other beliefs are built (Fumerton, 2022). The relationship of these other beliefs with the basic ones will determine their validity and acceptability (McIntosh,2020). Critiques may argue that this foundational nature of justification may lead to an infinite regress problem where belief B1 will be justified by belief B2 and B2 will be justified by B3, ad infinitum. A proponent of foundationalism will argue that this regress problem will not occur because of the existence of the basic beliefs.

An example of this kind of justification is as follows; one will believe that person X is a criminal because their fingerprints were found in a crime scene, witnesses report seeing the person around the scene, and X has had criminal charges pressed against him before. The conviction that X is a criminal is not based on an actual encounter with him engaging in the crime, but on a series of beliefs that point towards this conclusion. The claim that X is a criminal is justified by a series of beliefs such as; the fingerprints on the crime scene were not planted, a competent investigator lifted the

prints and did not mix them up with others, the eye witnesses are not lying, the previous criminal charges were based on evidence, among others.

The main assumption in foundationalism is that knowledge is based on basic beliefs that are self-evident. These basic beliefs are assumed to evident upon immediate perception, hence they require no further justification (Audi, 2010). Two kinds of foundationalist theories emerge from this discussion; classical and modest foundationalism (Stoutenburg, 2020). Classical foundationalism holds that the basic beliefs in any system of beliefs are infallible, thereby certain, indubitable and incorrigible (Mousavi Siany, 2024). Further, this school of thought posits that the only way we can transmit justification among beliefs is through deduction. Consider the following example for demonstration; assuming that one withdraws ksh.100000 from an ATM and all the notes that emerge from the machine are Ksh. 1000 notes. One may assume that they are justified in believing that the next withdrawal will produce Ksh.1000 denomination notes. A classical foundationalist would argue that this reasoning is fallacious because the first occurrence does not logically imply how the second one will occur.

Modest foundationalism is a much more accommodative version of foundationalist and its central thesis is that; firstly, the basic beliefs must not necessarily be infallible and secondly, both induction and deduction can be used to transmit justified beliefs (Lawlor, 2022). Concerning the ATM withdrawal example given above, a modest foundationalist would argue that one would be inductively justified to make that assumption because the available evidence greatly supports this conclusion.

Despite attempts to demonstrate the suitability of foundationalism as appropriate for justification, the theory has some shortcomings. Firstly, it leads to epistemic circularity. Circular reasoning is inevitable in this type of justification because the validity of a belief is based on the validity of another belief on which it is dependent, and so on. We cannot logically argue for a non-circular system of justification when arguing for this theory. Secondly, the foundationalist attempt to introduce basic beliefs to eliminate circularity fails because they do not offer any logical criterion for choosing these basic beliefs. Different people have their own standards of what

constitutes a basic belief but there is no universally accepted criterion that can be used to determine the nature of these beliefs; hence, it leads to ambiguity. Thirdly, this theory raises skepticism about the indubitability of basic beliefs because every belief will always be critiqued from various points of view. The question then arises, "how will we tell that a belief is indubitable?"

4.2.3.3.1.2 Coherentism

This theory posits that beliefs are justified by their agreement with other beliefs which have been already been accepted as valid within a system. This coherence does not in any way compare beliefs with empirical evidence or agreement with reality as it is (Olsson, 2022). The distinction of this theory with foundationalism consists in the fact that it is not dependent on basic beliefs which act as the core, but with an established web of beliefs.

Most of our beliefs concerning the world appear to be valid because they cohere with our established beliefs drawn from our culture and habits. However, this is a weak system of justification because it overlooks the possibility of a belief system being wrong. A belief can be contrary to our established web of beliefs and be true but this theory will deem it false. Additionally, just like foundationalism, this theory can lead to circularity where we seek justification of beliefs in an endless chain.

4.2.3.3.1.3 Reliabilism

Proponents of reliabilism argue that a belief is justified or not justified depending on the reliability of the cognitive process that produces it. This means that the belief is accepted regardless of its truth value (Goldman, 2012). The content of the beliefs is not in consideration in this theory and this aids in identifying beliefs that may be true but unjustified because the process used to arrive at it is unreliable. One of the main proponents of this school of thought is Alvin Goldman. In his essay 'What is Justified Belief? (2020)' he argues that there is only one kind of process that can lead to justified beliefs. This process, he argues, must include standard perceptual processes, memory, logical thought, as well as introspection. On the other hand, unreliable processes involve use of emotions, wishful thinking, guesswork and hunches, as well as hasty generalization.

Unreliable processes are easily to identify because they produce erroneous outcomes most of the time. Justification-conferring processes, however, result in beliefs that are generally true. Standard perceptual processes, memory, logical thought, and introspection are sources of justification because they are reliable; they mostly produce accurate beliefs. This theory, however, raises certain questions. For instance, "in order to produce a justified belief, how reliable must a process be?" To this question, Goldman (2020) answers that our processes do not necessarily need to be infallible or perfect to be sources of justification. In some instances, he says, imperfect processes can be sources of justification. False beliefs that emanate from such processes can still be justified.

According to Lemos (2020), three objections can be raised against reliabilism, namely; the new evil demon problem, the unknown reliability problem, and the generality problem. The new evil demon problem can be described as follows: it is not possible to be certain of anything because there is always a possibility that we could be systematically deceived by an evil demon to believe that our beliefs are justified. The Rene Descartes' work, 'The Meditations on First Philosophy' (2017) adequately demonstrates the possibility of being sure that our beliefs are justified while in fact, our minds have been deceived into believing so. In the contemporary world, this evil deceiver may refer to artificial intelligence which may include simulations which replicate our experiences. As such, we can never be sure that our knowledge acquisition processes are justified. Despite the fact that the processes that resulted in one's beliefs are false and based on deception, they would still be considered epistemically justified. We may infer, as a matter of logical necessity, that the process is unreliable and the outcome false, hence reliabilism does not offer an adequate justification criterion.

The unknown reliability problem makes reference to circumstances where the trustworthiness or reliability of an epistemic process is unclear or unknown. Some knowledge sources may not be reliable and can sometimes give accurate information (Lemos, 2020). For instance, a psychic may predict the course of events and they obtain. This person does not have any reason or justification for believing that these

events will occur, nevertheless, they believe it and it comes to pass. A critique of reliabilism will argue that the process is reliable, but it cannot be justified, hence, cannot be considered knowledge. In essence, being reliably produced does not make a belief justified.

The generality problem refers to the difficulty that arises when we attempt to reconcile the general nature of knowledge claims with particular contexts in which these claims are applied (Lemos, 2020; Goldman, 2021). Supposing one look out their window one night and see a shiny object in the shape of a moon and make the following claim, "there is the moon." At face value, this claim will seem to be justified. However, when we examine the process used to arrive at this claim, we notice that there are various processes and each has a distinct level of reliability. For example, there is perception, visual perception at night, and visual perception of the illuminated object at night. If these processes were to be examined individually, we would discover that some of them offer no justification, however, the first process, perception, offers no justification whatsoever to the claim that is made, the third process, visual perception of an illuminated object at night, offers a reliable justification for the claim. Reliabilism does not determine the level of generality the relevant processes have to determine the level of justification it offers the claim. This is a major concern for epistemologists because epistemic processes must have contextual specificity.

Reliabilism may offer an acceptable criterion for justifying knowledge, however, it is not adequate to justify our claims to know because it lacks a clear methodology for distinguishing true beliefs from those that are false. Further, it errs in positing that false beliefs and unreliable processes can still be justified. In addition to critique raised above, it is imperative that one considers this theory insufficient for justification of beliefs.

4.2.3.5 Knowledge without Justification

Some scholars have argued against the claim that knowledge must constitute justified true beliefs. They assert that there are instances of knowledge which do not involve justification. According to Olsson and Dellsén (2017), we have instances where

understanding occurs without either belief or justification. They argue that understanding can sometimes occur intuitively or through grasping relevant concepts even at moments where justification is lacking. We may understand reality without being able to explicitly justify it. For instance, a student by the name Alice has failed in all assignments in a given year. She has reason to believe that she will fail in the next ones. However, unknown to her, she has a knack for geometry (which is her next assignment) and she unexpectedly scores well in the assignment. These scholars present a second example to demonstrate their case. Assuming a man, Bernie, is aware that a known conman is coming to town and all residents have been warned not to believe a word from his mouth. The conman encounters Bernie and claims that his vehicle has broken down. Bernie does not believe him but helps him diagnose the problem with the car. Eventually, Bernie finds out that the conman was telling the truth.

In the first case, Alice is assumed to be ignorant of the fact that she can perform well in geometry and is therefore justified in holding the belief that she will fail, just like she has in all other subjects. However, her alleged understanding of geometry without logical justification does not demonstrate that she has knowledge. Firstly, she is not aware and even if she was, could not argue that she was justified in claiming that she will pass the geometry test. Secondly, her belief is that she will fail the assignment but the contrary happens, therefore, we can only claim that her belief was wrong and that she possessed no knowledge. If we claim that she had knowledge, it would be fallacious because it would contradict the evidence presented. Knowledge must involve instances where an individual has a belief (that she will pass the geometry test or she understands geometry), a justification (there must be sufficient grounds that demonstrate her ability to pass the test) and truth (she actually passes the test). Of these three conditions, Alice only met the last one, hence rendering Olsson and Dellsén's claim fallacious.

In the second instance, the same critique applies. Bernie does not believe that the conman's car is broken down. He is convinced that the man is trying to trick him. Bernie has enough justification that the man is a conman because it is widely circulated through trusted media houses. However, he later realizes that the man is not

lying and the car has actually broken down. The diagnosis given by Bernie turns out to be accurate and the conman is vindicated. In this case, the conclusion (that the car has broken down) is not adequately supported by the evidence (that the conman has a history of lying and is most probably lying), hence claims to knowledge cannot be attributed to this scenario. Bernie did not know that the car was broken down and his diagnosis was based on knowledge already accumulated from his experience as a mechanic. One can argue, that these two cases do not submit any compelling case for knowledge without justification.

Sartwell (2011) argues that despite justification being an important part of the knowledge acquisition process, it is not always required for one to have knowledge. In some cases, he says, we are willing to attribute knowledge to information that has limited or even absent justification and this implies that if justification was absolutely necessary for knowledge, we would not attribute knowledge to this information. For example, a man claims that he knows his son, who has been accused of a crime is innocent. He holds his position despite overwhelming evidence that points to the son's guilt. Ultimately, the son is proven innocent and one may claim that the father knew it all along.

This, one may argue, is a defective argument because the father is deeply convinced, not knowledgeable that the son is innocent. When his belief is proven right we would not be right to claim that he knew it all along, unless we can present evidence that he had that the son was innocent. Suppose that the son has always been truthful and had confided in the father that he did not do it. Suppose that the father was aware that people can be framed for crimes they did not commit. He would have sufficient justification to hold the belief. However, this is not the case in this situation. One may counter Sartwell's argument by presenting a scenario where an individual strongly believes in something but lack justification but it later turns out to be true. A mentally challenged person can believe that they are in Nairobi, without being aware that this is indeed true. We cannot claim that they knew just because the belief was proven true. We must demonstrate that they had sufficient grounds to make the claim.

Most of the arguments offered to demonstrate the irrelevance of justification in knowledge offer limited understanding of what knowledge constitute and mistake it for strong conviction or belief. These claims have not only been refuted, but this paper has demonstrated that knowledge is arrived at through a conscious process of evaluating beliefs, justifying why we believe them to be true and not any other, as well as the beliefs being actually true. In cases where justification is lacking, there is usually an element of guesswork or luck involved, not knowledge and understanding.

4.3 Conclusion

From the discussion above, one can confidently posit that arguments advanced against the necessity of the three conditions for knowledge are erroneous. Firstly, if belief is absent, one will not have a concept that they accept as the actual state of affairs. It will mean that they do not hold any position or conviction about the universe in which they exist. This state of existence is not possible for a rational mind. Secondly, truth is necessary because it is impossible to have knowledge of something that is false or that is not. The object of knowledge is being and, in its absence, then we can never know anything at all. If one were to misrepresent the nature of any being they seek to know, they would not know anything at all because falsity does not make reference to reality. Finally, in absence of justification, our beliefs can only be guesses and if proven to be true, cannot form instances of knowledge, but true beliefs. The necessity of these three conditions notwithstanding, none of them is sufficient for knowledge in isolation. They are all sufficient for knowledge and in cases where one is absent, then we cannot be certain that we have knowledge.

CHAPTER FIVE
NATURE OF THE TRUTH CONDITION IN SCIENTIFIC METHOD OF INQUIRY

5.1 Scientific pursuit of knowledge through the Inductive Method

As a branch of philosophy, Philosophy of Science concerns itself with the foundations or basis of scientific inquiry, its methods, as well as its implication in the world. These concerns can be explained as an examination of what qualifies a discipline as science, what distinguishes science from pseudo-science, how reliable scientific theories are, and what purpose science serves. In this investigation, this discipline relates closely with other branches of philosophy such as epistemology, logic and metaphysics (Rosenberg & McIntyre, 2019). In this study, an interrelation between philosophy of science and epistemology was demonstrated because the research sought to establish the reliability of scientific method and the accuracy of scientific claims to knowledge.

5.1.1 Role of the Inductive Method in Knowledge Acquisition in Science

Scientific advancements since the renaissance can be attributed to the level of civilization experienced in the world in contemporary times. Each century since then has experienced improvements in our understanding of the universe and how it works, improvement in the quality of life and significant growth of our body of knowledge (Zagidullin, Stenyashina & Nazmutdinova, 2020). Scientific methods can be rightly considered to be powerful methods through which our knowledge advances. Whereas scientific methods can be shown to have had significant impact in the world, religion, superstition, magic, and witchcraft have hardly had any contribution to the body of knowledge or tangible outcomes in terms of improving the quality of life (Ferngren, 2022).

Knowledge acquisition in scientific disciplines involves a systematic method in which scientists gather information through observation, analyse it, make appropriate interpretations and understand the nature of the physical world as well as make predictions on how it will be. This process begins with a researcher making an observation of phenomena in the physical world (Poincaré, 2022). This observation includes identification of patterns and sometimes anomalies in the operations of

nature. The researcher may raise questions which seek to find answers that explain why or how this observed phenomenon occurs the way it does (Haig, 2018). For instance, one may question how certain species of animals adapt in cold or extremely hot climates. Once these questions are cast, possible explanations arise and these constitute hypotheses. A hypothesis is a possible explanation for an observed pattern or anomaly. It is usually unproven and requires testing to establish its validity (Poincaré, 2022).

The process of testing may require further observations or experimentations (which may include crucial tests) in a controlled environment. Experimentation is a thorough process that involves rigorous testing and manipulation of variables to establish accuracy and reliability of test results. This process culminates in data collection from the observations or tests and this data is analysed, given meaning and projected as viable explanation for the phenomenon under study (Haig, 2018). In order to ensure the accuracy and reliability of the researcher's conclusions, it is recommended that peer reviews be done by other scientists in order to establish that the results and conclusions of the researcher are not biased or manipulated to achieve their own target. Ultimately, communication on the findings and contribution of the researcher's study will be done in various ways such as conferences and publications with an aim of building on the body of knowledge and transforming practice (Matsui, Chen, Wang & Ferrara, 2021). Despite the fact that new knowledge has been attained, it is imperative to acknowledge that scientific investigation is iterative; each new finding triggers new and more intriguing questions which prompt new research on the phenomenon. For example, the success in accomplishing medical procedures such as kidney and heart transplants have triggered research into more complex procedures that seek to restore life to deceased humans.

The demonstration above clearly shows that knowledge acquisition in scientific disciplines is dependent on the inductive method. As per Poincaré (2022), this method can be described as a way of reasoning that results in new knowledge through generalizing limited observations of phenomena. For example, if one encounters crows in their neighbourhood and notices that they are all black, they may make a general claim that all crows (including those not observed) are black. Induction relies

on identification of repeated patterns of occurrence which point to a possible relationship between the phenomenon and what is observed. An example may suffice to demonstrate this point. Supposing one observes that police officers along Nairobi-Embu highway collect bribes from public service vehicles and a similar observation is made along five other highways in Kenya. This pattern may justifiably lead one to conclude that police officers along any other road in the country have similar habits, regardless of whether this observation has been made. This generalization will be based on consistency of the behaviour pattern observed.

In inductive reasoning an explanation is assumed to be true on account of a number of perceptions of an occurrence and the subsequent generalization of the observation to all occurrences of a similar nature. Inductivists argue that without perception human knowledge is impossible, it is also impossible to observe all occurrences (past, present and future) of a phenomenon, hence, we would be justified in making a generalization (Copi, 2018). They acknowledge the possibility of committing the fallacy of hasty generalization but insist that this is an acceptable risk. Ultimately, application of this methodology will lead to acquisition of knowledge of the phenomenon being studied.

Scientific hypotheses are formulated in order to explain an observed phenomenon in the external world (Roelli & Schweizerischer Nationalfonds, 2021). A scientist will presume that their hypothesis explains a possible relationship that exists between two or more variables. A good hypothesis must be testable and falsifiable. Testability denotes the ability to be empirically examined to establish if it accurately describes the relationship of its variables (Binoy, 2019). For instance, the hypothesis that Chuka is a town in Tharaka Nithi County is testable because the researcher can use geographical coordinates of the town and compare it with a map of Tharaka Nithi County to determine if indeed the town falls within this county. Falsifiability of a hypothesis means that there is a possibility that this assumption could be proven false. Unfalsifiable hypotheses, such as God is good, can never be considered scientific because they can never be proven wrong using empirical research (Maxwell, 2017). Hence, hypotheses must seek to explain logical relationships that exist between tangible realities. In essence, therefore, a hypothesis must have the ability to be tested,

falsified, and their variables should be capable of being manipulated, observed and measured.

The inductive method, when applied to acquire knowledge, does not offer instantaneous truth about the entire phenomenon under investigation. Instead, it provides information in a gradual manner that allows incremental knowledge based on how much data and evidence is gathered at a given time. Scientific discoveries are only possible if scientists improve and refine their tools of investigation and when this is done, more information becomes available (Hayes & Heit, 2018). This means that at any given time, our knowledge may be revised, discarded or strengthened due to discovery of new perspectives and realities that had not been encountered before. In effect, then, one may argue that scientific truths are not absolute, but tentative because they are depended on the tools of perceptions used and interpretation made at the time of observation and analysis. Consider the following example for articulation of this point.

According to Shioyama (2021), Newton's Laws of Motion and his principle of Universal Gravitation was considered an articulate scientific discovery. This principle stated that everybody in the cosmos applies a gravitational force on every other body and the strength of the attraction between them is dependent on the product of their masses as well as the distance between them (Newton & Motte, 1962). Newton then demonstrated how these laws of motion specify this gravitational force and as a consequence, influence the bodies' motion. Newtonian physics held for more than two centuries until new developments in physics in early 20^{th} century cast doubts and eventually disapproved it. In his Relativity theory, Einstein (2008) demonstrated that Newtonian physics was flawed because, when applied to objects at a high velocity or massive objects, the desired results were not achieved. This example shows how knowledge in science cannot be argued to be absolute, but always subject to revision, improvement and even abandonment when new knowledge and evidence is discovered.

This discussion in this section demonstrated that in absence of the inductive method of investigation, scientific knowledge would not be possible and our claims to

knowledge would be futile. It was proved that this claim to knowledge of the physical world is not absolute, but tentative and subject to revision when new investigation tools and methods are adopted in science. However, this does not mean that one should abandon pursuit of knowledge because each epoch of the scientific advancement offers more insights that give us a clearer picture of reality as we perceive it.

5.1.2 Viability of the Inductive Method in Knowledge Acquisition in Science

Despite induction being a core method of scientific inquiry, it is not without its challenges. One of the shortcomings of this method is that it offers limited certainty of knowledge. This means that its conclusions are not absolutely acceptable because the evidence provided only offers partial support to them (Hayes & Heit, 2018). For instance, when one observes crows in their neighbourhood to be black and concludes that all crows in the world are black, their conclusion is not guaranteed to be true because they have not provided evidence that shows observations of crows all over the world drawing similar conclusions. As such, the inductive method is not definitive, it is probabilistic. David Hume also makes a similar observation.

In his critique of inductive reasoning, Hume makes a case for why it can never be reliable in our pursuit of knowledge. He argues that we claim to know things and make predictions because we are used to them occurring regularly, in close proximity, and in a specific pattern (Okasha, 2003; Lange, 2011). For example, if we claim that tomorrow the sun will rise in the east and set in the west, a scientist will hold that information as true because it has always occurred in the same way in the past.

However, according to Hume, we do not have a rational justification for this belief. Sloman and Lagnado (2005) make Hume argue that we do not base such claims to knowledge or rationality; rather, there is a habit or custom of the human mind to always associate events or things that occur in close proximity of each other on a regular basis. We attribute a necessary connection between or among these things and make a prediction that, at present and in the future, things of a similar kind will always occur in the same manner or have similar qualities. When we carefully scrutinize our claims to knowledge, we realize that we usually attribute cause-effect

relationship to phenomena and make a conclusion that one thing is a necessary consequence of the other. For example, if a rock is thrown at a window and the window breaks, we can claim that the rock is the cause of the shattering of the window. However, upon close inspection, we can only conclusively say that we observed a series of events, the last of which was breaking of the window. We can only be sure of the movement of the rock and its encounter with the window but can never establish causality (the rock causing the window to break).

This Humean reasoning is influenced by his claim that the basis of all knowledge is establishing a causal relationship among things or events. In its absence, any claims to knowledge will be invalid. Observation of two events in close proximity and a regular occurrence of a third event after this observation do not necessarily mean that the two events are the cause of the third. Sequence of events is not enough justification for claims to causality.

An investigation into induction leads to the conclusion that is it is not always reliable in giving knowledge because it only samples a fraction of phenomenon and generalizes its findings. This unreliability of induction can be demonstrated by the perennial abandonment and replacement of scientific theories that seemed accurate at specific times, but later proved to be defective since the rise of the scientific age in the 1500s. For example, according to (Habing, 2019), the geocentric theory (Ptolemy's theory) of the universe that held for approximately 1800 years stated that the earth was at the centre of the universe and all other bodies revolved around it. This theory was later proven to be false by Nicholas Copernicus who proved that the sun lay at the centre of the universe and all other bodies, including the earth, revolved around it.
Another shortcoming that may arise from the inductive method is that observations, analysis and interpretation of data may be influenced by subjectivity and biases of the researcher, hence the outcomes of the investigation may be flawed. The researcher's point of view greatly determines the quality of findings they draw from their observations and in instances where they have limited or flawed perception of phenomena, they are guaranteed to draw inaccurate conclusions (Salmon, 2017). For example, a doctor may observe a patient experiencing muscle paralysis, speech impairment and fatigue and draw a conclusion that the patient is suffering from a

transient ischemic attack (minor stroke) because they have previously treated patients with the same symptoms and their assumptions that it was a stroke were accurate. However, the doctor is found to be wrong and the patient actually suffers from myasthenia gravis, a condition which manifests similar symptoms but is an autoimmune disorder.

Further, one may consider the inductive method insufficient if the sample size of observed phenomena is not significant to warrant drawing of general conclusions about it. In most instances, scientific accuracy is guaranteed by a high quantity of observations (Poincare, 2022). This improves the chances of a certain conclusion about reality being acceptable as opposed to when only a limited quantity of similar occurrences or patterns is established. For example, the claim that all men are mortal is more acceptable in the scientific world because there is a wide range of evidence pointing to this claim. If one, on the other hand, claims that all men are selfish, it would be difficult to accept this generalization because we cannot possibly obtain sufficient evidence that would describe humans, both existing and deceased, that had this character trait.

A scientist, however, would not abandon their pursuit of knowledge due to challenges posed by the inductive method. One of the most erroneous inductivist approaches is naïve inductivism and it involves a simple enumerative generalization of a phenomenon that has been experienced many times (Alves, 2021). For example, the observation that all Kenyans I have encountered are black leads me to conclude that all Kenyans are black. This form of induction has been improved to guarantee accuracy in scientific discoveries and researchers have confidence that they can acquire truth through the hypo-deductive method of confirmation. As per Condit and Railsback (2016), in this methodology, the scientist formulates a hypothesis about an occurrence, establishes a testable prediction from this hypothesis, conducts a test (or tests) and checks whether the expected prediction is observed. If the prediction is observed, the hypothesis is confirmed, and if not, the hypothesis is rejected. The hypothesis can further be put to test by examining it in other circumstances and observing whether expected outcomes are realized.

Empiricists posit that unless reason is solidly based on experience, its data cannot be claimed to be representative of reality. Reason alone will result in speculation, which may not give meaningful information on the world and all that within it. Concepts and ideas are tested empirically to determine whether they correspond to the reality they represent in our minds. If we merely compare ideas to others, we may have consistency, but this does not mean that they are accurate. Coherence does not imply truth. Despite their rejection of reason as the sole criterion for knowledge, empiricists acknowledge that reason is not irrelevant in our pursuit of knowledge because it helps in organizing data from sense experience to make it intelligible and give it meaning (Vanzo, 2016).

The inductive method can be justified as appropriate for knowledge acquisition because all information about the physical world can only be acquire through the senses (Haig, 2018). In their absence, we would never know anything because our minds would be devoid of any data or impressions of the world in which we exist. However, since the senses give us these impressions, we can analyse, categorize and make sense of them. To some extent, we will validly make claims to know how the universe works and make accurate predictions about it. In absence of these perceptions, one would not be able to formulate hypotheses to explain them, neither would they be able to correlate patterns of occurrence and suspect possible relationships that exist between or among variables. As such, discovery of new knowledge or any knowledge at all would be impossible. It is, therefore, logical to argue for the indispensability of the inductive method in understanding phenomena.

In order to avoid the subjectivity of observations, analysis and interpretation of data from inductive processes, scientists are guided by the need to make pronouncements that are solely influenced by evidence and logical assessment of this evidence. Peer reviews are done before publication of one's findings and it ensures that experts in a particular area of research examine the findings and evaluate them against the evidence submitted alongside them (Matsui, Chen, Wang & Ferrara, 2021). This ensures objectivity in reporting and admitting information into the body of knowledge.

Additionally, the inductive method is appropriate for scientific discovery because it allows for development and evolution of knowledge. One may argue that this is not a desirable condition in knowledge, however, it is a necessary factor in our epistemic pursuits because the human being is incapable of grasping reality as it is instantaneously. Our minds gradually accumulate knowledge and more often than not, new information will replace existing information that has long been held as factual. With the inductive method, this human frailty in knowledge acquisition is accommodated because theories can be revised, abandoned and replaced in accordance with new evidence at various stages of investigation. This adaptability is commendable especially in the 21st century where new and advanced technology offers new perspectives each day.

In conclusion, this section showed the indispensability of the inductive method and posited that there are shortcomings associated with it, especially its inability to guarantee accuracy and wholesomeness of knowledge. However, it is a method that serves as the root of all scientific investigation and cannot be abandoned because this action would render it impossible to ever know anything at all. In essence, the induction method can be made reliable by emphasizing on the need for sufficient evidence, checks against biasness or the influence of subjectivity (by way of peer reviews) and the recognition that induction accommodates improvement of knowledge claims in a gradual manner and on evidence-basis.

5.2 Pragmatic Truth in Scientific Inquiry

Scientific inquiry, as demonstrated in section 5.2 above, concerns itself with inductive processes of knowledge acquisition. For some scholars, especially those who hold that knowledge must involve truth as correspondence, the scientific method of inquiry does not accurately present the actual state of affairs. It was therefore imperative to examine the conception of truth advanced by inductivists so that one can evaluate whether these claims by proponents of correspondence are valid. This section examined the nature of pragmatism (as envisioned by its key proponents), and how scientific investigation culminates in pragmatic truth. The ideas of notable philosophers of science were presented for demonstration.

5.2.1 Nature of Pragmatism

The pragmatic theory of truth posits that a proposition is true if, when acted upon it results in practical outcomes that are satisfactory. This school of thought is informed by the understanding that knowledge is dynamic and subject to change when one encounters new ideas or evidence. Among the major proponents of this position include: Charles Sanders Peirce, John Dewey and William James. Their views on the nature of truth were discussed in this section to shed light on the key tenets of pragmatism.

Charles Sanders Peirce, in his work, *How to Make Our Ideas Clear,* describes truth as propositions or beliefs that are accepted at the end of an inquiry. Pragmatic theories, therefore, consider true propositions to be those which may be useful when believed, that are the end product of a process of inquiry, that have persistent rigorous scrutiny, or those that have met established standards of warranted assertibility (Peirce, 2020). Contrary to the correspondence theory of truth which views truth as a relation between a truth-bearer (the object of knowledge) and a truth-maker (the knower), the pragmatic theory of truth considers truth to be a function of the activities or functions that individuals engage in, as well as the commitments made by people during problem solving processes, when making assertions, or when conducting scientific investigations.

According to Peirce (2020), the meaning of a statement or proposition is necessarily linked to its possible implications or outcomes. This idea is informed by the understanding that our knowledge is not absolute, hence, can be disapproved even when we hold it for a long time as the truth. Mounce (2002) argues that this fallibility of knowledge is caused by scientific advancements that always result in new evidence, some of which may refute our beliefs and convictions about the universe. It is therefore wise to always keep an open-minded perspective which will enable scholars to continually refine their hypotheses and theories after running tests or conducting experiments which yield new findings.

He argues that pragmatism is a means of clarifying and testing ideas or concepts, hence we should not limit ourselves to just examining the practical value of these

concepts. Meanings of concepts used by humans can be understood by observing its practical effects on our beliefs (Riga, 2020). Peirce, in this context, is more interested in the methodology of inquiry as opposed to observation of specific beliefs.

Peirce's position is supported by Bain's claim that the sole purpose of empirical inquiry is to overcome the discontent and annoyance that arises when existing theories or beliefs do not offer satisfactory explanation for phenomena. Only empirical tests offer objective means through which we can seek to understand reality and predict future perceptions. Bain supports Peirce's claim that, if we lack such a methodology of inquiry our beliefs would be unsatisfactory to meet the goals for our inquiry, which is not to establish truth, but to find beliefs we believe to be true as a consequence of applying what we consider an objective methodology (empirical testing) (Zimmerman, 2021).

Scientific inquiry owes Peirce for introducing the concept of abduction. Abduction is a form of thinking which aids a scholar to make conclusions based on limited information. This form of thinking operates on the principle that, in the absence of definitive evidence, one should select the explanation that is most likely to be true. The best explanation will be determined by available evidence. If the evidence strongly supports a particular claim over others, then this claim will be accepted as the most probable solution to a problem or explanation for the phenomenon being investigated (Dreamson & Khine, 2022). The abductive process involves formation of hypothesis(es) which, if true, is more likely to offer a better explanation for an observation compared to other hypotheses. For example, one may not have sufficient evidence to know what happens in a different town from theirs, however, they may opt to believe as true claims made by a trustworthy person in the society as opposed to the claims made by a known pathological liar. If no one else except these two people was present when the occurrence happened, one will be justified to agree with the trustworthy person because there is overwhelming evidence that they have always told the truth whereas the liar will not be trusted due to their history of lying. Abductive thinking implies pragmatism because truth is determined, not by the actual state of affairs, but by what is implied by the evidence available at the time and has

utility. Further, it does not encourage differing judgment if evidence is insufficient. If an idea does not result in satisfactory outcomes, it is considered false.

In defence of the pragmatic nature of scientific inquiry, Peirce argues that despite the fact that this inductive approach to knowledge may sometimes be misleading, it will ultimately lead us to knowledge of the truth (objective truth) on any matter that we pursue (Hookway, 2012). At the present moment, we cannot shy away from pursuing knowledge if our expectation is to draw only objective knowledge. Its realization will only come if we start with our subjective inquiries into the nature of the universe with the hope of achieving truth someday. Further, Peirce demonstrates how abductive thinking is essential in bridging the gap between making observations and formulating hypotheses which ultimately become theories. If one does not formulate hypotheses because they do not have conclusive data, they cannot proceed to test the hypotheses to determine whether they are accurate or not. As a result, our pursuit of knowledge is hampered. It is therefore important to make judgments of this kind.

William James, another one of the major proponents of this theory of truth, argues that pragmatism is a method of resolving epistemic disputes and clarifying concepts. This is an idea that echoes Peirce's (2020) description of pragmatism. In his work, *What Pragmatism Means,* James (2020) argues that the truth of a proposition or an idea should be determined by its practical consequences as well as its ability to aid us in navigating the world we live in. The theoretical or abstract validity of ideas should not be used to define their truth, rather, their usefulness is a much more logical criterion of establishing this truth.

One may consider James' views on truth as instrumental because he asserts that truth of any statement is determined by its ability or effectiveness in helping one solve problems or achieve their purposes. Additionally, James' pragmatic theory of truth rejects absolutism which is characteristic of the correspondence theory. His argument is that the truth of a proposition is not independent of our minds and their experiences, but relies on context and can change when context changes and new perspectives are adopted (Russell, 2020). As such, we can validly claim that truth has a pluralist value, that is, various people can have diverse beliefs and perspectives and still be

considered valid in their thoughts. He argues that we have no single unified reality that can be perceived in exactly a similar manner by everyone who encounters it.

An assessment of the pragmatism of James demonstrates that he does not advocate for a theory of truth in which all knowledge is based on indubitable principles. Rather, knowledge should be open to new perceptions, ideas and judgments, and should value practical results of beliefs but not established doctrines.

James Dewey, just like Peirce and James, asserts that truth of a proposition is dependent on its utility. That means a proposition has meaning if it can be used to address the concerns or goals of an individual. This can be interpreted to mean that truth has an instrumental value and it is only achieved when it is helpful in solving a problem of issue at hand. In order to establish that a theory or hypothesis is true, he argues, it has to be evaluated through practical experience (Riga, 2020). This means that a theory may be in coherence with other beliefs or theories but still be considered false because it has not yet demonstrated its practical value.

Truth, Dewey (2022) posits, is a result of a democratic as well as a collaborative investigation which is not based on rigid and dogmatic principles incapable of adapting to new evidence. He further claims that truth is not an end point of investigation, rather, it is a level in a continuous process of investigation which brings out new perspectives, ideas as well as theories as new methods and more efficient tools of investigations are adopted.

Dewey proposes adoption of this pragmatic approach to not only scholarly ventures, but also in real life situations such as democracy and ethics. He stressed that ideas are useless and irrelevant if they remain abstract, however, they become meaningful if they are practically applied to address or solve issues in society (Riga, 2020).

The ideas of Peirce, Dewey and James may have slight differences, however, they all stipulate that pragmatism involves emphasizing on the consequences or outcomes of beliefs or ideas as the best criterion for truth. If one adopts the theory of truth that pragmatists propose, it means that they do not consider truth to involve rigid

correspondence of an idea in the mind with reality outside of it. It simply implies that this idea must have utility that can be practically demonstrated. Moreover, these scholars reject absolutism of truth because they consider it to be flexible and capable of change when new ideas or evidence are presented. In essence, a pragmatism insists on determining the truth of a proposition on its ability to produce results after undergoing empirical tests.

The pragmatic theory, as demonstrated above, advocates for subjectivity of truth, and in effect, subjectivity of knowledge. If one agrees with the basic tenets of this school of thought, they would argue for the existence of truth, even in cases where information does not cohere. For instance, the claim that truth consists in propositions that have utility can be used to show contradicting propositions in which there are practical results. This would render both propositions true. An example can suffice to explain this point. Suppose two different patients are participating in clinical trials; one is offered medicine while the other gets a placebo but they are unaware of it. When both take the pills, they get healed. Each of them believes that they have taken the right medicine for their ailment while in actual fact only one of them is right. A proponent of pragmatism may when this claim is made by the patient who took the placebo, it is true because the outcome was expected. However, the proponent of the correspondence theory of truth will claim that the belief and the actual state of affairs contradict, hence this patient's statement is false.

A further critique that can be advanced against the pragmatic conception of truth is that it seeks to substitute the objectivity of truth with statements that are instrumentally useful. This is an error in knowledge acquisition because truth and instrumental value of a statement are not synonymous, neither is one a prerequisite of the other (Capps, 2019). Skeptics of the pragmatic school of thought can argue that just because an idea is useful does not mean that it is indeed true. For example, in some societies, children are discouraged from playing in the rain by being lied to that rainfall causes malaria. This helps keep the children away from cold rainfall and mud, hence, keeping them away from potential germs. If a child believes this claim, they may not fall sick and in return, assume that they were given factual information. However, this is contrary to the truth.

These critiques to the suitability of the pragmatic theory of truth lead one to opt for the correspondence theory as the most suitable theory of truth in scientific research. However, correspondence as a criterion for truth raises more serious concerns. Firstly, there is the verifiability criterion. A statement is true if it is capable of being empirically verified. This means that it has to be compared with reality in order to establish if the idea agrees with the thing itself. The challenge arises when one realizes that this verification is impossible because the physical appearance of things is just that, an appearance, not things as they actually are. Reality and its appearance are two different things which should not be confused. Claims that scientific truth meets the correspondence criterion are mistaken because objective reality is out of reach of the senses. Reality in itself, as Kant demonstrates, is unknowable through empirical channels.

A closer inspection of the method of scientific investigation reveals that scientists are actually not interested in establishing correspondence of their theories with reality in itself, but they seek pragmatic solutions or explanations for reality. That is why they only accept theories as true if they meet expected outcomes. As such, pragmatism is at the core of scientific investigation and is the criterion applied to distinguish a good theory from a bad one. It may have its shortcomings, such as the ones mentioned above, but these can be remedied as demonstrated in chapter 7 of this work.

5.2.2 Pragmatism in Scientific Methodology

In essence, the scientific pursuit of knowledge is premised on the following pragmatic tenets;

i. Knowledge of the universe and its workings is possible, albeit systematically and over a period of time, through establishing how well our beliefs and theories are useful in solving problems and the strength of their predictive power.
ii. Human knowledge is a construct of our experiences. These experiences can be studied, patterns observed, and the meaning drawn out of it can be an explanation of how the universe is. Without these perceptions, we would not claim to know anything at all.

iii. The concept of truth at any given time is determined by human experiences at the time, the context or point of view of those interpreting these experiences, and the data available to the scientist at this time. This means that truth, at any given time, is tentative and subject to change over time

iv. Propositional knowledge about the physical world is not about the truth value (truth or falsity) in relation to the entity that it describes, or its source, rather, truth is about whether the belief leads to its predicted outcome.

In order to demonstrate how scientific research and progress is dependent on adoption of the pragmatic theory of truth, several philosophers of science were worth mentioning. They include: Karl Popper, Thomas Kuhn and Imre Lakatos. In section 2.3, the works of Popper and Kuhn were extensively discussed and critiqued. In this section, their ideas were presented, albeit briefly, and the Lakatosian philosophy of science also examined.

5.2.2.1 Pragmatism in Kuhn's Philosophy of Science

Kuhn, a philosopher of science, just like Popper has contrary views to how scientific knowledge is attained and advances. However, he still maintains a pragmatic approach in his philosophy of science. In his work, *The Structure of Scientific Revolutions,* Kuhn challenges traditional and classical epistemology by demonstrating that science does not progress by seeking static and indubitable truths that are achieved in a linear manner (Kuhn, 2012). Instead, his theory posits that paradigm shifts are the means through which science evolves. This means that any shift from one scientific paradigm to the next is determined by a shift or change in how scientific communities perceive phenomena.

Kuhn's Philosophy of Science presents human knowledge as a collaborative effort among empirical evidence, social, cultural and historical factors which define our approach and perception of phenomena. These factors influence the nature of our beliefs and what we consider knowledge (Nickles, 2012). As such, each paradigm will have its own principles that qualify as knowledge and these principles are not rigidly accepted. They can change when perspectives change. This, one may argue, is scientific development that is pragmatic in nature because what is considered

knowledge is subject to change based on how it adequately addresses the concerns of the paradigm.

In his discussion of normal science, Kuhn (1997) explains how scientific theories face anomalies and action is taken so as to address these anomalies without abandoning the scientific theory experiencing these challenges. As long as the anomalies do not completely compromise the ability of the theory to solve problems and make predictions, the theory will stand. During the period of normal science, addressing anomalies will be done with the aim of maintaining the validity of the theory in the paradigm, but not for the sake of disapproving this theory. Preston (2008) makes Kuhn say that an anomaly that can compromise the integrity of a paradigm violates fundamental principles of the theory in place and resists attempts by scientists to eliminate it from the paradigm. When scientists are unable to defend this paradigm, it is weakened and consequently undermined. At the same time, the crisis is escalated by emergence of a rival theory which seems to be better and more effective than the existing one. Eventually, this paradigm is replaced with the new one.

Additionally, Kuhn advances the argument that scientific acquisition of knowledge is not cumulative, rather, it is discontinuous. In his claim, he shows how a theory that is no longer effective in explaining phenomena and making predictions is completely abandoned, together with the methodologies, perspectives and assumptions that created it, and a new paradigm emerges. This new paradigm should not have any elements of the previous one because the latter is no longer valid and cannot fit into the point of view and assumptions of the former (Anand, Larson & Mahoney, 2020). His incommensurability thesis helps to clarify this point. Incommensurability means that two different paradigms have nothing in common and therefore it would be futile to attempt to reconcile them or merge them together. The concerns of each paradigm are different and their solutions cannot be effectively adopted in a different paradigm (Kuhn, 2012). Kuhn's work, therefore, is hinged on the assumption that knowledge is not objective, universal and standard. Instead, it is dynamic, depends on one's point of view, instruments of investigation and agenda or purpose.

Various critiques can be advanced against Kuhn's assertions that science evolves through paradigm shifts. For instance, his assumption that there is no continuity of ideas and principles from one paradigm to the next seem to be an exaggeration of how science progresses. It would be illogical to argue that once anomalies have rendered a theory insufficient to explain phenomena, it is completely abandoned and its tenets cannot in any way influence the next theory that replaces it. In some cases, a theory may be abandoned but some of its principles remain relevant. For example, in education, a system of learning is usually not completely abandoned and a new one adopted without some elements of the previous one. In Kenya, the new learning model, the Competence Based Curriculum (CBC) still has it some elements of the 8-4-4 systems such as retention of classroom models, levels of learning (primary, secondary and tertiary), and some subjects (e.g. mathematics, languages, religion, etc.) have still been maintained. This critique raises a valid point because not all epistemological advancements require a complete abandonment of previously held beliefs. This notwithstanding, the central concern of this section was to examine whether Kuhn's understanding of scientific advancement affirms the correspondence, coherence, or pragmatic theory of truth. A keen examination of his work leads to the conclusion that the insistence on practical outcomes for validation of theory agrees with pragmatic tenets. As such, one may associate Kuhnian philosophy of science with pragmatism.

Another critique to Kuhn's paradigm shift theory has been advanced by Ogundele and Ogunyomi (2020) who notice contradictions in his work. They argue that Kuhn's claim that paradigm shifts are caused by anomalies and insufficiency of theories to adequately explain and predict phenomena is contradicted by his assertion that a new paradigm is chosen based on its ability to avoid fault (anomalies). This critique is based on the assumption that if a paradigm is chosen due to its ability to avoid anomalies, then anomalies in the paradigm once it is adopted would not be a problem. They further think that a paradigm chosen using this criterion cannot be so adversely affected by anomalies to the point of being unable to solve problems and make accurate predictions. This critique, one may argue, is not entirely justified because scientific advancements are characterized by improvement of knowledge acquisition methods and techniques. This means that new information that was not anticipated at

the time of adopting a new theory and methods of research may come to light and significantly challenge existing knowledge. When this occurs, the existing theory becomes redundant and need for an updated and more precise theory arises. It is therefore logical to accept the fact that we cannot acquire new knowledge if paradigms are not challenged and replaced by more competitive ones. In addition, this critique does not cast any doubt on the pragmatic nature of scientific knowledge and its advancement as envisioned by Kuhn.

A further critique that may be advanced to challenge Kuhn's work is that the acknowledgement of irrational factors such as cultural social and historical factors in knowledge acquisition erodes the objectivity of knowledge pursuit. Such factors should not play a significant role in epistemic pursuit because they are subjective and may be influenced by ignorance, personal bias and insufficient evidence (Condé, 2023). However, this critique does not object to acknowledgement of empirical evidence in this process. If these three factors (social, cultural and historic) are eliminated from the pursuit of knowledge, the process will still remain pragmatic because it will depend on the availability of empirical proof to demonstrate validity or invalidity of a scientific theory.

On examining Kuhn's work, one may infer that his major interest is how consensus among scientists (a social process) plays a role in abandonment of theories or paradigms, but not the logical process of determining whether a theory accurately defines the reality it purports to describe. Kuhn risks being referred to as a relativist but in his defence, he argues for a revolution that is headed towards objective description of reality.

Just like Popper (who argues that we can never acquire knowledge due to the impossibility of conclusive investigation), Kuhn also rejects the possibility of paradigm shifts leading to objectivity in future by introducing his incommensurability thesis. The standards and principles of one paradigm cannot be used to assess another because they are both different and do not use similar theories or methodologies. One paradigm replaces another because the one that takes precedence dies off and the new paradigm defines science from that moment onwards until it is replaced. Given this

incompatibility of paradigms, one cannot claim that one theory is better and closer to truth than the other, but both explain reality using different points of views and experiences and each is relevant in different circumstances.

In conclusion, Kuhn's work adequately demonstrates that scientific advancement are pragmatic in nature. His work can be interpreted as a rejection of scientific realism, a school of thought that presents truth and consequently, knowledge, as objective and static. His introduction of paradigms and the fact that truth in each paradigm is determined by how well a theory solves problems is an acknowledgement that truth is pragmatic in nature; if it works it is true, if it fails, it is false.

5.2.2.2 Pragmatism in the Popperian Philosophy of Science

Popper's philosophy of science is not strictly pragmatic, however certain elements can be said to align with the basic tenets of pragmatism. For instance, he advances the view that scientific progress can only be achieved if scholars engage in critically testing and falsifying theories. These processes, according to Popper (2015), emphasize more on practical approaches to knowledge as well as assessment of the utility of the investigation outcomes. In his theory of falsification, he advocates for a method of seeking to refute a theory, rather than proving it right. This is contrary to the inductive method which seeks to justify the accuracy of a theory by seeking evidence that supports this theory. Nevertheless, one may argue that falsification advances pragmatism because it posits that a theory is accepted as valid until such a time when it is practically proven to be false by at least one counter instance.

Additionally, Popper's theory acknowledges the limitation of human understanding due to constant changes in methodology, perspective, investigation tools as well as knowledge. Just like the pragmatists discussed in sub-section 5.3.1, Popper embraces the concept of fallibility of scientific knowledge. He asserts that our knowledge is tentative and can be revised when new perspectives emerge and they contradict an existent theory or belief. When new evidence is found, new beliefs are formed and they in effect replace the falsified ones (Popper, 2002). In essence, one can validly argue that Popper's stance on scientific theories is that they are conjectural and do not correspond to reality as it is (Gorton, 2012).

Thirdly, is important to note that inductive and deductive logic do not establish the accuracy or truth of a scientific theory; however, they can be effectively used to establish the falsity of these theories. For example, in the claim that "All Swans are White because the observed ones were all white," one may declare that the conclusion is false through deductive logic. Science, therefore, begins with attempts to refute theories, not with observations as claimed by inductivists (Popper, 2002). A theory that has withstood these tests can be accepted, but only tentatively. This makes it impossible for one to know any scientific theory because new evidence may come to light in subsequent tests and falsify the theory. For example, the claim that all Swans are white will be falsified when one black Swan is observed. The theory that all swans are white will be abandoned immediately this discovery is made. Therefore, Knowledge, in the proper sense of the term (objective and static), according to Popper, is impossible in scientific investigations.

An acceptable scientific finding must be achieved after a rigorous process of observation of a phenomenon, gathering data about it, and testing it to verify the truth of a hypothesis that has been formulated to explain it. Findings of specific instances of a phenomenon are then generalized as the properties of phenomena of the same kind. Testing the hypothesis, analysing the findings and publishing or sharing them with the scientific community is an important part of this process because it enables scientists to make public their findings and add to the bod of knowledge (Popper, 2015). This, at face value, seems exhaustive enough to guarantee certainty of the findings; however, Popper considers it far from achieving truth.

Popper embarks on a demarcation criterion which he assumed would provide an objective methodology of distinguishing science from pseudo-science. He is also interested in prescribing a better methodology of gathering scientific data and determining the truth value of a scientific theory (Popper, 2002). This means that his work is not only evaluative, but also prescriptive. He argues that scientific adoption or discarding of theories should be done through a rational process. This conception of science agrees with the pragmatic principle that theories which fail empirical tests

should be abandoned and replaced with one that adequately explains reality as perceived.

Knowledge, according to Popper, should be sought in an open-minded perspective. This means that we should not have predetermined conclusions or principles in our mind because they may distort it. (Mitra, 2020). A flexible mind accepts changes and new perspectives and abandons them when new and more compelling evidence is availed. This principle is similar to the pragmatic theory's tenet which posits that knowledge acquisition should involve a process that allows one to abandon a theory due to its inability to fulfil required outcomes and adopt as true one that satisfies their need or meets expectations.

Nevertheless, one may raise some objections to some of Popper's conclusions. Firstly, falsification is not historically valid. This method ignores the fact that scientific knowledge advances through acquisition of new data and testing of theories in various situations which it claims to explain. A scientist discovers more information systematically and over a period of time, as demonstrated by Kuhn's work. If a scientist adopts Popper's falsification, their theories will be incapable of being utilized anymore by observation of a single contradictory incident. Most scientific theories, which are capable of being adjusted and adequately explain reality, will be abandoned in their infancy. Refutations should be ignored, at times, when there is hope that making adjustments will make the theory have more accurate explanation for reality and improve its predictive power. This critique, in as much as it raises logical concerns, does not refute the claim that Popper's theory of science advances a pragmatic conception of truth. It is therefore valid to argue that Popper is not a proponent of correspondence, coherence or any other theory of truth other than pragmatism.

Popper's work clearly demonstrates how scientific disciplines seek and acquire knowledge of the physical world in which we live. These disciplines adopt a pragmatic method which focuses on the workability of ideas and as Popper argues, the only justification one should have, for abandoning a theory in favour of another, is if at least one occurrence of a counter observation proves the theory wrong. As such, the

outcome of the investigative process is what ultimately determines a theory's acceptance of rejection. A pragmatism would argue that this is a practical approach that focuses on the usefulness of a theory in making explanations and predictions in order to maintain its validity.

5.2.2.3 Pragmatism in Imre Lakatos' Proofs and Refutations

Lakatos, in his work, *Proofs and Refutations*, seeks to reconcile Popperian Falsification and Kuhn's paradigms explanation of how scientific knowledge unfolds. He thinks that both take extreme positions. He argues that we do not have a perfect theory, rather, we should think of theories as acceptable because we have not yet found their counterexamples. This means that no theory can be deemed to be absolute or objectively true. Even when a counterexample has been found, the theory should be adjusted to address the concerns that arise from this occurrence (Lakatos, 2015).

The introduction of the concept of 'Research Programmes' by Lakatos was a deliberate attempt to reconcile Popper's concept of empirical validity with Kuhn's insistence on the need for conventional consistency. A Research Programme can be understood as a 'professional network of scientists conducting a basic research'. Lakatos further describes it as a sequence of theories or components of large cognitive units within a domain of scientific inquiry whereby each later, or successor, theory, is held to mark an advance over its predecessor (Lakatos, 2015).

A Research Programme has two components; a hard core and a protective belt. A hard core entails a set of assumptions about the universe or an entity that cannot be altered or surrendered without compromising the entire program altogether. This hard core is considered immune to refutations (or falsifiable) and lack of conformity between the theory and the object of study will be attributed to the protective belt of the theory (Larvor, 2013). This part is constituted by a group of assumptions, commonly referred to as auxiliary hypotheses. These hypotheses are expendable, depending on their conformity to the theory. As such, they can be altered or eliminated altogether if they cannot be manipulated to protect the hard core. Auxiliary hypothesis can be altered to enhance the programme's explanatory or predictive capacity (power) (Lakatos, 2015).

Research programmes can be generative or degenerative depending on the impact of adjusting their auxiliary. If the result of this alteration is increase in the predictive and explanatory power of a theory, then the theory is generative but if the result is a reduction in these powers, then the programme is degenerative and will need to be replaced entirely. Scientists replace a degenerative programme with a new one with higher predictive and explanatory powers (Lakatos, I., & Feyerabend, 2019). Lakatos' Research Programmes are more concerned with whether theories produce new scientific facts as opposed to whether hypotheses are true or false. If a research programme is progressive, scientists are justified in continuously adjusting the protective belt in order to address anomalies that may arise.

Every Research Programme has a set of rules which guide the scientist on what to do and what not to do. Lakatos refers to these rules as 'heuristic'. He divides them into two; negative and positive heuristic. Negative heuristic makes reference to what a scientist is not allowed to do; for instance, adjusting the hard core of the research programme they are working on. The positive heuristic includes what a scientist should do within the programme; for example, how the protective belt should be modified to make a research programme more productive of novel information and predictive power (Nickles, 2017).

Lakatos' work can be accurately said to be a synthesis of both Poppers falsification and Kuhn's philosophy of science. More critical to this study is the observation that Lakatos does not claim that scientific research yields absolute truth as understood in epistemology. As a matter of fact, he can be associated with the pragmatic school of thought which posits that acceptability and truth of a proposition at a given time is determined by its usefulness. If, for instance, a theory's hard core is enhanced by its protective belt, one would be obliged in accepting the theory as true on account of new information and an improvement in its predictive power. In this regard, therefore, truth of this theory lies not in its actual pronunciation, but its results.

Lakatos' account of science, just like Popper's and Kuhn's, appears to contradict the conventional understanding of the nature of truth in knowledge. It portrays truth as a matter of a theory's practical value but not agreement with reality as it actually is. The

Lakatosian Methodology of Scientific Research Programs (MSRPs) asserts that a viable program is one that can explain the observed world, make accurate mathematical phenomena and at the same time, withstand attempts to refute it. If a program fails to achieve these requirements, then its background assumptions are modified in an attempt to strengthen the entire whole. In essence, one is justified in concluding that Lakatos' account of scientific advancement is hinged on the conception of truth as pragmatic, not correspondence. The fact that it allows for evolution and revision of ideas over time adequately demonstrates this point.

Moreover, Lakatos 'work presents one with a framework for arguing for pragmatism in science. He firstly acknowledges that knowledge (specifically, in mathematics) is fallible and can be revised. Revision of any theory requires dynamic critique and replacement of irrational components and this cannot occur if the scientist is not guided by new and more robust empirical evidence. It also implies that what we consider knowledge at a given time can only be tentative and subject to refinement when new information is discovered (Morgan, 2022).

This Lakatosian concept of knowledge mirrors the pragmatic tenet that knowledge is tentative and is subject to change, especially when it is proven incapable of adequately solving problems and making accurate predictions. For instance, treatment of malaria has experienced an evolution of drugs at various points in time. Quinine was the first medicine to be introduced as an intervention but cases of drug resistance were reported and this necessitated refinement of the drug to reduce these resistance instances. However, scientists sought to develop new and more effective drugs such as chloroquine, Proguanil, Sulfadoxine-Prymethamine, among others. When patients developed resistance to an existing drug, a new one was made and the cycle was experienced all over again (Dagen, 2020). At the time when a specific medication was considered a cure, it was regarded as such due to its ability to completely eliminate the disease, however, when it lost the ability to do so, it was no longer considered appropriate and a new one had to be created for the same purpose. This evolution of ideas is not only in medicine, but in all fields of empirical inquiry.

Lakatos further adopts pragmatic principles in his advocacy for a heuristic role of counterexamples in scientific acquisition of knowledge. According to Zeng (2022), counterexamples play a crucial role of challenging theories that are in existence and considered accurate. In some instances, these theories are found to be wanting and are replaced by others which achieve the goals of science. A counterexample, in any research process, helps to refine a theory, make it more accurate and increase its predictive power.

The discussion of Lakatosian philosophy of science adequately demonstrated that scientific knowledge agrees with the pragmatic conception of truth, as opposed to the conventionally accepted correspondence theory. This raises epistemic concerns because if one were to consider truth as pragmatic, it would, as a consequence mean that knowledge is subjective, dynamic, subject to refutation and in effect, unattainable when empirical methods are adopted. This conclusion also holds for both Popper's and Kuhn's accounts of science. This concern was addressed in chapter seven of this thesis.

5.2.3 Probability and Confirmation of scientific Theories

The discussion on the pragmatic nature of science leads one to conclude that that our claims to knowledge can at best be probabilistic, if we define knowledge in its objective sense (corresponding to reality). Scholars such as Popper, Kuhn, Lakatos, and others opine that this tentativeness notwithstanding, we still can make valid claims to knowledge. Scientists assume that if something (p) is a logical consequence of another (q), then it follows necessarily that verifying that p is true will lead to concluding that q is true as well. We can only talk of this relationship between beings with extension, not abstract realities. These abstract realities are not known or understood through the senses (Bird, 2013). And therefore, the question arises, "can abstract realities which cannot be directly perceived by the senses be adequately explained by science?" Some of these realities include; atoms, magnetic fields, electrons and mental representations of things. In response to this question, a scientist may argue that these realities may be out of reach of perceptive methodologies but theories offer predictions on how these beings affect perceivable realities that can be tested and observed.

A proponent of the possibility of scientific theories in explaining abstract realities may claim that a theory that has consistently predicted how these realities affect physical beings or processes is a valid one and should be accepted as true. This is not based on a verified cause and effect relationship between the abstract reality and the consequences of the theory, but on an inductive arbitrariness which has no logical basis. Nevertheless, philosophers of science such as Leplin (1986) would argue that, since it has not been falsified, then it should be accepted until such a time when its prediction is realized. Further, there are already sufficient grounds to acceptance of the theory as an accurate account of the state of affairs. The scientist will be convinced that the probability of it being accurate is high, hence or should be adopted as an explanation of that reality. This justification by Leplin can be compatible with scientific realism, the school of thought that argues that abstract realities can be sufficiently explained on probative grounds. Scientific testing and application of theories can result in outcomes that provide sufficient grounds for one to believe that these theories offer an adequate explanation for the reality they describe (Ladyman, 2018). It is not enough to claim that these realities exist; we also have to offer an explanation of how they are and how they behave under certain conditions. Once our prediction of their behaviours in these conditions is verified through observation, we can make a case for acceptance of our theory about them.

Leplin's argument seems valid; however, we may argue that he abandons logical justification of theories when he proposes their acceptance based on their appearance to work and lack of evidence that they are false. He creates an accidental (coincidental) relationship between what is observed and what the theory predicts, without considering if there are other conditions or entities responsible for these observations.

An argument for accepting highly probable theories as true can be presented in response to the critique of Leplin in the paragraph above. It is a common occurrence to rank our beliefs based on their probability of predicting reality. For instance, one can claim that they are 100% sure that corruption in Kenya will not end in 2024. Their claim that this statement is true is based on their observation of an increase in

corruption and impunity in the last decade, as well as the evidence available showing that elimination of corruption requires a lengthy period of time. This belief will be accepted as true if the year 2024 ends while Kenya is still bedevilled by corruption. The claim, during the year, will be considered true because there is a high probability that it makes an accurate prediction. A theory formulated from this belief will therefore offer a valid account of corruption in Kenya. Locke (2004) presents an argument that agrees with this assertion. He argues that a belief is rational if it has a sufficiently high degree of belief.

Since scholars (philosophers, scientists and any others) can never adequately demonstrate the necessary link between a theory and observed consequences of an empirical test, they accept or reject these theories on their subjective interpretations of the results. A theory is accepted if its predictions are observed, without the researcher necessarily examining if other factors could be involved in facilitating this outcome. In essence, in describing reality, especially, existence that cannot be perceived, scientists rely on theories based on their conformity with expected outcomes.

Scientific methods, if applied appropriately, lead one to conclude that they can have knowledge, even if it is limited, about the physical universe. This certainty can be used to make claims that one possesses knowledge. Certainty makes reference to the degree of conviction or belief that one knows something. It arises from possession of evidence about a belief or claim as well as lack of doubt or skepticism about it (BonJour, 2020). For example, one can be certain that the sun will rise tomorrow, even if they do not have 100% proof that that is the case. This certainty will be based on previous observations as well as an understanding of how the solar system functions. Scientists use evidence available to them to make claims and predictions (which they consider to be certain of) about the universe. Certainty, however, is not a guarantee that one is accurate. It is therefore possible for one to be certain of something and still be wrong at the same time. Scientific knowledge, while heavily reliant on empirical evidence, instils a sense of certainty in scholars and some may mistake this to be truth.

One can definitively argue that scientific claims to knowledge are influenced by certainty, but not knowledge of facts (knowledge of things as they actually are). It is therefore based on probability (truth may be highly probable or unlikely) (Moore, 2020: Williams, 2020). For instance, at the time when the geocentric theory of the universe was abandoned in favour of the heliocentric theory, scholars, religious people, societal leaders (including religious ones) were certain that the earth was at the centre of the universe because human observations perceived the sun to change positions over the course of the day, hence signifying motion. However, upon critical assessment of this claim, it was found to be false (Ayoob, 2021). This is a clear demonstration that certainty is not a prerequisite for knowledge of things in the strict sense of the term.

Despite the fact that highly probable theories are accepted in science, there is still room for error in interpretation that may arise due to impaired, biased or erroneous observation. In cases such as these, some scientists may use statistical methods to quantify possible uncertainties as well as examine the reliability of empirical methods and theories. This, however, is not sufficient because there is still the possibility of error. This margin of error is occasioned by the fact that experimental results are not absolute or comprehensive. In order to remedy this challenge, scientific investigation demands for peer review of findings in order to seek and correct biases and subjectivity that may distort the results (Matsui, Chen, Wang & Ferrara, 2021). Researchers, other than those who conduct experiments and introduce new knowledge, examine the methodology, quality and quantity of data utilized, professionalism in research, as well as the logical correctness of the research findings in order to guarantee the validity of this new knowledge. In its absence, it is possible that the research findings may be skewed towards the interests of the researcher.

Objections may be advanced against the scientific method's reliance on probability. One of the arguments that may be presented is that these empirical tests can satisfactorily explain what is observed (the question, what?) but is incapable of explaining underlying mechanisms of phenomena (the question, why?) (Katzner, 2023). Observations can only explain what is experienced by the senses, however, the causes of these experiences as well as how they occur may be difficult to understand

because they are not available to the senses. Concerning this objection, one may adopt the Kantian explanation that we can only have experience and knowledge of *phenomena* (physical appearance of things) but not of things themselves (*noumena*). As such, the researcher should not be interested in seeking to know that which is beyond their limits, but seek to understand the nature of things as they present themselves to us. If this response is accepted, then the pragmatic principles will still stand as the guiding tenets in scientific investigation.

The discussion above demonstrated that certainty has within itself elements of probability but it cannot be cast aside in formulation of theories or creation of new knowledge. This is because a probable theory needs to be tested and if the results show that has a practical value and gives expected outcomes, then it is accepted, albeit tentatively, as true. A skeptic would doubt the validity of probability in knowledge acquisition because it offers no guarantee that the outcome of empirical investigation will be accurate and objective. However, if one abandons the scientific method, they would not be able to acquire any knowledge whatsoever. An apologetic of the scientific method would argue that, despite the fact that this method does not guarantee truth (correspondence) or knowledge itself, humans get closer to it by continually improving their understanding of reality and abandoning irrational explanations. Absolute certainty may not be possible, but practical certainty leads us closer to it.

As such, probability plays a significant role in scientific knowledge acquisition. This raises another challenge. How can a scientist establish accuracy of their theories if they cannot attain conclusive proof of their truth? Further, are empirical tests sufficient in explaining the nature and behaviour of non-observed realities? These questions were extensively addressed in chapter 7 of this thesis.

5.2.4 Preference of Pragmatism over Correspondence conception of truth in Scientific Investigations

The pragmatic theory of truth is indispensable in any empirical pursuit of knowledge because it determines the truth of any proposition on the basis of the proposition's (or belief's) practical consequences (James, 2020). Practical outcomes of the belief must

be examined to determine whether the expected beliefs cohere with an already established set of belief system (Peirce, 2020). This pragmatism identifies with the goals and concerns of individuals in the society thereby making truth more relevant and practical to human experience. The best alternative to pragmatism would be the correspondence theory which would guarantee that our knowledge claims are firmly backed by agreement of our ideas with reality itself. However, reality in itself is beyond the scope of our empirical perception, hence, achieving correspondence is not possible. Additionally, suppose we could be able to compare ideas with things as they are, we would still rely on the senses which have been deemed unreliable (by rationalists) in knowledge acquisition. As such, we would still be unsure of whether our perceptions really correspond to reality or our ideas are founded on mistaken grounds.

This theory is also preferred by scholars because it makes truth less rigid and adaptable to contemporary changes in methodology, perspectives, and research tools. Beliefs can therefore be examined based on their satisfaction of expected outcomes. According to James (2020) and Rorty (2020), pragmatism allows truth to have a dynamic nature and evolve over time in regard to changes in the world. In essence, this theory holds that truth is not determined by abstract principles and a proposition's correspondence with the reality it describes. Truth, this theory asserts, is also determined by point of view, human values, and objectives. As such, it cannot be alienated from the individual who knows. Beliefs that are based on tangible outcomes are more acceptable than ones accepted on abstractness that is not verifiable or accessible through our faculties of knowing.

One may argue that the pragmatic theory is justified in scientific research because of the following reasons. Firstly, there arises verification challenges when one seeks to examine the correspondence of an idea with reality (Russell, 2020). When dealing with abstract or complex ideas, it becomes difficult (in some cases impossible) to acquire knowledge of the actual nature of reality because it may be beyond the grasp of the senses. However, pragmatism can adequately explain the nature of this phenomenon by relating the idea with its expected output. Phillips (2020) vindicates pragmatists by arguing that if it produces the expected outcome, it is considered

factual, but if it fails to meet the expected results, it is considered false. This justification, one would argue, offers concrete grounds, away from speculative bases, for knowledge, that can be easily verified or disapproved.

Secondly, if one adopts the correspondence conception of truth they cannot be able to determine if their ideas correspond to the reality it describes. In fact, proponents of the correspondence theory offer no criterion to determine how well ideas agree with actual objects or the acceptable degree of correspondence required to make a belief true (Vision, 2023). This leads to ambiguity in the definition of truth and could cause lack of consensus and agreement on what truth constitutes. Vision's claim can be affirmed by human experience which only affirms that the truth of an idea conforms to reality it describes but does not have a concise way of determining the nature of this reality or how it can be assessed by way of the senses (which are primary in acquisition and pursuit of human knowledge). How, then, one may wonder, can we know when our ideas are corresponding to reality yet we cannot know this reality using our usual channels?

In addition to the concerns raised in the paragraph above, one may ask, "how can our subjective experiences conform to an objective reality?" this question is triggered by the realization that knowledge is depended on subjective factors such as point of view, tools or instruments used in investigation, cultural and social factors, among other considerations. All these make our perception of things and ultimately formation of ideas concerning these perceptions entirely subjective. Subjectivity refers to biased thinking and it is not compatible with reality in its objective sense. Pragmatists argue that it is possible to know in our subjective states because there are other criteria for determining truth other than just correspondence, however, advocates for correspondence claim this is an erroneous claim (Wills & Lake, 2020).

Additionally, cultural and historical contexts differ over time, each epoch has its own cultural values which influence the thinking and action of people at that time. As time changes, so do these values and actions. Ultimately, their belief systems and claims to knowledge will gradually evolve. As such, it would be impossible to hold a belief as true over an extended period of time, unless it has been adequately verified and has

sufficient proof to support it. This assertion is collaborated by scholars such as Singh, Mazumder & Namboodiri (2021) as well as Ravetz (2020). They argue that at no given time can one validly argue that they have entirely of knowledge concerning the universe and how it works. Knowledge is bound to change because new methods and ways of thinking are invented each day and they introduce new perspectives which may challenge existing knowledge claims.

The arguments presented above clearly demonstrated the relevance of pragmatism in empirical research. They illustrated the shortcomings of correspondence as a theory of truth, especially when one needs to compare a belief with the actual state of affairs. From these arguments, then, one may conclude that pragmatism is justified. On the other hand, vital questions can be raised on the suitability of pragmatism in knowledge acquisition.

Firstly, the subjectivity that arises when pragmatism is used to determine whether propositions are true presents a challenge in establishing truth because different perceptions and interpretations of information lead to formulation of different conceptions of truth (Capps, 2020). It is illogical to describe the nature of truth as subjective because it would allow for acceptance of contradictory beliefs as valid, yet they represent the same reality.

In response to this critique, a pragmatist may raise the concern that if at all humans were to acquire knowledge of things as they are, they would not rely on senses or any other empirical means. Human knowledge, however, is limited to rely on sensation such that without any of the five senses functioning well, we would not be able to understand anything at all. For instance, if one lacks proper functionality in these senses, they would not be able to feel the texture, temperature, or shape of anything, they would be completely ignorant of any information derived from sight, knowledge of anything communicated through hearing would be impossible, taste and temperature would be alien to them, and the possibility of understanding scent would be nil. It is therefore imperative to acknowledge sensations in human understanding. The correspondence theory of truth requires an abandonment of the senses, which would not be possible if we were to know anything at all. Reality in itself is

inaccessible to humans and therefore advocacy for correspondence in human knowledge is not justified.

A second critique that can be advanced against pragmatism is that it focuses less on the actual nature of truth and more on the instrumental value of beliefs. Snelgrove (2022) asserts that instrumentalism of this theory means that it is interested in establishing the practical value of beliefs rather than whether these beliefs really represent the actual state of affairs. Moreover, according to Perkins (2020), there is lack of an objective evaluative standard for beliefs outside human experience and usefulness of these beliefs. It is therefore difficult to ascertain that the belief is true especially when there is a pattern of adoption of beliefs as true but they are later abandoned when it is established that they are false. In defence of pragmatism, one would argue that it is appropriate for human pursuit of knowledge because our cognitive processes acquire, interpret and give meaning to experience in a gradual way. In such a cognitive system, it would be impossible to know everything as it is at once, it is therefore essential to always scrutinize and evaluate our knowledge claims, abandoning false beliefs and strengthening accurate ideas until such a time when we will have clear understanding of reality. The pragmatic treatment of truth as instrumental is therefore necessary because it helps us to improve existing ideas and add new knowledge.

These objections to the pragmatic theory of truth raise an important element of scientific pursuit of knowledge; verification. The criterion of verification of knowledge in pragmatism is the outcome, which is a theory's ability to provide practical results or demonstrate utility. This criterion, at face value, seems good enough, however, it offers a vague methodology which may not lead to knowledge acquisition. For example, Hume argues that we attribute causality in instances where we experience correlation and make assumptions that one occurrence is the cause of another. Empirical evidence may always show two events occurring frequently, in the same sequence, and in close proximity, and this may lead one to assume that the one that occurs first is the cause of the preceding occurrence (Lange, 2011). If we solely rely on empirical evidence, we can never draw a different conclusion. However, if the criterion for truth involves more than just observation and focus on the consequences,

then one may be able to identify other factors and potentially disapprove this assumption.

5.3 Conclusion

This chapter presented the nature of truth as adopted by scientific methods of investigation. It was found out that scholars in philosophy of science agree that science does not conceptualize truth as correspondence because human perceptions vary from one person to the other and reality in itself is alienated from the senses (which are the conduits through which knowledge is acquired in humans). Their adoption of truth as pragmatic is informed by acknowledgement of this subjectivity of human experience, variations in data collection and analysis instruments, as well as production of tangible outcomes in scientific methodology. As such, the epistemological conception of truth as correspondence has not been met in scientific research. The following questions arise, "does it mean that science cannot offer us knowledge of reality? Can the correspondence and pragmatic conceptions of truth be synthesized? If not, is it logical to abandon scientific pursuit of knowledge because we can never get it?" these questions were extensively interrogated in the seventh chapter. In the next chapter, an examination into the nature of the Duhem-Quine thesis was done and its epistemic implications evaluated.

CHAPTER SIX

THE DUHEM-QUINE THESIS AND ITS IMPLICATIONS FOR SCIENTIFIC CLAIMS TO KNOWLEDGE

6.1 The Duhem-Quine Thesis

This thesis is sometimes called the Duhem-Quine problem and it states that it is impossible to test a scientific hypothesis in isolation. This is position held by both Pierre Duhem and W.V.O. Quine. They posited that any scientific theory has within itself unstated o implied assumptions that play a significant role of ensuring coherence in the validity of the theory (Szalek, 2020). These assumptions can be beliefs or statements not explicitly pronounced, or methodological and sometimes, even theoretical (Evans & Thébault, 2020). Consider the following for example; research techniques, instruments, the procedures used in experimentation (e.g. the order in which compounds are introduced to a solution), models, and principles, among others, significantly determine the nature and validity of research findings in any scientific investigation. If they are altered, they may result in acquisition of information contrary to what one would have attained if the initial order had been maintained. These assumptions are known as auxiliary assumptions or background assumptions. Any hypotheses must be founded on some auxiliary assumptions and any test that is done to this hypothesis cannot be said to be solely done to it (Fairweather, 2012). These background assumptions are the theoretical framework on which the hypothesis was formulated and that means its acceptance as a valid theory will be acceptance of the background assumptions as well. Its rejection will require an assessment to determine which background assumption is defective.

For instance, one wants to test the hypothesis that liquid X boils at 90 degrees Celsius. They will not only have this hypothesis but also have assumptions such as; the liquid being tested is actually X, it is pure, not tainted, the apparatus used to test it is in good condition, among others. Once the test is done and unexpected results are received, it may not be clear which part of the hypothesis, its background assumption, or the entire theoretical framework should be revised. Since auxiliary assumptions are integrated into the whole testing or experimentation process, it is necessary to evaluate them to determine whether one or more of them are the reason for the failure.

If found to be at fault, a, auxiliary assumption can be revised or adjusted accordingly to make the hypothesis valid.

This means that scientific hypotheses cannot be isolated from their background assumptions and theoretical frameworks, hence making it impossible to objectively falsify the hypotheses. As a consequence, scientific knowledge can only be said to be tentative, not objective because a theory can still be maintained even when overwhelming evidence is presented. Maintenance of this theory will be done through making adjustment to auxiliary assumptions that will be found to be problematic (Massey, 2011). In the section that follows the independent works of both Pierre Duhem and W.V.O. Quine were interrogated to establish their respective contributions to this thesis.

6.1.1 Pierre Duhem's Theory

Duhem's work, *The Aim and Structure of Physical Theory,* demonstrates the nature of scientific theories and the outcome of experimentation aimed at testing their accuracy. The work begins with an explanation of the relevance of physical theory. He argues that these theories have two major roles: firstly, it seeks to explain the nature of a group of laws that have been established experimentally, and secondly, it summarizes and logically classifies a group of experimental laws, but does not explain them (Duhem, 1954).

This means that when conducting experiments or empirical tests, we involve metaphysical explanation of things. Theories that are tested are an abstraction of many other theories and background assumptions that have been summarized as one theory. A theory, therefore, is a work of both abstraction and generalization. According to Szabo (2020), abstraction occurs when we observe a number of physical or concrete but distinct and particular occurrences and summarize what is common and essential among them. We then formulate a theory to explain this set of beings and it becomes a law. Upon examination of Duhem's insistence on abstraction and generalization as criterion for knowledge acquisition, one may argue that certainty is not guarantee because these processes overlook important elements of reality and focus on a limited part.

In this work, Duhem (1954) observes the limitations of induction (attributed to the scientific method) as follows: when one conducts an experiment, they seek to acquire an approximate value of something. Scientific facts are therefore composed of two elements; the object or entity being perceived, and a theoretical act which gives or assigns an exact worth to the object. The terms, "truth" and "certainty" have only one relevance in scientific tests, and that is to express the concordance of the theory and the rules established by the researcher (de Broglie, Vuillemin, Wiener & Duhem, 2021). It is therefore valid to argue that Duhem's understanding of science veers off from the epistemic understanding held by proponents of correspondence. The concept of truth, a proponent of correspondence will argue, is not a tool for determining how a hypothesis or theory produces expected outcomes.

This work demonstrated the impossibility of directly verifying or even falsifying scientific theories through presentation of physical evidence. As demonstrated above, scientific theories involve both abstraction and generalization and it means that one theory contains within it many other theories. If one were to start analysing one theory, they have to also examine the background theories. Each background theory has its own background theories, and this implies that the investigation process will be infinite. Any theory will have within itself an interconnected series of networks and effectively testing one will only occur when all of them are tested. It is on this theoretical framework that scientific knowledge is built and systematically refined over a period of time.

According to de Broglie, Vuillemin, Wiener & Duhem (2021), the observational consequences of any theoretical hypothesis requires another set of theories to interpret it and as a result, no theoretical hypothesis has any observational consequences by itself. From this claim, one may infer that experimentation in physics is not simply the observation of phenomena, rather, it involves precise observation and interpretation of phenomena. An example will suffice to demonstrate Duhem's point. Supposing an experiment to test the volume of a gas needs to be done, it would be impossible to make direct observations of the result of this test. The outcome of the test is reliant on the validity and accuracy of the tools used. These tools are sophisticated entities and

are formulated and calibrated based on other theories. In essence, the theories on which these tools or instruments are formulated and calibrated will also be involved in the test. These theories will be based on other theories and assumptions as well. This foundational process can involve many theories, hence, making testing of the initial hypothesis comprehensively difficult because it is impossible to carry out all tests for all background assumptions at the same time one is testing the volume of the gas. Once the test outcome is out, we cannot with certainty say that it represents the actual state of affairs, we can only compare the outcome with the expected results based on our theory and determine if both agree. This, one may argue, means that truth is not referenced as the agreement of an idea, hypothesis, or theory with reality as it is, rather, it has a pragmatic value which consists in the ability of ideas to produce desired observations (sometimes after being adjusted accordingly).

Additionally, in his work, Duhem (1954) advocates for the adoption and adherence to the principle of conservation of matter. This principle asserts that matter cannot be destroyed during physical processes. As such, its quantity remains constant over time if it is in a closed system, even when it undergoes various transformations. When scientists incorporate this system into their theories, it helps them to develop models that accurately explain the behaviour of physical systems. These theories also have internal consistency and coherence of ideas which makes them consistent with scientific knowledge. An examination of Duhem's insistence on this principle as a consistent basis upon which theories should be formulated may lead one to conclude that he advocates for foundationalism in science. Conservation of matter, one may argue, is a foundational principle effective in shaping our scientific understanding as well as demonstrating the importance of coherence and consistency in knowledge acquisition.

The concept of accuracy or exactness as used in Duhem's work greatly differs from the same concept in an epistemological perspective. In empirical science, this concept makes reference to the agreement of the outcomes of experimentation with the accepted degree of approximation. In epistemological terms, accuracy makes reference to the agreement of the outcomes of experimentation with the actual state of affairs (Brenner, Needham, Stump, & Deltete, (2011). Duhem (1954), in his sixth

chapter, claims that there is only one purpose of a physical theory; to represent and classify experimental laws. We can only judge a theory as good or bad by comparing the consequences of this theory with the experimental laws it represents and classifies.

According to de Broglie, Vuillemin, Wiener & Duhem, (2021), Duhem's work limits this thesis to physics and he is silent on whether the same applies to all other scientific disciplines. He does not exclusively argue that all scientific hypotheses confront observation directly, rather, he demonstrates the case for impossibility of direct observation in physics alone.

Duhem makes a contribution to instrumentalism in his work because he claims that the authenticity of a scientific theory is not based on its accuracy in explaining the universe, rather, in its utility in explaining and making predictions about the physical world. This means that if a theory accurately describes the universe (we would not be able to know this), it would not be considered factual unless it produces expected or required outcomes. This emphasis on utility rather than accuracy also means that scientific knowledge is not in accordance with the truth condition accepted by epistemologists (correspondence), hence, making knowledge (in the proper sense of the term) impossible in science.

Additionally, the theory-ladenness of observations, as explained in Duhem's thesis, means that our observations of phenomena are not direct, free from bias and objective. Instead, they are influenced by theories of phenomena that we have formulated and ultimately, these observations will be interpreted in accordance with these theories. For example, during an experiment to test the reaction of compound X when mixed with compound Y, the researcher will have assumptions about how the two interact and the reactions expected. Their observation will already be influenced by these assumptions such that whatever they observe will be interpreted and given meaning in accordance with these theories. If expected outcomes are observed, the researcher will confirm their assumptions as accurate (even if the observed outcomes were influenced by something else) and if unexpected outcomes are observed, the assumption will be that either the theories are wrong, their background assumptions were wrong, the procedure was not properly done, or the researcher used tainted

compounds, among others. In essence, then, one may argue that attaining knowledge in its proper sense is impossible and that our claims to knowledge only make reference to the usefulness or practical value of our beliefs, hypotheses or theories.

A further examination of Duhem's theory can lead one to argue that knowledge claims in science are interconnected and refutation of a claim does not necessarily mean that it is false. This interconnectedness makes it impossible to isolate a claim and examine it for inconsistency of falsity. Instead, it is supported by many other assumptions which may be altered to give the hypothesis or claim authenticity. This dynamism in knowledge is not accommodated for in the correspondence theory because its proponents argue for objectivity and rigidity of knowledge. If the classical epistemic view of knowledge stands, one is justified in arguing that Duhem shows that knowledge acquisition is an impossible venture in science.

In conclusion, Duhem's work leads one to cast doubt on the possibility of acquiring knowledge by way of empirical methods because these methods do not focus on comparing observations with reality. Instead, an observation will be assessed in relation to its utility such that if it does not succeed in achieving expected results, its auxiliary assumptions are revised until they result in expected outcomes. In order to adequately demonstrate the nature of the Duhem-Quine thesis, an examination of the ideas of both scholars were necessary. Quine raises concerns that are similar to Duhem's, albeit in some areas, and his work was discussed in the section that follows.

6.1.2 W.V.O. Quine's Thesis

Quine, in his work, *Two Dogmas on empiricism,* seeks to demonstrate errors in our pursuit of knowledge that occurs in two kinds. Firstly, he argues, there is a misconception that a rift exists between truths that are analytic, independent of reality, and truths that are synthetic, grounded in reality (analytic/synthetic dichotomy). The second misconception is that every meaningful statement is akin to a logical construct upon terms which make reference to immediate experience (reductionism). These two misconceptions, he calls dogmas, and argues that once we abandon them, we realize that the line between natural science and speculative metaphysics is blurry.

Ultimately, our abandonment of these dogmas leads to adoption of pragmatism (Quine, 2000).

Quine begins the above-mentioned work with a definition of the term analytic statements. He defines them as statements that are true by virtue of meaning and independent of facts. Analytical truths are of two types; firstly, those which remain true under different reinterpretations of components (Peacocke, 2017; Verhaegh, 2017). For example, the statement, "no unmarried man is married" remains true regardless of the interpretation the terms "unmarried" and "married." The second kind of analytic statements are those which are capable of being turned into logical truths by replacing the terms therein with their synonyms. For example, in the example given above, the term "unmarried man" can be replaced with "bachelor" and the statement still remains true. Statements in the second kind of analytic propositions will therefore have the form, "no bachelor is married" (Schwartz, 2016).

Transforming statements from the second kind of analytic propositions to the first requires an understanding of the synonyms for the terms in the statement. However, Quine thinks that this is a problem because a synonym is a word that is the equivalent of another. One may ask, "How did we know that bachelor is the synonym for unmarried man?" If we cite the dictionary, it would be of no use in answering this question because the book is only a record of predetermined synonyms. This will lead to a circular argument because the concepts of synonymous terms is dependent on the notion of analyticity which also requires defining. If we also assume that synonyms are interchangeable in all possible scenarios without changing context and meaning, then we would be wrong because the term "unmarried man" cannot be logically replaced by the term "bachelor" in all instances (For example, in poems the two terms cannot have the same poetic rhythm) (Quine, 2000).

Quine, one can assert, challenges the traditional distinction between analytic and synthetic propositions by asserting that they are all dependent, to some extent, on empirical proof, therefore this perceived distinction is untenable and not clear.

Concerning the verification theory of meaning, Quine asserts that the meaning of a proposition is determined by the method of empirically infirming or confirming it. He sets to demonstrate the relationship between a proposition and the experiences which contribute to its confirmation or refutation. Quine rejects the empiricist claim that all statements that have meaning can be reduced to propositions about sense data. This is reductionism in its radical form and is a theory that was held by scholars such as John Locke and David Hume (Verhaegh, 2017). Carnap (2003), in his work, *The Logical Structure of the World*, reduces all human knowledge to rely on a foundational framework that is established on elements of experience. The entire body of scientific knowledge can be logically reconstructed from this foundational framework by way of rules of inference.

This dogma of reductionism thrives on the idea that every proposition, when taken in isolation from others, can be used to confirm its claim about the physical universe. Reductionism in epistemology makes reference to the assertion that complex knowledge claims can be broken down into simpler units that are independent. After breaking them down, one can study them in isolation and determine their exact nature (Murphy, 2016). Understanding of the isolated components of the complex whole helps in understanding the entire system because knowledge from each component will be synthesized for constitute a whole. The rationale for this claim is that in complex systems of knowledge, there are underlying principles or mechanisms at work which can only be known when knowledge is broken down into simpler and autonomous parts. However, this claim is false as per Quine (2000). He argues that our propositions concerning the physical world are tested not as individuals, but as a corporate body of statements. Single statements are not verified, rather, it is the entire body of scientific knowledge that is being investigated. This is because there is interconnectivity among statements. As a result, it Quine (2000) posits that it is impossible to demonstrate distinction between analytic statements (whose truth lie in analysis of the statement) and synthetic statements which are dependent on experience for verification. Quine posits that any proposition can hold true if the right adjustments are made elsewhere in its system. This implies that all propositions can be revised, none is immune.

Quine adds that science plays a primary function of predicting future events or experiences on the basis of past ones (Emina & Ukwamedua, 2020). As such, the only valid way of choosing theories to believe is by examining the degree or extent to which they advance our relations with sense experiences.

An examination of Quine's thesis demonstrates that he considered empirical evidence an important element in knowledge acquisition. Definitions of terms e.g. bachelor, require empirical proof as well as auxiliary assumptions in order to make sense. For instance, the proposition, "Bachelors are unmarried men" cannot be understood and have meaning if one did not have an empirical experience of marriage. If this proposition was only analysed, without making reference to an entity or experience that is represents, knowledge of its meaning would be impossible. As such, one would be justified in concluding that Quine's discussion of analytic and synthetic statements is hinged towards drawing the conclusion that the practical value of a proposition is what gives it meaning, hence, knowledge consists in understanding the context in which a term is used. In essence, empirical adequacy is more important in knowledge acquisition as opposed to ensuring that our beliefs and hypotheses adhere to a predetermined abstract principle.

Further, Quine goes contrary to traditional epistemic schools of thought which consider knowledge as capable of being broken down and analysed in smaller, more specific and understandable units. Quine's claim is influenced by the belief that all statements of fact are interconnected and as such, they cannot be isolated from each other and examined independently. When an anomaly is detected on any part of this belief system, the entire system is revised, not just a proposition isolated from the rest of the coherent body of thought. Quine's presentation of knowledge as an interconnect web of beliefs challenges traditional knowledge claims because it makes it impossible for one to refute false statements. As such, it makes knowledge, in the strict sense of the term, impossible.

Quine's work abandons the traditional epistemic principle that knowledge must consist in correspondence of a belief or idea with the actual state of affairs. In its place, his thesis adheres to the pragmatic principle that empirical proof, a coherent

system of thoughts and beliefs, and a practical approach to phenomena help us to understand the reality we are scrutinizing.

6.2 Points of Convergence and Divergence in Duhem's and Quine's Theories

Both Duhem and Quine have similarities in their respective works, especially concerning the role of empirical evidence in knowledge creation. They also have points of divergence. These similarities and differences were discussed in this section. Firstly, the similarities were expounded, then the differences.

To begin with, both scholars acknowledge that theories alone cannot account for the nature of phenomena. They have to be backed by empirical evidence because there may be instances where empirical data can be accounted for by various theories. When tangible evidence is introduced, cases of this kind would not exist because one would identify the theory which agrees with the evidence.

Further, both scholars insist on the holistic nature of knowledge. They agree that scientific explanation of phenomena cannot be done when propositions are isolated and understood differently. Neither can one isolate and affirm or falsify any proposition because it belongs to a web of interconnected beliefs or theories. Duhem asserts that hypotheses are tested not as individuals, but as a whole and these tests are done against empirical data. On the other hand, Quine posits that revision of beliefs cannot be done if each belief is isolated from the rest. Revision is done to the whole web of beliefs. In essence, both Duhem and Quine acknowledge the impossibility of successfully isolating a hypothesis, theory or belief from the entire framework in which it belongs in order to test it.

One would argue that the highlight of both Duhem and Quine's works is that scientific knowledge is developed through an interplay of interconnected and coherent beliefs and empirical adequacy but not observations that are isolated or easily verified through simple crucial tests. This complexity ensures that falsification of theories becomes a herculean task.

Concerning the differences between these two scholars, one may notice that Duhem is primarily interested in evaluation how hypotheses are tested as well as the manner in which scientific theories evolve. This is more of a methodological and historical perspective of science. Quine, on the other hand, focused on analysis of language and meaning and the foundations on which knowledge is built.

Despite their different methodological approaches to knowledge, their conclusions were that knowledge is a complex whole which cannot be broken down and studies using abstraction. Rather, it should be understood in its entirety, with elements within it adjusted or manipulated to achieve expected goals.

6.3 Implications of Duhem's Under-determination and Quine's Holism to Knowledge Acquisition in Science

A critical examination of Duhem's and Quine's theories brings to light various implications for our methods of seeking to know as well as our knowledge claims. One of the implications of Duhem's theory is that it recognizes the fact that scientific theories are embedded in a broad network of auxiliary assumptions which cannot be isolated and tested individually (Szałek, 2020). As a result of this understanding, a scientist operates on the assumption that there is a possibility of interconnectivity of theories that they deal with. A scholar acknowledges that knowledge forms a network of theories, beliefs and assumptions which are both interconnected and dependent on each other. This awareness fosters critical thinking and analytic skills when conducting tests because assumptions are not merely ignored, but examined to determine their contribution to knowledge. Scholars are therefore compelled to adopt critical questioning which culminates in revision of their theories in order to enhance knowledge.

The implication of claiming that a scientist cannot isolate hypotheses or theories and test them in isolation leads to skepticism that we can have knowledge. Knowledge requires a belief or certainty I something, however, this certainty cannot be achieved if Duhem and Quine are correct in their assertions.

In some cases, scholars may resort to reductionism by assuming that their perceptions are sufficient to draw accurate conclusions on reality. This over-simplification of phenomena is erroneous and the Duhem thesis adequately demonstrates it (Munro, 2016). When it demonstrates interconnectedness of theories, it discourages the habit of isolating theories and treating them as if they were independent. Duhem's thesis encourages a comprehensive examination of reality and its theoretical explanations. Additionally, this thesis promotes intellectual humility by recognizing the limits of scientific methods of critique as well as scientific knowledge. A scholar will, therefore, be slow to claim knowledge of phenomena when they do not have sufficient grounds to support their claims.

In a similar manner, Quine's rejection of the possibility of falsification in empirical research gives support to Duhem's under determination claims. Quine posits that a hypothesis cannot be falsified because it belongs in a greater network of beliefs which cannot be individually assessed and refuted. If the claims of these scholars are accepted, then knowledge acquisition may be a difficult process because it will be impossible to eliminate a theory as a possible explanation of phenomena. Each theory will be considered valid because adjustments can be made elsewhere in its system and make it an accurate explanation of phenomena.

Quine's holism, apart from insisting on the impossibility of validly isolating theories from their background assumptions, also incorporates elements of coherence and systematic development of scientific knowledge (Fairweather, 2012). If offers a holistic framework of investigating scientific knowledge and insists on the essence of flexibility and adaptability to new evidence, regardless of whether it agrees with our beliefs or not. It implies that a scientist must always revise their beliefs in light on new compelling evidence. This enhances coherence of ideas and predictive success of belief systems or an entire theory. This, in turn, guarantees comprehensive evaluation of ideas.

Quine's theory is also important in scientific investigations because it insists on the relevance of empirical proof in evaluation and revision of beliefs. As a consequence, Quine bridges the gap between speculative disciplines such as philosophy and

empirical ones like science. The insistence on the relevance of empirical evidence as justification for beliefs guarantees ease in evaluation of beliefs as well as determining their validity and pragmatic value (Harding, 1976). Moreover, Quine's holist has instigated debate concerning the suitability of traditional theories of knowledge such as reductionism and foundationalism. Scholars have been triggered to seek more comprehensive explanations of reality as opposed to the subjective and limited perceptions in these traditional theories.

Despite these strengths in both Duhem's and Quine's ideas, one may have some concerns on the viability of their theses. For instance, in Duhem's thesis, there is no clear criterion for evaluating or falsifying theories. Without such a basis, we cannot validly claim that we have sufficient evidence to accept or reject a theory and its auxiliary assumptions. This means that we cannot tell whether a theory should be abandoned and replaced by another because all of them can be altered to still be relevant in explanation of phenomena.

In addition, Duhem's thesis solely relies on the logical and coherent relationships that exist between a theory and its auxiliary hypotheses. It ignores the role of historical and social factors that influence the formation of beliefs and theories. In some instances, examination of these factors can offer sufficient knowledge that may lead to acceptance or rejection of a theory. If Duhem's thesis is to be accepted, then one can posit that it makes all other factors, other than the logical connection of theories in a system, irrelevant in knowledge acquisition.

One of the most important observations one can make from Duhem's thesis is that he rejects the relevance of empirical evidence in falsifying scientific theories. His argument is that no matter how compelling evidence to discredit a theory is, one can always make adjustments in the background assumptions to make the theory valid. This point of view can make one skeptical of the possibility of acquiring knowledge through scientific methods. This, one may argue, is under-determination of theory by evidence. According to Newton-Smith (2017), under-determination occurs when the available evidence is not sufficient to warrant making a categorical conclusion because the evidence can be equally used to support various theories or beliefs. This

concept is effective in demonstrating the ineffectiveness of empirical evidence in affirming or falsifying knowledge claims. For instance, when cosmologists seek to understand the origin and nature of the universe, various theories, each with adequate empirical evidence to back it up, suffice. They include; the big bang theory, cyclic cosmology (universe experiences repeated cycles of expansion and contraction), and inflationary cosmology (exponential space expansion), among others. Each of the proponents of these theories can gather evidence in support of their claims, however, these proofs will be insufficient to offer an accurate description of the process of formation of the universe.

Another example, in evolutionary biology suffices to demonstrate this point. It may be difficult to establish exactly what kind of evolutionary mechanism is responsible for human life as we have it today. Each of the following mechanisms, genetic drift, natural selection, and sometimes punctuated equilibrium, may be advanced as responsible for the nature and constitution of the human race today. However, despite having evidence to support all of them, it may be impossible to effectively determine the role and time each of them was involved in evolution of mankind. It therefore makes it impossible for researchers to arrive at a definitive conclusion on the same. In the same manner, it may be difficult for a scientist to establish which background assumption is more relevant in explaining phenomenon and which carries little consequence.

The Duhem-Quine thesis, if given, can make uncertain all knowledge processes and no amount of evidence will ever be sufficient to claim that a theory is false. Every piece of evidence obtained will be potentially compatible with a number of beliefs or theories and as such, scholars will always have a degree of uncertainty in their knowledge claims. This means that we cannot not sufficiently justify our claims. This epistemic uncertainty occurs due to the difficulty in establishing the exact causes of failure in empirical tests or experiments. For instance, if one wants to test the theory that compound X's weight is 5 grams and the test brings different results, they may have difficulty pointing to the exact cause of this failure. It could be the apparatus is wrongly calibrated, defective, the compound is impure, or some other reason. From the example above, one can posit that there is a network of background assumptions

to which a scientist can attribute failure to achieve the desired results. Each of these assumptions, when revised, can influence the desired outcome in the experiment or test. It is therefore imperative to note that this uncertainty implies that scientific knowledge is always tentative and subject to revision when new evidence arises.

Another implication of the Duhem-Quine thesis is that it demonstrates the theory-ladenness of observation. This means that scientific observations are never objective, but influenced by the concepts in one's mind or the theoretical framework that guides them (Pantazakos, 2021). In essence, our perceptions and their interpretations are influenced by our belief systems, points of view, and assumptions about the phenomenon we are investigating, or even about the world in which we exist. This theory-ladenness of observation is contrary to the common man's assumption that observations are usually objective, precise and independent of our biases. For example, two scientists may observe the exact same phenomenon but develop different theories on the same. This diversity will be influenced by their points of view and interpretation of this observation. Subjective perceptions may be formed by one's culture, sociality, religion, educational background and theoretical biases, among other influences. It is essential, therefore, that one become aware of their biases because they influence their claims to knowledge.

Ultimately, the Duhem-Quine thesis can be said to be advocating for coherence of ideas because it demands for an adjustment of background or auxiliary assumptions instead of abandoning an entire theory that has been proven wrong by empirical evidence. Duhem and Quine, the proponents of this theory, claim that abandonment of the theory is illogical because adjustments can be made elsewhere in the system of theories and the end result will be ensuring that empirical evidence corresponds to the theory. This, as mentioned earlier in this section, limits scientific knowledge to subjectivity, hence, our claims to knowledge in science can never be objectively justified.

6.4 Conclusion

The Duhem-Quine thesis introduces a significant debate on the objectivity and reliability of scientific knowledge. The thesis demonstrates how in the scientific

method (which involves empirical tests) a scientist cannot claim to have evidence that satisfactorily refutes or falsifies a theory. It further demonstrates that scientific inquiry is a complex process that should not be simplified into basic processes such as simple enumeration, testing of hypotheses and making judgment based on mere observation. Both Duhem and Quine advance a holistic approach to understanding reality which includes knowledge of both theories and their background assumptions. If one accepts the validity of the Duhem-Quine thesis, it is possible that they develop skepticism of ever obtaining knowledge in its objective sense. In fact, they may take skepticism to its logical conclusion, that humans can never know anything at all.

This section demonstrated the nature of this thesis as envisioned by its two proponents and examined its implications. In the section that follows, an evaluation on whether the concerns raised by the Duhem-Quine thesis completely eliminate the possibility of acquiring knowledge through the scientific method was done.

CHAPTER SEVEN

POSSIBILITY OF KNOWLEDGE ACQISITION THROUGH EMPIRICAL METHODS

7.1 Distinction between Correspondence and Pragmatism in Scientific Pursuit of Knowledge

A critical assessment of chapters two and five may lead one to form the conclusion that the correspondence and pragmatic theories are incompatible, and as such, the correspondence theory clearly articulates the nature of truth for knowledge while pragmatism fails to do this. The correspondence theory posits that truth is a matter of correspondence between reality and ideas or propositions that represent this reality and that means that reality or the actual state of affairs is independent of our perceptions or biases as well as their interpretations, while truth is an accurate description of this state of affairs (Ulatowski, 2015). On the other hand, pragmatism does not focus on the reality and its objective representation, rather, it interests itself in the practical outcomes or consequences or beliefs. Truth, for pragmatics, involves that which works or proves useful in realizing established goals. (Capps, 2019) A pragmatist, therefore, does not consider truth to be something independent of our minds that is absolute or fixed, instead, it is determined by our experiences, actions and interpretations.

Most scholars in epistemology may argue that the correspondence theory of truth is the right one and that pragmatism makes truth subjective, hence not accurately representing reality. This distinction leads to the conclusion that that which is objective and does not change with context or any other factor is the accepted criterion for truth, hence, correspondence is the correct position (O'Connor, 2023). However, concerning human knowledge, one may ask, “how is it possible to have knowledge of the universe without adopting pragmatism?” This question arises from the realization that human knowledge is dependent on the senses, which transmit their experiences for reflection and attribution of meaning the faculty of reasoning.

During this process, the mind accepts as true that which is in agreement with their previous experiences, as well as ideas that have consistency. This means that our knowledge processes are dependent on some pragmatic and coherent perceptions of

truth (James, 2020). For example, if one was to make judgment that person Y is a liar, they have to compare Y's statements and compare them with what they have established as true. If Y's words do not agree with the standards established, then they will be considered a liar, but if the statements agree, they will be considered to have told the truth, hence not a liar. From this example, one can draw the conclusion that our knowledge acquisition processes are necessarily tied to a comparison of ideas and their practical value or agreement with a set of established principles. It is clear that the distinction between correspondence and pragmatism lies in their understanding of the nature of truth, either as an objective representation of reality, or as a practical value of a statement.

The challenge that arises can be stated as follows; if one were to select only one theory of truth as the acceptable standard, then it would be difficult to determine which one would be adequately applicable for evaluating the truth in scientific knowledge. If correspondence is chosen, how would one know that their idea corresponds to reality in itself? If one chooses pragmatism, how would one establish that if an idea works, is it also in agreement with things as they are?
These questions are important in seeking to understand the exact nature of scientific knowledge and the possibility of knowledge acquisition using empirical methods. In this chapter, the researcher sought to investigate claims for and against the possibility of knowledge acquisition and proposed an alternative to these opposing perceptions.

7.2 Arguments that the Scientific Method cannot result in knowledge

Various scholars such as Kant (2005) have raised concerns that regardless of how precise, clear, flawless and relevant our empirical tests are, and we can never acquire knowledge of the things we investigate. This is because, firstly, scientific studies are based on mere observations (which can always be doubted), may involve generalizations (which can result in fallacious conclusions) and are always subject to revision every time a new experimental apparatus is introduced (Marchesan, 2019). Sometimes, a change of apparatus or perspective can change an entire knowledge claim such that what was once considered accurate becomes wrong and what was once considered inaccurate is found to be true. A sceptic would therefore reject the scientific method because of these shortcomings.

David Hume is one of the major proponents of this claim that it is impossible to acquire knowledge because all our knowledge is derived through experience (which includes sensory impressions). Ideas are derived from these impressions through various processes such as reflection, comparison and abstraction. Our understanding of the universe in which we exist is based on an association of ideas using principles such as resemblance, contiguity, as well as cause and effect relationships (Lange, 2011). Hume argues that it is impossible to ever acquire knowledge that is beyond the realm of experience but the fact that we cannot perceive the occurrence of cause and effect between two phenomena (Winkler, 2016). This means that it is impossible to be sure that we can attribute the occurrence of the second phenomenon to the first one. For example, to claim that flipping a switch causes the light bulb to produce light will not be justified. Hume argues that we only observe a sequence of events and then make a habit of associating them together such that if one occurs, then the second one is expected to automatically occur. We cannot claim that flipping the switch is the cause of the second event (lighting the bulb) because we do not experience the first event causing the latter. We can only say that we observe a series of events, but do not have adequate grounds to establish causality.

The necessary connection between cause and effect cannot be known due to the fact that it does not directly derive from experience. Our connection of ideas is born out of the habit of our minds to associate events with each other. He also critiques the inductive method because of its tendency to generalize future events from past events. Induction is fallacious because it wrongly makes an assumption that nature is uniform and will always maintain the same structure, but this assumption is only based on habits of thought and customs, not logic. It should therefore not be justified (Newton-Smith,W, 2017). In essence, Hume's critique is that we cannot know anything outside basic experience and when we make connections between things or events, we are not rationally justified because we do not experience these connections (Winkler, 2016). This means that in scientific investigations, our interpretation of observed phenomena is not rationally justified, hence, we can only validly report the observations we make. If we attempt to make a connection between these events, we will be required to have

direct experience of these events, and this is not possible. We are therefore mistaken in claiming causality.

Despite raising sensible arguments on the limitations of human knowledge, Hume can be critiqued on various claims. Firstly, Hume does not offer a justifiable reason for his skepticism and rejection of reasoning and induction. One may claim that it is the role of reasoning to identify patterns in empirical observations and make conclusions on how each affects the other. It is justifiable to draw a conclusion on the relationship of these events based on a consistent pattern of behaviour instead of advocating for the necessity of experiencing every sensation. Ducasse (1966) agrees with this critique and further enquires that, if every statement of fact must be experienced, then one may ask, "Which experience tells Hume that whatever is not directly experienced is not known?" His conclusion is made on observation of a pattern of events and habits of associating these events, and ultimately drawing a conclusion (through reasoning) concerning all human knowledge. According to Schafer (2016) Hume takes an extreme skeptic position which cannot be adequately supported. If we are to consider Hume's claims to be true, Schafer (2016) says, it would also compel us to admit the validity of knowledge sourced from reasoning. To some extent, one may argue, Hume presents a self-defeating position. We cannot argue that we do not know and yet this claim already presupposes knowledge (we know that we cannot know). This is a contradiction that can be inferred from Hume's thoughts.

In the event that Hume's claims on the nature of knowledge and the possibility of achieving it are accepted, then the methods used by scientific disciplines would be ineffective and lead to ignorance. This is so because these methods cannot aid us in experiencing causality among events or phenomena, hence, we would only make assumptions about the relationship of things without having empirical evidence of their necessary connections. Hume's skepticism would reduce scientific investigations and findings to mere conjecture. As such, no individual can claim to have knowledge, regardless of their level of certainty.

Hegel presents a skeptical view of human claims to knowledge by advocating for the impossibility of ever knowing anything at all. He argues that human cognition is

limited and humans do not have an adequate and objective standpoint from which they can understand reality (Heidemann, 2018). This makes knowledge, in its absolute sense, impossible. As per Nuzzo (2016), in his dialectic reasoning, Hegel argues that truth is always dynamic and changes when it meets conflicting positions, then a new truth is formed from the interaction of these conflicting ideas. Factors that influence our knowledge include language, context (mostly historical), and culture. According to Westphal (2018), these factors affect how we perceive reality as well as how we interpret it and give it meaning, as such, it would be fallacious to claim that there is truth that exists independent of our minds and how they think. Subjective biases and our conditioning, therefore, are great influences in our knowledge acquisition processes. Hegel, however, does not accept the claim that reality is objective and static. He argues that the dialectic process of thesis, antithesis and synthesis creates new realities that are also subject to modification and change, hence, making reality dynamic. Each synthesis creates new perspectives and ideas and as a result, make it difficult to establish a fixed reality.

An examination of Hegelian philosophy of knowledge demonstrates an advocacy for skepticism. However, he fails in distinguishing between reality and our perception of it. Our perceptions are not perceptions of reality as it is, but as we experience it. He should have acknowledged that our social conditioning and subjective biases only give us a perception of reality, but do not define reality in itself. It is therefore erroneous to argue that reality is dependent on these subjective biases. This would imply that all points of views are knowledge, depending on the language, culture and conditioning of those who hold them. This is an illogical way of thinking because it automatically rules out the possibility of falsity or making errors. However, he makes valid claims that our knowledge claims are dynamic and subject to change based on various factors such as point of view, history, culture and our subjective experiences and orientation.

Hegel's work is a contradiction of traditional metaphysics which assumes that knowledge is objective, cannot be influenced by history, culture and circumstances, and is independent of the human mind (Redding, 2020). For Hegel, knowledge is shaped by history and culture as well as the knower's subjective consciousness. One

significant distinction that can be identified in Hegelian work is that he opposes the traditional view that the knower's mind is passive and can only perceive reality as it is, without making a contribution to the determination of the nature of the known object. Instead, he presents an active mind that can synthesize the knower's experiences and interpret them and ultimately, present the perceived object in light of the knower's point of view (Rorty, 2020). Hegelian work, therefore, presents a pragmatic view of truth because it is transformed by the mind depending on many circumstances, as such, truth is not static and rigid as presented by traditional epistemologists. Proponents of correspondence would disagree with Hegel's claims, but pragmatists would argue that Hegel's assertions demonstrate the validity of scientific methods in knowledge acquisition.

Kant (1953), in his work, *critique of Pure Reason,* demonstrates the impossibility of acquiring knowledge in better and clearer terms than Hume and Hegel. He introduces the concepts of *noumena* and *phenomena* to denote 'things as they are' and 'things as we perceive them' respectively. He argues that we can never have knowledge of 'things as they are' because they are beyond the limits of our perception and understanding. Our minds have conceptual frameworks (known as the categories of the mind) which receive data from experience, organize it and give it meaning. The final product of this process will not give us knowledge of things as they actually are, but will be dependent on how the mind understood, organized and gave meaning to the data it received from the senses (Kant, 2022). In other words, the mind acts are a lens through which information is filtered. The final outcome of perception is dependent on the nature and specification of the lens (Gava, 2023). For example, if one were wearing blue lens that have magnification properties, their view of reality will be distorted to suit the lens. The wearer of the lens will conclude that they are perceiving reality, while in actual sense, they are interpreting and giving meaning to their perceptions through biased and subjective influenced of their lens. Kant demonstrates that these categories of the mind shape our experiences and interpretation of reality as it appears to us, but not as it actually is.

Kant is categorical that absolute reality cannot be known by the human mind because the conduits through which this knowledge can be acquired are not made to acquire

this level of knowledge (Bird, 2013). As such, the standards established by the JTB conditions discussed in chapter four of this work cannot all be sufficiently met if we use the human cognitive processes to seek knowledge. Truth as correspondence of ideas with reality will be impossible to satisfy. In this context, then, one may be justified in concluding that these skeptical philosophers have valid claims on the impossibility of knowledge whatsoever. However, Kant (2005) opens up a different channel of debate on knowledge through the senses when he claims that the impossibility of knowing *noumena* does not imply impossibility of acquiring knowledge. He argues that our senses and reason can work together to acquire knowledge of the universe in which we exist. Kant's ideas and those of other scholars who give a lifeline to knowledge were discussed in subsequent sections of this thesis.

Kant's work makes a clear statement of fact; that scientific methods cannot validly result in knowledge in the proper sense of the term because knowledge requires correspondence of an idea with reality (*noumema*). Since this is not possible using empirical means (*noumena* cannot be accessed through the senses), we can only perceive the appearance of things (*phenomena*). In essence, this Kantian pronouncement is a skeptic stance towards knowledge of anything at all. However, he may be said to advocate for a pragmatic approach to knowledge (the term is used here in a popular sense) acquisition because our perceptions of the physical world can be organized, interpreted and given meaning. This is to say that our claims to knowledge are only valid if we make reference to knowledge in its popular or general sense, not its technical or proper meaning.

The 17th century philosopher, Foucher, argues that the primary sources of human knowledge, namely, sensation and intellect, are unreliable as sources of accurate information. These sources, he claims, only offer subjective information that is limited and fallible, and as such, we cannot guarantee certainty in our knowledge claims (Neto, 1997). In his work, 'Critique of the Search for Truth,' he asserts that we should be skeptical in our search for knowledge, adopt skepticism and refrain from making dogmatic claims on the nature of knowledge. He also claims that Descartes' rational epistemology fails to provide a firm ground or foundation for knowledge because the work ultimately relies on the same foundations (senses and reason) that it

started by doubting (Boudreault & Charles, 2017). One may agree with Foucher to the extent that knowledge claims should always be treated with skepticism because the limits of our perception and understanding are limited and it would be unwise to claim more than they have proof of.

Objections against the possibility of knowledge acquisition has not been limited to these classical scholars only. The American philosopher, Richard Rorty adopts scientific anti-realism, the stance that scientific theories are incapable of objectively defining or explaining reality as it is. Instead, he argues, these theories can only suffice to explain phenomena as shaped by our language, social practices as well as culture (Voparil, 2022). In essence, Rorty considers scientific theories to be constructs of human subjective perceptions formed by cultural, historical and social factors, hence, incapable of giving us objective information about the world and its underlying principles. This position goes contrary to the claim that humans can possess ideas that directly correspond to things as they are.

According to Voparil (2022), Rorty's philosophy is aligned to pragmatic principles which recognize that our claims to knowledge are subjective, dynamic and not always universal. His advocacy for pragmatism can also be demonstrated by his assertion that the validity and acceptance of scientific theories is determined by their ability to practically solve problems, and enhance the quality of human life as opposed to merely adhering to abstract principles or some reality beyond the scope of human understanding. Evolution of knowledge consists in abandonment of theories which have ceased to serve their purpose in favour of new ones that are more effective.

Further, Rorty (2020) argues that knowledge is communicated through language. This means that if the language used is ambiguous or vague, improper information will be communicated. As such, language has to be precise and accurate. Despite this, there is always an element of limitation in language, regardless of how accurate and precise we consider it to be. Scientific communities formulate concepts, which form definitions of terms that are used in scientific discourse. These terms are formulated in accordance with subjective principles proper to the scientists at the time. This means that at no given point will language used in scientific discourse be a precise

representation of reality that is independent of people's minds. Instead, the language will represent the scientific community's observations, interpretations and attribution of meaning to these perceptions. Rorty, based on this argument, can be viewed as a pragmatist who does not advance the view that we can acquire knowledge (in its objective sense) using empirical methods.

Rorty's ideas have been objected to by various scholars. Firstly, Gascoigne and Bacon (2023) argue that he takes a radical stance by rejecting scientific realism yet it is clear in scientific advancement that there is an objective truth which science advances towards. This critique is informed by the assumption that there must be an anchor on which knowledge claims can be accepted or rejected. This anchor, some may argue, is the objective truth which is not impossible to achieve. Each generation of scientists refines its understanding of the universe and gets closer to knowing things as they actually are. Eventually, an assumption is made, the scientific method will result in knowledge of things in themselves.

A second critique that can be advanced against Rorty's pragmatic claims is that he limits scientific theories to only achieving practical outcomes and solving problems. There is more to science and the role of theories also include giving explanations of the nature of the universe and making predictions about it (Voparil, 2021). One can argue that when Rorty limits the role of scientific theories, he errs because they are not only formulated for instrumentalist purposes. Moreover, one can argue that Rorty confuses subjective beliefs with objective truth. It is important to acknowledge that dynamism in information points towards subjectivity and knowledge should not be reduced to these contexts. Instead, there is need to acknowledge that these subjective contexts (such as language, sociality and culture) only suffice to influence our perceptions but do not necessarily take away the possibility of understanding reality beyond its appearances.

An examination of this critique exposes a weakness in that it suggests that it is possible to understand reality in its objective sense. The empirical method relies on subjective perceptions and it is these perceptions that serve as the foundation on which our understanding of reality is established. It is therefore impossible to detach

our cognitive processes from them. Reality in its objective sense is not accessible through these means, hence, we cannot claim to have knowledge or even the possibility of knowing it in its proper sense.

One can argue that the objections raised against Rorty's pragmatic claims do not offer a compelling reason to reject his description of the scientific method and its outcomes. Their arguments are based on assumptions, for instance, the claim that objective knowledge against which all other knowledge is evaluated is not based on any conclusive proof. After all, the works of philosophers such as Kant clearly demonstrate the limits of empirical methods in knowledge of reality in itself. In essence, one may argue that Rorty's claim that scientific theories are accepted or rejected based on their utility is valid and so is his demonstration on the limitations of human understanding in pursuit of knowledge.

Nancy Cartwright, in her 1983 work, *How the Laws of Physics Lie*, critiqued and rejected scientific realism as a valid theory of knowledge via empirical methods. She introduced the concept of entity realism which asserts that scientific theories do not give true accounts of reality as it is, instead, they are context dependent and only provide information regarding phenomena in certain contexts or domains. She further adds that, based on this understanding of science, theories should be evaluated based on their practical success in explaining phenomena in different contexts as opposed to their precision in an explanation of laws of nature as they apply universally (in all situations and domains). Cartwright (2022) further advances the claim that social as well as historical influences shape theories and practice in scientific ventures. This means that scientific knowledge is contingent and subject to change when its contextual influences are altered.

An assessment of Cartwright's explanation shows that she moves away from the traditional assumption that knowledge of the world as it is can be achieved and hinges on a pragmatic stance which advocates for an abandonment of seeking knowledge of reality and instead, focus on understanding phenomena in its contextual presentation. This point of view agrees with that of many other scholars, from ancient age of

philosophy (e.g. Plato) modern age scholars (Descartes and Hegel, and Kant) to contemporary scholars such as Rorty.

The philosophers whose views were examined in this section have demonstrated how it is impossible to acquire knowledge of reality as it actually is. The primary reason for this claim is that our knowledge is dependent on the senses and they have limits such as subjectivity, biases, and limited points of view. As such, reality is beyond their scope. However, research and scientific tests are continuously being done and the results of these investigations point towards the possibility of acquiring knowledge. It is therefore important to establish what kind of knowledge this is and what justification one can give to defend it.

7.3 The Possibility of Knowledge Acquisition through Empirical Methods

From the preceding discussion, one can validly infer that humans cannot acquire knowledge of reality in itself due to the limits of our cognitive processes, which include the senses (which can be deceptive), use of stipulative definitions in language, points of view which are subjective and our interpretation of data from sensation which depends on how we have been conditioned. Upon a critical assessment of these claims, this thesis concurred with the assertion but sought to establish the whether we can rightly claim to possess knowledge. The essence of this investigation was to seek a valid explanation to the question, "if we cannot not know reality, can we justify the knowledge claims that we have concerning the physical universe?" In the following discussion, the study examined different justifications for knowledge acquisition in humans using scientific methods.

7.3.1 Immanuel Kant on Knowledge of *Phenomena*

Immanuel Kant clearly demonstrates the inaccessibility of *noumena* but advocates for the possibility of knowledge, but of *phenomena*. The phenomenal realm can be known to us because it is immediately accessible to our faculty of sensation but the noumenal world is not (Kant, 2022). There are limits to human knowledge that should be known to everyone so that they do not make illogical claims which end up causing confusion and misleading claims to knowledge. This limits concern knowledge of reality that exists beyond the scope of human experience.in this respect, one can infer that Kant is

cautioning against claiming to have absolute knowledge. However, the fact that we cannot know things as they are does not mean that we cannot claim to have knowledge of things as they appear to us. Knowledge of the phenomenal world, however, is controlled by the manner in which we perceive, organize and give meaning to the things we encounter (Kant, Haywood, Araille, 2008).

Concerning how humans acquire knowledge of the world, Kant argues that there are two categories of knowledge, each with its own channels of knowing: *apriori* and *aposteriori* knowledge (Kant, 2022). The former is known independent of experience and it includes principles of logic and mathematical facts. These are known through reason alone. The latter is derived from empirical evidence or experience. In some cases, Kant acknowledges the existence of judgements that are both apriori and synthetic because they are known without experience (*apriori*) and they also add new information to an argument. For instance, 1+3 =4 is *apriori* because it is known by the faculties of our mind, regardless of whether senses are involved, and the combination of 1 and 3 creates new knowledge, 4.

According to Kant, we have knowledge of things as they appear to us and as our minds understand them. This knowledge, however, is more representative of the structure of our cognitive faculty (our perception and reflection) as opposed to the world in its independent state (Kant, Haywood, Araille, 2008). The world 'as it is' cannot be directly accessible to us but that should not stop us from seeking to acquire some knowledge about it. This doctrine is referred to as transcendental idealism (Bird, 2013). It asserts that knowledge acquisition involves two steps; firstly, the sensation stage where our senses encounter *phenomena* but they cannot make sense of it or even organize it to give it meaning. The second stage involves the reflection step where the mind (guided by its categories) organizes the chaotic sensations, gives them meaning and projects them as accurate representations of the phenomenal world. These categories of the mind are inherent in the mind of the knower, not in the objects of perception (Kant, 2022).

Kant rules out the possibility of knowing reality in itself or our minds corresponding to reality as if it were passive. Our knowledge processes involve sensation and then an

active participation of the mind of the learner. This active thought process involves the mind of the learner, by way of its categories, establishing ways in which the object will be understood (Stratmann, 2023). It is therefore logical to claim that Kant's epistemology presents human knowledge acquisition as a limited affair where the structure of the mind determines the extent and nature of our knowledge. These categories synthesize and unify the knower's experiences. For instance, it imposes the concept of quantity, quality, relation and modality to transform raw data into intelligible beliefs about the physical world.

One may argue that Kant's transcendental idealism offers scientific claims to knowledge a lifeline because it offers an alternative explanation for the nature and purpose of scientific investigation. Proponents of metaphysical realism argue that if scientific investigations are to be considered accurate and reliable sources of knowledge, they are supposed to accurately represent the world as it actually is. They posit that science should grasp the nature of things as they are and accurately represent this reality (Hale & Wright, 2017). However, transcendental idealism corrects this fallacious assumption by demonstrating how impossible it is to know something beyond the realm of human experience. It also demonstrates that is possible to acquire knowledge of things as they appear to us by adopting a systematic and logical process which involves critically evaluating the data from our perceptions, organizing it, and giving it meaning.

According to Kant (2022), knowledge of the phenomenal world cannot be possible without the innate mental structures that form the categories of the mind or categories of understanding. These categories perform an important role that the senses cannot accomplish, shaping, organizing and attributing meaning to the data from senses. Without them, we would only have a chaotic data in our minds. There are basically twelve categories that can be grouped into four: quality, quantity, relation and modality. Under quantity, we have unity, plurality and totality; under quality, we have relation, negation and limitation; under modality we have possibility, existence and necessity; and under relation we have inherence and subsistence (substance and accident), causality and dependence (cause and effect), as well as community (reciprocity or interaction) (Kant, 2005).

Kant argues that these categories are the necessary conditions that make it possible for us to have any experience at all, so it would be wrong to assume that they are derived from experience. They are *apriori* because they are already inherent in the mental faculty of humans. The functions of these twelve categories are to consolidate the data of experience and formulate coherent experiences which in turn allow us to make logical judgments about the world we perceive (Strawson & Allais, 2018).

Kant's work has been received with applause as well as critique. Those who applaud the work acknowledge a realistic approach to the problem of human knowledge by acknowledging the fact that there are limits to what we can know and why it is important to adopt intellectual humility. One may also think that Kant makes a commendable effort to justify the need to always conduct scientific investigations even when it is not guaranteed that the outcomes we get do not accurately described the world as it.

Critiques of Kant's transcendental idealism may offer one major claim to demonstrate the insufficiency of this theory. Kant's assertion that reality in itself cannot be known may lead one to epistemic nihilism where they reject any possibility of acquiring knowledge (Franks, 2014). To this critique, one may argue that this skepticism should only be directed to that which is beyond the scope our senses, which is reality in itself (which is abstract). However, Kant makes it clear that that which can be perceived is capable of being known by virtue of the manner in which our cognitive faculty perceives, organizes and gives it meaning. Moreover, there is a clear articulation that knowledge of reality is impossible because it would require knowledge of the non-physical elements that are inaccessible to our senses. In Kant's point of view, knowledge of the appearance of things can be clearly understood and disseminated.

From Kant's point of view, traditional epistemology which asserts that knowledge of reality can be attained by the human being is mistaken. The limits of human understanding are limited to that which is perceived through the senses and these senses can only encounter the appearance of things, not their actual nature. In essence, if one argues that they can have knowledge of the universe, this claim to knowledge

will only make reference to the phenomenal world, not the real world. Kant's philosophy, therefore, does not advance realism (which alienates the knower from object of knowledge), instead, it advances a collaborative cognitive process which involves active participation of the subject (the knower) in the cognitive process of seeking to understand the object of perception (the phenomenal world).

7.3.2 Scientific Realism on the Possibility of Knowledge Acquisition through Scientific Methods

According to Stern (2021), Scientific Realism is a school of thought that advocates for the existence of an objective reality that is independent of our perception or interpretation. If we never existed, the world would still be in existence. Realists also posit that scientific methods of investigations can help us to acquire knowledge concerning the universe, albeit, over an extended period of time and in a systematic manner. Scientific realists claim that scientific theories offer approximately true descriptions of reality, not just explanations of our perceptions of reality. Over a period of time and a series of observations, theories advance and get closer to the truth and this means that scientists should have confidence that each observation made and theory proved is a step closer to knowing reality as it is (Sankey, 2016). Observations are therefore, theory-laden because they are influenced by the theoretical frameworks that make them. However, these observations may sometimes prove theories wrong. It is difficult to establish whether a theory is very close to truth or farther away, but these theories enable scientists to approach truth asymptotically (in a continuous manner, getting closer without necessarily achieving it) because evidence slowly accumulates and theories are refined (Smart, 2014).

One way of proving the validity of scientific realism is by examining the successes of scientific theories in explaining reality over a period of time. Scientific theories have been able to accurately predict phenomena, make true descriptions of reality, and facilitated technological advancement in the contemporary world (Sankey, 2016). For example, the theory that all humans are mortal has been proven through an examination of the strengths and frailty of the human body over an extended period of time. This theory can be considered an accurate explanation of human life because

predictions made on the life expectancy, human organ behaviour and other medical issues have been proven over and over again.

One of the key proponents of this school of though is Michael Devitt. He argues that scientific theories are empirically adequate, both in their description of observed phenomena as well as unobserved reality that these theories seek to describe. This means that one can make an observation of phenomena and use it to validly make a prediction on similar phenomena in the future (Devitt, 2020). For instance, our observation that humans are mortal is based on the theory that all humans must die and this theory can be validly held true for future generations of humans. Evidence acquired so far points to the truth of this theory, not its falsification.

To this claim, anti-realists may opine that realists can only validly argue for the empirical adequacy of scientific methods in describing observed phenomena. Concerning unobserved phenomena, realists should not claim knowledge because unobserved or unexperienced entities cannot be known. According to Van Fraassen (2017), unobserved entities cannot be described by theories because these theories are only sufficient to describe what they have evidence for. It is therefore essential that theories are formulated strictly in accordance with what had been directly experienced. The aim of scientific theories, Van Fraassen (2017) argues, is not to accurately explain the nature of the world, but to produce empirically adequate evidence of our observations. One may make the assumption that he is advocating for instrumentalism, a theory which posits that the role of a scientific theory is describe and predict observable phenomena, but not make claims about unobserved ones.

Upon inspection of Devitt's claim that scientific theories can give one knowledge of reality as it is, one may be inclined to reject this position because the scientific method is limited and can only work with that which has been experienced. One cannot presume to know that their experiences are purely of reality. Reality, as demonstrated by Kant (2022), is unknown and we can only competently claim to know our experiences of reality. If Devitt had argued for knowledge of that which we experience and prediction of future phenomena, then it would be acceptable because he would limit human knowledge to the realm of that which can be experienced and

not include objective reality. Van Fraassen (2017) also demonstrates this point by positing that these theories do not need to inform in the actual nature of the universe, rather, they should be useful in making accurate and informed predictions of the universe and its operations. This, however, can raise a challenge to identifying the best theory among a group of theories each of which is empirically adequate in explaining phenomena. This thesis rejects Van Fraassen's attribution of instrumental value to scientific theories because their role includes an explanation of observed phenomena, not just prediction and control.

A more logical argument on the possibility of knowledge acquisition of knowledge through empirical methods can be demonstrated by Fine (1984) in his "Natural Ontological Attitude' (NOA). Fine seeks to find a middle ground between the two opposing positions held by realists and anti-realists. Realists assert that reality itself can be known through empirical methods and theories while antirealists argue that scientific theories are merely instruments through which scientists manipulate knowledge and make predictions. According to Fine (1984), the pragmatic approach towards scientific theories should be adopted. This approach should include acknowledging that scientific theories do not correspond to reality and as a consequence, we should dismiss the notion that these theories only have an instrumental value. Instead, he posits that scientific theories are beneficial frameworks which aid scholars in firstly, organizing information, then, understanding phenomena. These theories should not be considered to have an ability to make valid metaphysical knowledge claims or to provide truth that corresponds to the actual state of affairs.

This means that Fine's NOA advocates for acceptance of scientific theories on the basis of their pragmatic utility. It also encourages a pluralistic view where theories are both tools of prediction as well as accurate descriptions of reality. However, this study argues that the claim that theories can correspond to reality is a fallacy and should be rejected. Theories can only accurately represent phenomena, not noumenal existence.

Scientific realism, this thesis may argue, is mistaken because it fails to distinguish the reality and appearance of a thing. At any given point in time, there are scientific theories in existence which are assumed to be accurate descriptions of the universe.

Scientists and others scholars of the day are convinced that they are right and can even support their claims with empirical evidence. However, the question arises, "aren't there scientific theories which were held in the same regard but were later abandoned due to insufficiency later on?" According to Boge (2021), the philosophical school of thought referred to as Pessimistic Induction clearly articulates this critique. It states that there are no sufficient grounds to argue that a theory that is successful in explanation of phenomena as well as making accurate predictions is representative of the actual state of affairs. This can be demonstrated by the observation that theories which were once highly successful and universally accepted, such as the geocentric theory, were later cast aside because they were deemed erroneous and replaced with others. Newton's theory of mechanics was also replaced by Einstein's relativity theory.

Similar objections have been made by scholars such as Lam (2021), Tulodziecki (2021) and Musavi Karimi (2022). Their arguments can be used to infer that, despite the fact that these scientific theories were empirically successful, they were still found to be wrong or false. Therefore, the realist, in their argument that the fact that a theory is considered right today is proof that it is indeed accurately representing reality, wrong. A proponent of Pessimistic Induction may argue that Scientific Realism is wrong because there is no guarantee that a theory that makes accurate predictions is necessarily true. There is always a possibility that it will be revised in the future.

It is the position of this thesis that realism and anti-realism do not demonstrate the possibility of knowledge acquisition because realism wrongly assumes that it is possible to know reality beyond perceptions while using empirical methods, and anti-realism assumes that the only role a scientific theory has is instrumental.

7.3.3 Revision of the Truth Condition and Novel Grounds for Justification.

Given the evidence, coherence and rational presentation of ideas in Kant's description of the phenomenal world, one can argue that his distinction between knowing 'things as they are' and 'as they are experienced' is logically justified. His argument that we can acquire knowledge of the world in which we live, on condition that we do not claim that it is the nature of reality in itself is also valid. This means that if the JTB

conditions for knowledge were to be employed, and if the Truth condition makes reference to correspondence, then it would be impossible to know anything at all. However, introduction of this distinction between the noumenal and phenomenal worlds means that correspondence applies to the former, while there should be a theory or theories of truth to account for knowledge or lack thereof in the phenomenal world. The key question that arose from this discussion, then, was, "which of the remaining theories of truth is sufficient to justify scientific knowledge?" This study sought to respond to this concern in this section.

Adoption of correspondence leads to skepticism of ever knowing anything at all. Assessment of the foregoing argument may lead one to be skeptical of our claims to knowledge of the external world as well as the methods of investigations we adopt to meet this end. According to Lemos (2020), skepticism is a school of thought which asserts that acquisition of knowledge, either in some context or area, and sometimes wholly, is impossible for humans. A skeptic may either suspend judgment and refrain from making claims to knowledge, or declare categorically that humans cannot know at all. Moderate skepticism involves shelving judgment that one can never know anything at all and preserving hope that it is possible to acquire knowledge if certain conditions are met. For instance, Pyrrho (the founder of the Pyrrhonic School) claims that skepticism involves accepting the limits of human knowledge but still persisting in the search for truth, which may be realized sometime in the future (Sinnott-Armstrong, 2004). A moderate skeptic is informed by the fact that our suspension of judgment is due to lack of sufficient information about the phenomenon of our investigation and our hope of attaining knowledge is kept alive by the fact that we discover new facts every day (Marušić, 2010).

On the other hand, a global skeptic makes a categorical declaration that we can never know anything at all, either due to limits of the human condition, or due to our investigation methods (Audi, 2010). For instance, Immanuel Kant argues that our condition as humans can only allow us to perceive that which is physical. This perception is not of the thing-in-itself, rather, of the thing-as-it-appears to us. These perceptions are then given meaning by the categories of our minds and assumed to be knowledge. However, this alleged knowledge is at best a subjective interpretation of

how the universe presents itself to us, not the actual nature of the universe. Hume is also a global skeptic when he argues that our attribution of causality to events and eventually relationship between things and occurrences is only a habit of the mind; hence, we cannot establish cause-effect relationship between or among occurrences that occur simultaneously and regularly.

Despite the fact that Skepticism arises from the discussion above, we cannot deny the fact that we have some information with us that we consider knowledge. In some cases, our beliefs are justified and persist over extended periods of time, withstanding criticism and empirical tests. It was important to establish the foundations on which these beliefs are based and determine if they can be held true, even if they are not consistent with the correspondence theory.

The correspondence theory, if correct, implies that what is stated of an entity remains true, regardless of any changes, any new tools of investigation or point of view. But it is not possible to know reality in itself and at the same time have ideas that correspond perfectly with it. Our knowledge processes are majorly hinged on the senses, and these senses experience what they encounter, not as whole, but depending on various conditioning and points of view of the perceiver (Berent & Platt, 2021). One may argue that the objects of sensation are already distorted because they present themselves to the viewer in a particular way and are interpreted according to the apparatus or tools used to study them. The theories that are formulated end up being biased towards the mind-set, method, objectives and goals of the researcher. In most cases, scientific theories are revised, refined and modified (sometimes abandoned) due to these changes (Ma, Liu, Dubois & Prade, 2010). Modification or abandonment of theories may not necessarily imply that the previously held theory was faulty or wrong, it could mean that the point of view was limited and it captured what the tools used to examine the phenomenon could manage to perceive. As such, one may find accurate elements of theories that have been abandoned and these elements persists in finer versions of the new theories.

Solutions to the perennial debate on whether scientific methods can offer knowledge of the world in which we exist can be found in the description of our knowledge

acquisition process. Scientific knowledge is not an independent reality out there, but a conscious understanding of information that is considered factual and justified (Mircică, 2011). This means that there are two parties involved; the knower and the object of knowledge. The object of knowledge, as demonstrated in this thesis, is not reality itself, but things as they appear to us. The knower is the human mind which is also dependent on subjective conditions, perspectives, goals and expectations in order to organize and attribute meaning to the perception it receives from the senses.

This means that our knowledge acquisition processes are not objective, they also lack reference to things in themselves, and therefore, attaining knowledge in the strict sense of the term is an impossible venture for humans. We should therefore reconsider our definition of knowledge, especially concerning the concept of truth. It is illogical to expect our faculty of knowing (senses and the mind), which are subjective and operate in accordance with that which they perceive, to grasp reality in itself (which is inaccessible through sensation). Even when we make an assumption that a theory or idea corresponds to reality, one may ask, how do we establish the truth of this claim yet we cannot know how this reality is? It is not possible to step outside our own minds to compare what we claim to know with reality which is beyond our understanding (McDermid, 2006).

We should, however, not become epistemic nihilists by claiming that lack of knowledge of objective reality amounts to total ignorance. We must seek to establish a new foundation for knowledge born out of empirical means. The JTB conditions need to be revised, albeit slightly to accommodate new perspectives of knowledge. In this regard, the condition of truth must remain necessary, however the correspondence theory should be replaced by two complimentary theories; pragmatism and coherence. From the discussion that has been ongoing in this work, it is clear that the correspondence theory of truth is static and not subject to confirmation or falsification using empirical methods. It is therefore not compatible with scientific methods of investigations. On the other hand, the pragmatic theory and coherence theories are widely employed to justify or falsify scientific theories. The pragmatic theory justified the use and validity of empirical methods in science because a prediction that is fulfilled by empirical observations gives credit to the validity of a claim. Coherence,

on the other hand, ensures that a theory has internal consistency as well as an integration of principles within the theory's system. It also maintains interconnectivity of parts or sections of a theory such that ideas agree with each other. It is therefore, logical to conclude that correspondence and these two latter theories describe different modes of existence. Scientific inquiry is not interested in description of things as they actually are, but as they are experienced through our senses. It is therefore reliant on pragmatism and coherence.

In the section that follows, the study sought to demonstrate how a redefinition of the truth condition for knowledge would help solve the conflict identified and extensively discussed in this work. Justification for substituting the conception of truth as correspondence with both pragmatism and coherence was demonstrated.

7.3.3.1 Advocacy for Pragmatic Conception of Truth in Scientific Knowledge

Our understanding of things as they appear to us is usually systematic, gradual and over a period of time, we acquire more perspectives about them. A major conviction among pragmatists is that knowledge of the universe is based on socially constructed belief systems as well as habits (Capps, 2019). This knowledge, however, cannot be known immediately or once and for all. Our understanding systematically deepens and allows us to formulate theories which, at times, generalize the phenomenal world. One of the critiques to this form of reasoning is that generalization of the observed to encompass all other realities of a similar nature is fallacious (Urbatsch, 2023). However, one would content that it may not necessarily be so. For instance, when the Kenyan National Transport and Safety Authority claims that more than 80% of road accidents in Kenya are as a result of human error (Ochomo, 2022), one may defend their claims on the already observed phenomena and the logical inference that can be drawn from this data. This claim will prove true, because the prevalence of reckless driving and other ignorance related activities on the roads results in a high number of accidents and when these instances of human error are reportedly low, so does the prevalence of accidents. Generalization of inductive claims is, however, not done arbitrarily, it must be based on reliable empirical evidence.

Pragmatism can be adopted as a theory of truth that can be verified and tested for reliability. Research of any kind, including scientific, aims at achieving true propositions about the universe, and therefore, it is imperative to establish beliefs that cannot be doubted. We cannot have reason to doubt these beliefs if they work (help us achieve our goals) and if they succeed in doing this, then one can confidently say that these beliefs are justified. Critiques may argue that a belief may work but not be true (Mounce, 2002), for example, in some societies, children are discouraged from unethical behaviour by being threatened that they will go to hell if they commit certain actions. They form this belief and consistently act ethically. This belief produces results and yet one may argue that it is not factually correct. One may respond to this objection as follows; firstly, it is impossible to determine that this belief is factually wrong because we cannot compare it with the actual state of affairs to establish this claim. Secondly, the claim that if an idea works it is accepted as true is not only limited to the utility of the belief alone, but also other factors such as; availability of evidence to support the claim, the existence of firm grounds on which this belief is derived, and a coherence of other ideas of a similar nature (Hookway, 2012). This is a demonstration that the new JTB framework being proposed in this work has a wide array of conditions that must be met before a belief is accepted as knowledge.

Pragmatism is essential in scientific research because without it, we would not be able to acquire knowledge that defines the universe in which we exist and make accurate predictions of phenomena. It helps us sort scientific theories on the basis of their scientific utility and prediction power, not their absolute truthfulness (which has been demonstrated to be unachievable) (Peirce, 2020; James, 2020). If a theory makes many more accurate predictions of phenomena and demonstrates utility in problem solving than others, it may be considered closer to the truth. Hence, it will be considered the most superior and taken to be the dominant theory of the day. It must have a higher predictive power, generate new knowledge and have more explanatory power than the rest. This means that there must be an evidential basis for selecting theories that describe the phenomenal world.

Moreover, the ability to accommodate new perspectives and revise the existing body of knowledge in accordance with new findings makes pragmatism an ideal theory of truth. Given the fact that knowledge acquisition in humans is dependent on the senses, it is logical to expect a gradual accumulation of information and occasional mistakes that arise from the imperfection of the senses. It is therefore necessary to admit a theory of truth that is capable of making necessary adjustments as well as enhancing improvement of our body of knowledge. Correspondence as a theory is incapable of accepting the possibility of adjustment in knowledge. its proponents would argue that if this adjustment is done, the previous body of knowledge was false because truth is constant and not subject to revision. As such, pragmatism is accommodative of the limitations of the human cognitive process.

One may also justify the adoption of pragmatism as a theory of truth in scientific knowledge due to the fact that science studies the phenomenal world (as described by Kant) and one of the features of this world is that it involves appearances that may be perceived differently by different people. This means that the same being can be understood from multiple points of view. As such, the explanation that offers a more comprehensive description of this phenomenal world, and can make accurate predictions of it and similar phenomena, should be considered more superior and adopted as valid until such a time when new perspectives emerge and offer us a more comprehensive view of the object of study. Scientists may use pragmatism to assess verisimilitude (closeness of theory to truth) by examining the effectiveness or utility of different theories in producing desired outcomes and making accurate predictions.

Verisimilitude makes reference to the acknowledgement that scientific theories do not accurately describe reality as it is. However, as constructs of the human mind, these theories aim to offer insights that have utility for human needs as well as seeking to increase the chances that they accurately describe the phenomenal world (Potolsky, 2023). Theories that explain the same phenomenon will therefore be evaluated based on their ability to produce useful results and make accurate predictions and those which will be found to have less accurate predictions or imperfect explanations will be abandoned. This is a pragmatic way of selecting theories and attributing verisimilitude to them.

Apart from verisimilitude discussed above, Richard Rorty introduces a new perspective to pragmatism that was accepted as valid in this thesis. He argues that the idea of foundationalism in knowledge should be abandoned because it implies the existence of indubitable and self-evident facts on which all other knowledge is built (Rorty, Putnam, Conant & Helfrich, 2004). One may agree with Rorty because, the mind, when organizing and giving meaning to data from the senses, has its own points of view and assumptions which may influence the final output of the cognitive process. Truth, will therefore not be indubitable and objective, rather, it will be situated, either socially, historically, or even linguistically. This paper argued that truth, as we envision it, is a product of all these elements and circumstances, hence, it is contingent.

Scientific investigations are all empirical in nature and require empirical methods of determining their validity and quality of their outputs. The only way to determine that a theory has accurate results is by examining whether its predictions have been observed. For example, if we want to test the hypothesis that adding compound X to chemical element Y results in a black solution, we have to perform actual tests in a controlled environment. If the observations made do not concur with the expected results, then the theory can be said to be erroneous because it did not have the desired outcome (The Duhem-Quine thesis may refute this claim. This was examined in subsequent sections of this work).

It is important to note that advocating for pragmatism as the criterion for truth does not mean that it is without its shortcomings. One critique that can be advanced is that utility of theories is not an adequate or clear normative guide for determining truth. In some cases, it may lead to ambiguity or wrong choices in decision-making (Shook, 2023). To this critique, one can argue that pragmatism requires both a complimentary theory of truth as well as a strong justification basis in order to adequately describe reality as it is experienced. This work proposed adoption of coherence as the complimentary theory.

Secondly, one may posit that pragmatism leads to indeterminacy which may occur where various beliefs have equal utility yet they are different. They may wonder how

possible it is to identify which one is true and which one is not (Shook, 2023). To this second critique, one may argue that the theories with a strong evidential support and those whose internal components cohere and have practical value are chosen.

A further objection to the pragmatic conception of truth is that it creates vagueness when the term 'utility' or 'usefulness' is used. These terms may have different meanings because different scholars have different expectations when conducting an experiment (Wills & Lake, 2020). If different people conduct similar tests, get different results but are both satisfied that the outcomes were useful to them, how would one decide which theory is better than the other? This creates unnecessary subjectivity which in effect hampers decision making and problem solving. It also demonstrates the insufficiency of pragmatism as a criterion for truth. The subjectivity of pragmatism may influence indecision during conflict resolution when a scientist encounters different theories which seek to explain the same phenomena but have different outcomes.

The challenges raised concerning the inability of the pragmatic theory of truth to offer a comprehensive basis for acceptance of scientific methods lead one to infer that there is need for a complimentary theory of truth. This theory should be able to address the problem of ambiguity that may occur when a scientist is unable to determine the quality or quantity of utility a theory has in order for it to be accepted over others. This study proposed the coherence theory because it contains within itself attributes that can be effectively used to address such concerns. In the following section, a demonstration of how the coherence theory of truth supports pragmatic theory of truth, was discussed.

7.3.3.2 Advocacy for Coherence as a Complimentary Criterion for Truth

Coherence, as a theory of truth holds that a belief is true if it agrees or fits in well with a set of pre-established beliefs. These kinds of beliefs ensure that there is internal consistency in knowledge this theory is adequate as a complimentary criterion of truth for pragmatism because it advocates for integration and organization of individual beliefs into an interconnected network or framework (Schantz, 2011). The realization that beliefs are interconnected leads to a broader understanding of phenomena that

could otherwise remained unknown or barely known if these connections were not perceived. It is important in scientific research because it helps in discovery of new perspectives and points of view.

A scientist always seeks more evidence for their theories and once new evidence comes to light, it is necessary that scientific theories be revised in order to refine them. Coherence is used as a standard to guarantee a belief system's consistency and connection with the new evidence. It ensures that two or more beliefs are not accepted if they contradict each other. In cases where there is contradiction, the scholar will be conscious of the fact that their data is not accurately representing the phenomena it seeks to explain (Alcoff, 2018). They will be then compelled to revise their belief systems and use evidence to identify and eliminate the inconsistent propositions. Moreover, coherence accommodates flexibility of knowledge because beliefs can be revised at any point new evidence is available, either, in support or in refutation, of an existing system of beliefs (Olsson, 2022).

The choice of coherence as an appropriate theory of truth was also influenced by the fact that, unlike the theory of correspondence, coherence presents a holistic approach to investigation of phenomena. It does not limit itself to just examining the relationship of propositions with the phenomenon it describes, rather, it is interested in examining all propositions within a system and checking their consistency with the entire network of beliefs in this system.

Additionally, coherence is suitable in solving persistent problems in epistemology such as the infinite regress problem and foundationalism. The infinite regress problem is one that arises in justification whereby a belief is dependent on others for justification and acceptance and this beliefs on which the former is dependent is also dependent on another, and so on. This creates an infinite chain of beliefs depending on each other and it becomes difficult to find the original foundation on which these beliefs are based (Lemos, 2020). This problem makes it impossible to establish the validity of arguments. Coherence's insistence on the logical relationship between propositions in a system helps to address this problem because one would investigate the logical flow of ideas and eliminate those contrary to the rest. This, at first glance,

would seem to be erroneous because the incompatibility of a belief with a network of other beliefs is insufficient to justify its rejection. However, the coherent test should be done after the pragmatic conception has been applied and used to determine which theories have beliefs with practical or useful outcomes. Coherence will be helpful in advancing further discrimination of these theories to determine which one is better suited for description of phenomena.

One of the critiques raised against pragmatism in the previous section was that it may be impossible, at times, to determine which outcomes are acceptable and have more predictive power than the rest. This perceived weakness in the pragmatic theory can be addressed when the coherence theory is used as a complimentary theory. Firstly, this theory ensures that a theory has internal consistence such that all propositions or statements within it have cohesion and lead to similar conclusions. If a theory is formulated in such a way that it has inconsistent, vague or ambiguous propositions within it, it should be discarded in favour of one with these characteristics. For example, if one uses terms that have multiple meaning but fails to define the use of these terms in exactly the same manner, their theory cannot have internal consistency, regardless of whether their outcomes are useful. This inconsistency leads to commission of the fallacy of equivocation, hence, reasoning in accordance with this theory will be fallacious as well. From this demonstration, one can clearly understand the essence of using coherence as a complimentary theory for pragmatism.

In some instances, however, coherence of theories or beliefs is allowed but empirical evidence is rejected or lacking. In such cases, the coherence is usually the only criterion of truth employed. For example, a well-orchestrated lie can be considered true because there is agreement of ideas from many witnesses or individuals. One may be inclined to overlook empirical evidence, especially if it is not adequate in favour of this coherence of thought. However, this study argued that pragmatism should be the primary criterion and coherence be secondary. If this is the case, it guarantees that empirical evidence takes precedence in determining the truth value of a belief system and coherence is employed to ensure that there is internal consistency among these beliefs.

Acquisition of knowledge in scientific disciplines is done by way of empirical methods and these methods are pragmatic in nature. Sometimes, the findings and conclusions of scholars may be erroneous due to intentional or accidental reasons. As such, it is important to ensure that such information is examined for inconsistencies and errors within it (Lemos, 2020). The process of peer reviewing requires experts in an area examining knowledge claims and determining if the conclusions are logically drawn from the data gathered. Peer reviewers also investigate the authenticity of the methods of research utilized. It is therefore an indispensable process in knowledge acquisition (Aggarwal, Louie, Morreale, Balon, Beresin, Coverdale & Brenner, 2022). This process cannot be effectively done if the coherence perception of truth is not utilized. Peer reviewers will determine as authentic any findings that have been properly derived (through the right research tools, audience or materials, and methodology of both data collection and analysis). If there is no logical consistence in the methodology, data and its interpretation, then the outcomes of the research will be rejected. Peer reviews are also important in scientific advancement because they create room for improvement by pointing out gaps and points of correction in research. This aligns well with the principles of pragmatism. The pragmatic and coherence theories, therefore, must be complimentary in order to attain accurate and valid scientific knowledge.

Additionally, since knowledge acquisition is gradual (owing to the limitations of the senses and our research tools and methods), it is important to always investigate the agreement of new findings with the already existing body of knowledge. This helps to not only integrate new ideas into the body of knowledge, but to gradually enhance adoption of new research tools, methods and perspectives in scientific investigations. In some instances, however, there may be need for instantaneous abandonment of ideas, especially when existing body of knowledge was founded on false grounds. Coherence will not be relevant in this case because it may reject the new ideas, something that must be guarded against. This example means that in some instances, coherence may not be adequate to justify our knowledge claims. This study recognized this shortcoming and sought to establish justification grounds that can guard against instances such as these.

Adoption of both pragmatism and coherence as criteria for truth is not enough to guarantee acquisition of knowledge in scientific disciplines as demonstrated in the previous paragraph. This is because these theories of truth are dependent on evidence that is availed or obtained by a researcher during their investigation. As such, there is a possibility that their conclusions may be influenced by wrong or erroneous data. Therefore, in order to secure the basis of our knowledge claims, it is important to establish justification conditions without which a researcher should not accept empirical evidence. Firstly, the evidence

In the section that follows, a discussion of how justification plays a significant role in scientific knowledge was done. Specifically, the indispensability of evidence and acceptability of the method or procedure of knowledge acquisition were demonstrated. The section focused on evidentialism and Reliabilism as indispensable principles of justification.

7.3.4 Evidentialism and Reliabilism's Roles in Justification: Demonstrating the Validity of Empirical Methods in Knowledge Acquisition

Evidentialism is a philosophical school of thought concerning the justification condition for knowledge. It posits that beliefs can be justified by way of evidence that is satisfactory (Feldman & Conee, 2020). Reliabilism, on the other hand, does not focus on evidence, but on the reliability of the cognitive processes used to produce knowledge (Goldman, 2020). Both of these epistemic justification theories are important in demonstrating the indispensability of empirical methods of science in acquiring knowledge of the world in which we exist. They are also important in ensuring that challenges associated with the quality of evidence in scientific inquiry are effectively resolved.

7.3.4.1 Evidentialism

Any rational belief in a proposition requires evidence. It would be fallacious to argue that a proposition is accurate if no evidence has been presented to support this claim. It would be similarly wrong to claim accuracy of a statement when the evidence points to its insufficiency. As per Feldman and Conee (2020), evidentialism posits that it is the role of evidence to offer epistemic justification. An individual's beliefs

can only be epistemically justified if they agree with the evidence the person has or that which is available.

It is not in contention that beliefs should only be accepted if they are backed by evidence, rather, one may inquire on the nature and quality of evidence that can be deemed sufficient for making categorical knowledge claims. This school of thought greatly emphasizes on critical thinking and logical processes, rather than intuition, faith, emotions or habits and tradition (Way, 2016). Unlike coherentism, and foundationalism, evidentialism does not allow other sources of justification which may not have evidence to support it. This theory was deemed appropriate as a criterion for justification because it ensures that the only claim that is acceptable is one that is sufficiently backed by proof. It also ensures that the researcher does not make inferences that are not explicitly proved by evidence. The logical fallacy of hasty generalization is avoided when this justification theory is applied in reasoning. This fallacy occurs when one seeks to make general statements regarding reality even when the evidence available to them does not necessarily point to their conclusions.

Evidentialism is a valid theory of justification because it offers a clear, simple and logical criterion for acceptability of beliefs. Beliefs can only be justified to the extent that they have empirical evidence to support them (Feldman & Conee, 2020). This ensures that beliefs based on arbitrariness and unfounded claims are abandoned. It also leads to adoption of critical thinking in assessment of our beliefs. As a result, intellectual integrity is enhanced and are beliefs are evaluating using the same standards, and only accepted or abandoned depending on the quality and quantity evidence for or against them. Evidentialism is also essential to developing the attitude of open-mindedness which makes an individual consider diverse points of view and be open to change of beliefs if evidence against them is submitted (McCain, 2014).

One of the most important reasons why evidentialism is considered the best theory of justification is that it offers a consistent standard of assessing beliefs in various domains of knowledge. Regardless of the content of a belief, it is judged based on evidence available, and as a result, biased reasoning is avoided and fair thinking as well as objectivity enhanced. It also mitigates dogmatism and rigidity in ideology

(Feldman, 2009). Thinkers who base their reasoning on evidentialism develop intellectual integrity which allows them to abandon their personal biases in favour of evidence and logical correctness.

Despite the seemingly objective nature of this theory of justification, several critiques can be raised against it. Firstly, one may claim that it sets the standards too high such that some beliefs may be rejected even when they are true (Dodd, 2012). This high bar for evidence may be unachievable due to the limits of human understanding and experience. For example, beliefs concerning reality beyond physical existence cannot be backed by evidence because it is not available. The evidentialist will argue that these beliefs are not justified.

A second object to this theory is that it can lead to epistemic circularity. This occurs in instances where the evidence available is determined by one's beliefs. These beliefs will lead one to seek evidence that aligns with them and ignore that which proves them wrong (Beddor, 2015). After all, the individual is responsible for the choice of evidence they submit to support a belief. In such a case, it would be difficult to establish a firm foundation for our belief systems.

To the first critique, one may argue that knowledge acquisition requires indubitable proof and cannot rely on intuition or weak evidence. In order to eliminate subjectivity and acceptance of unjustified beliefs as knowledge, we should establish a rigorous criterion that will distinguish unjustified beliefs from those that are epistemically justified. This means that we should refrain from claiming knowledge of reality beyond our scope of perception and understanding, and which we cannot submit adequate proof for. This will ensure that our knowledge claims can be adequately and competently accounted for. Concerning scientific knowledge, scholars will only make claims to knowledge if they can adequately use evidence to support it.

To the claim that evidentialism leads to epistemic circularity, one can demonstrate the objectivity of this justification theory by arguing that knowledge claims must be rigorously evaluated and as such, evidence against a claim will always be availed. In these instances, it becomes difficult for one to choose only the evidence that supports

their claim and ignore that which disagrees with them. Some of the core features of this theory is that it enhances open-mindedness, intellectual humility and intellectual integrity. These intellectual virtues would greatly influence a thinker to always adopt objectivity in their pursuit of knowledge.

Scientific claims to knowledge should be justified by availability of evidence that fully supports its belief systems. Evidentialism in scientific investigations requires scientists to have rigor in belief evaluation because all evidence for and against the belief must be investigated before making the final verdict. Reliable evidence is the only standard that can be used to distinguish between valid scientific claims and invalid ones.

This standard also advocates for formulation of scientific theories can be empirically tested and falsified. It ensures that evidence for either support or falsifiability of theories is easily obtainable. It also offers an opportunity for revision of theories if new evidence is found. As earlier demonstrated in this chapter, scientific knowledge is tentative and subject to revision with new or improved methods of inquiry and knowledge. It is therefore important to ensure that our justification frameworks allow for this flexibility. Evidentialism offers this opportunity perfectly. Finally, evidentialism applies to all empirical disciplines universally and is consistent and clearly understood by anyone who engages in research of any kind.

Availability of evidence is crucial to scientific progress. However, one must be cautious of the nature and quality of evidence presented in order to make valid claims about phenomena. In some instances, evidence may be fabricated, or attained from illogical processes which involve personal biases and prejudices, subjective theoretical frameworks as well as historical and methodological factors. In such cases, the reliability of evidence is definitely compromised, regardless of how convincing it may be. It is therefore essential to ensure that our knowledge claims are justified further. This study argued that evidentialism can be complemented by Reliabilism as a theory of justification. In the section that follows, the nature and essence of Reliabilism in empirical research was demonstrated.

7.3.4.2 Reliabilism

In scientific investigations, reliable processes are those which produce true beliefs. In this theory of epistemic justification, the processes, not the person's intention or subjective views matter in the investigative process (Goldman, 2020). We can demonstrate Reliabilism as follows, "a person, X knows that Y if and only if Y was obtained or arrived at through a reliable process." This implies that S could not have believed Y if Y was not arrived at through a reliable process.

Reliable processes in scientific inquiry include empirical methods which have produced accurate predictions and solved problems on a consistent basis. Empirical methods of science involve a carefully designed system that includes regulated interaction of elements or phenomena and a systematic observation for patterns and outcomes. If a test or experiment is done rigorously and repeatedly severally, it can produce data which can be used to support or refute theories (Sosa, 2001).

These findings are not be determined to be reliable by the same scientists who conduct the experiments. Their methods, instruments, data and interpretations of data are reviewed by peers in the same area of expertise to ensure objectivity in reporting. This is a quality control mechanism which guarantees that the right findings and conclusions are made. According to Riggs (2002), a reliable process is one which can produce similar results when conducted by other scholars in different settings. Replication of results also helps to identify reliable scientific processes. This replication involves same experiments or tests done by different scholars, but yielding similar outcomes.

Moreover, reliability of scientific research processes is determined by adoption of data analysis instruments and methods that are standard, rigorous, and proven to be accurate in producing genuine results (Comesaña, 2011). Poor sampling techniques and defective data analysis formulas will always produce defective results; hence, scientists should avoid these kinds of errors. Evidentialism, if applied by itself, may result in reliability challenges because keen focus is not given to determining if the processes used to acquire evidence are valid. For example, it is necessary to adequately prove that the methodology chosen for research in a particular area of

research is the best one and the one guaranteed to provide logical conclusions. Any empirical research must have a section of research methodology which clearly stipulates why, among many possible research designs, a researcher chose a particular one, and not the rest. This is a demonstration that scientific investigations are not only interested in acquisition of evidence, but also ensure that research processes are reliable and lead to the best possible explanation for phenomena.

Additionally, reliabilism and evidentialism are complimentary methods of justification because, in instances where the evidence acquired is inconclusive or insufficient to warrant making of categorical conclusions, reliabilism can be used to examine if the processes through which the available evidence was acquired is justified (Comesaña, 2010). This helps to distinguish acceptable evidence from that which is not valid for making scientific claims to knowledge. Reliabilism, in this case, acknowledges that researchers may not always have conclusive evidence concerning phenomenon under investigation but are still needed to explain this phenomenon. It is therefore imperative that a reliable process of choosing research tools and materials (which include respondents), data collection methods, its analysis and eventually dissemination is done in a logical and objective manner.

Reliabilism is evidently an important component of epistemic justification required to demonstrate that scientific knowledge is possible and can be acquired if the right methods, tools and techniques of inquiry are used. Evidentialism is essential in epistemic justification as well. This thesis demonstrated that evidence is not just accepted because it is available. It has to be justified by the methods and factors that formed its existence. As such, these two methods complement each other because in the absence of evidence, reliable investigation processes are insufficient and lead to blind acceptance of conclusions, and without reliable processes of evidence acquisition, this evidence is not trustworthy. As such, both must be present for justification of empirical knowledge to occur.

The challenges posed by the truth condition in knowledge were resolved by substituting the correspondence theory with both pragmatic and coherence theories. The research further clarified that these theories of truth, if supported by the

justification theories of evidentialism and reliabilism, can lead to knowledge through empirical methods. However, the skepticism that arises from the Duhem-Quine thesis have not yet been addressed at this point. In the section that follows, the paper sought to examine whether the Duhem-Quine thesis completely eliminates possibility of knowledge acquisition and if a solution to the skeptical challenges it raises can be found, hence, justifying the claim the crucial tests can lead to knowledge acquisition.

7.3.5 Possibility of Knowledge against the Skepticism of the Duhem-Quine Thesis

The Duhem-Quine thesis, as discussed in chapter six of this work, leads to the logical conclusion that scientific methods cannot give us certain knowledge because theories are under-determined by evidence. However, this may not be the case. Scholars have presented arguments to demonstrate that this thesis does not imply impossibility of knowing through empirical channels.

A critical assessment of the ideas of both Duhem and Quine demonstrates that most of their focus lies in the falsification of scientific theories, not their confirmation. Duhem's under-determination is based on the assumption that we may not have enough data to prove a theory wrong because unexpected results could arise from any of the many auxiliary assumptions. In cases where the expected outcomes are achieved, then we can still argue for knowledge. For instance, if we test the theory that the boiling point of water is 100 degrees and the experiments produces this outcome, we will not investigate the background assumptions. We will consider the outcome accurate. The challenge arises when we seek to dispute the theory because the findings of the test are different from the expectations of the theory.

To the above claim, Duhem would argue that sometimes various theories have evidence behind them and this evidence is equally convincing. In these instances, scholars do not have a criterion by which they would pick the best theory and drop the rest. This is also partly because we cannot use crucial tests to determine which one is false. One would respond to Duhem that in cases where various theories have evidence behind them and cannot be falsified, it is important to examine which one has more accurate and successful predictions and adopt it as the better theory. This ensures that a more superior theory (in terms of production of favourable and useful

results as well as the one with more predictive power) is chosen to explain the nature of phenomena.

7.3.5.1 Inference to the Best Explanation as a solution to the Duhem-Quine Problem

From the ongoing discussion, it has been shown that it is possible to acquire knowledge (of the phenomenal, not noumenal world) through scientific methods if we adopt the JTB criterion. The condition of truth should include both pragmatism and coherence to ensure that our truth claims are useful in explaining what is experienced and there is internal consistency of ideas. The justification condition must include within itself adequate or sufficient evidence and reliable data collection, analysis and interpretive methods. The challenge posed by Duhem and Quine in their under-determination and holism also needs to be addressed to guarantee the claim that knowledge can be acquired despite their skepticism. Inference to the best explanation is a model that can be adopted to address this skepticism. It was authored by Gilbert Harman, an American scholar, who argues that a scientific theory should only be accepted over others if and only if it demonstrates superiority to its rivals in offering explanation of observed phenomena (Harman, 1965).

Inference to the best explanation (IBE) is a form of non-deductive reasoning that is useful in addressing knowledge claims that are faced with ambiguity and/or uncertainty. It involves the selection of a theory among other competing theories because it has been considered as having the best explanation for observed phenomenon. This theory must have a more superior predictive power, explanatory power, internal consistency or coherence, and in agreement with available empirical evidence. As such, it is the one that gives the best explanation for phenomena and produces accurate results given the available evidence (Lipton, 2017).

For example, supposing one finds their vehicle window broken and a laptop that had been placed in the back seat missing. Various hypotheses can be proposed based on the available evidence (shattered glass and missing laptop). One theory could assert that the window was mistakenly broken by children while playing with a ball and they carried the laptop, another theory could claim that it was broken by a curious passer-

by and they took the laptop, while a third could argue that a thief intentionally broke the window and stole the laptop. Of these three theories, one may rule out the first two and claim that the third offers a more logical and likely explanation for the event. They can claim that it could be possible in all the cases, but the most likely explanation is the third because an act such as breaking the window and stealing are rarely unplanned or accidental events.

The kind of inferential thinking drawn from the example above best describes Inference to the best explanation. IBE is a model or system of evaluating hypotheses or theories to determine that which is more suitable. This kind of thinking is opposed to the precision and certainty that is common in deductive reasoning (Care, 2017). The Duhem-Quine thesis argues that we must always be certain that a hypothesis and its background assumptions are wrong in order to falsify a theory. However, this is an impossible task in scientific investigation because it can only provide sufficient evidence for abductive thinking (a method of formulating hypotheses using available evidence), not deductive reasoning. It is therefore essential to note that the articulation and accuracy specific to deduction is not applicable to scientific investigations. However, this does not mean that we cannot make valid inferences from the data we gather through empirical means. IBE involves both critical thinking and a thorough examination of evidence to determine the best possible explanation that can be offered to explain phenomena.

IBE can be explained as follows; Firstly, a phenomenon P is observed, then hypotheses Q, R and S are formed to explain P, thirdly, an evaluation of the hypotheses an observed phenomena shows that R better explains P (it is precise, consistent, has a higher explanatory power, and its outcomes are consistent with available evidence), fourthly, the conclusion, "R is (probably) true" is made.

Critique of IBE may involve pointing out that the criterion for deciding which theory offers the best explanation is arbitrary and dependent on the subjective views of an individual. Different scholars may determine the appropriateness of a theory using various criteria such as a theory's predictive power, simplicity, and quantity of evidence, among others. This subjectivity may lead to confirmation bias in which an

individual selects the theory whose tenets are in agreement with their existing beliefs (McCain, 2017). Contrary to what these critiques may argue, it is not so. This process begins with formulation of possible explanations for an observed phenomenon, then follows a critical assessment of the strength and viability of each of these possible explanations. It is important to consider all possible explanations for phenomena. Ultimately, one is guided by a set of background evidence to determine which of these explanations best fits to describe the observation. This available evidence helps to ensure that unsuitable hypotheses are ruled out as well as guaranteeing the impossibility of an infinity of hypotheses for the same phenomena. Additionally, adoption of evidentialism and reliabilism as theories of justification will ensure that evidence is comprehensively analysed and chosen, not based on the researcher's taste or interest, but in accordance with its ability to explain phenomena and make accurate predictions.

IBE is a relevant model for addressing the concerns of the Duhem-Quine Thesis because scientific research always requires explanation of phenomena. In the absence of explanation, scientific progress is halted. Explanations are frameworks that help scientists understand and give meaning to observed world. These explanations are not merely guessed or wished, rather, they are inferred from empirical evidence, critical thinking, as well as theoretical models (Woodward & Zalta, 2017). A good explanation should offer a description of an observed phenomenon, demonstrate its underlying mechanism and even predict future patterns of occurrence of this phenomenon. It is therefore the submission of this research that the skeptic attitude attributed to the Duhem-Quine problem can be sufficiently addressed by adoption of IBE in scientific justification of its research data and interpretations.

The sufficiency of this model is informed by an understanding that acquisition of knowledge in itself is an impossible venture when scientific methods are used. As such, we can never acquire comprehensive knowledge of reality that is free from any doubt. Therefore, our methods of investigations should not be expected to result in absolute knowledge. In cases where doubt is raised concerning the objectivity of scientific methods, researchers should adopt logical evaluation methods of data collection, data analysis and interpretation of findings. This involves adherence to

logical correctness where they are guided by evidence (that has been derived from reliable processess). Logically derived evidence helps to eliminate scientific theories founded on insufficient evidence as well as those obtained through irregular processes or methodologies. Ultimately, inference to the best explanation offers scientists with the best explanations for phenomena by choosing, among competing theories, one with more pragmatic utility, better predictive capacity and internal consistency.

7.4 Conclusion

This chapter demonstrated that knowledge of reality as it is (Kant's *Noumena*) is impossible owing to the limited nature of our perceptive and cognitive processes. It also asserted that scientific pursuit of knowledge is not rendered invalid by this realization. On the contrary, the study demonstrated that the world as it appears (Kant's *Phenomena*) can be known as it manifests itself to us. The kind of knowledge derived through scientific methods is therefore not objective knowledge that is compatible with the correspondence theory of truth.

The JTB conditions still hold true, however, with reference to the scientific method, few adjustments need to be done to qualify information from empirical processes as knowledge. Firstly, the truth condition should make reference to both pragmatism and coherentism. The former ensures that all information that is accepted as knowledge works, accurately makes predictions and successfully addresses problems that it targets. The latter ensures that there is internal consistency of ideas such that logical principles which guarantee proper thinking (such as the principle of non-contradiction, sufficient reason and identity) are not violated. Concerning the justification condition, evidentialism and reliabilism should be present in any system of knowledge. There must be sufficient evidence to make a theory acceptable and the processes through which a theory is formulated and tested should be valid.

Finally, the Skeptical concerns raised by the Duhem-Quine thesis concerning the possibility of knowledge acquisition by way of empirical methods can be remedied by adoption of the Inference to the best explanation model. Theories that seem to have equal evidential claims for observed phenomena can be assessed based on their ability to consistently produce accurate results, predict phenomena correctly, and have

internal consistency. This model offers a solution that can be used to make valid inferences based on available evidence and critical thinking.

CHAPTER EIGHT

FINDINGS, CONCLUSION AND RECOMMENDATIONS

8.2 Summary of Findings

This work generally aimed at establishing the validity of scientific methods of inquiry in knowledge acquisition. It had four objectives which included: examining the necessity and sufficiency of Belief, Justification and Truth as conditions for knowledge; a demonstration of sciences' adoption of pragmatism as its preferred theory of truth; an exploration of the Duhem-Quine thesis, its major thesis, as well as its implications to scientific knowledge; and ultimately, establish the possibility of knowledge acquisition through empirical methods of science.

The findings of each of these objectives are discussed below.

Most philosophers have always considered knowledge in an epistemological perspective to entail propositional knowledge, not skill acquisition or possession or acquaintance. In order for information to qualify as knowledge, it must meet three necessary and sufficient conditions; belief, justification and truth. A necessary condition in knowledge is one without which we cannot validly claim to know. A necessary condition is that which offers enough basis to guarantee the existence of knowledge.

The belief condition makes reference to a mental condition in which an individual is convinced of the truth value of a thing. It is a propositional attitude characterized by the relationship between the proposition and the person or subject seeking to know. This is a necessary condition because without it, the subject cannot be cognisant of the thing to be known. Knowledge is a conscious process that must involve awareness of a thing and a feeling that it is the case (the actual state of affairs). Various scholars have attempted to demonstrate that belief is not important for knowledge but have failed. For instance, Farkas offers counter-examples in which a person loses memory of the museum's location, looks it up in a notebook, and acquires knowledge before formulating the belief that the museum is on the 53rd street. An assessment of this counter-example demonstrates that the belief was already formulated when the subject wrote the location on the notebook.

Another counter-example was offered by Collin Radford who argues that one can successfully advocate for knowledge without belief. In his example, he presents a scenario where an individual answers questions even though he does not think his answers are correct. To his surprise, they turn out to be correct and yet he never believed them in the first place. This claim was examined and it was found out that Radford was mistaken into attributing knowledge to these examples because to know something requires a conscious awareness of the fact. If the respondent of these questions would have gotten the answers wrong, he would have argued that he did not know. This, the paper concluded, was a case of a lucky guess.

The final counter-examples to demonstrate the possibility of knowledge without belief were presented by Myers-Schulz and Schwitzgebel and they involved use of laymen who used the term 'to know' and 'to believe' synonymously. In all the five examples they gave, it was clear that the respondents did not understand the true nature of knowledge and could therefore, not competently describe it. Additionally, there was linguistic ambiguity in the use of the terms 'belief' and 'knowledge' and individuals ignorant of the epistemic use of these terms could not offer valid feedback to questions asked.

The research clearly demonstrated that belief is a necessary condition because it enables the subject to have an awareness of the truth value (truth or falsity) of their ideas. A conviction that an idea is true or false forms the basis of one's understanding of it.

Truth makes reference to a state in which a proposition is in agreement with a fact or state of affairs. It is the quality which makes a proposition to match with that which it describes. This research established that truth is a necessary condition for knowledge because in its absence, then we cannot be conscious of any information. A statement must be compared to something that it describes in order for it to be termed true. If it does not match with the object it describes, then we cannot say that we have knowledge because one cannot know that which is not. In other words, if a statement is false, it means that there is no reality with which it matches. Falsity is merely a fault in beliefs.

There are various theories of truth, including; correspondence, coherence, pragmatic, semantic, deflationary and redundancy. Out of all these theories, many scholars point at correspondence as the most valid and acceptable one because it necessarily evaluates the accuracy of a claim by comparing it with the object or being it describes. Despite the seemingly necessity of truth in knowledge, some critiques have been levelled against it.

Firstly, Popovic argues that knowledge is possible without truth. His counter-examples show a situation in which a person claims to know that a team has won a match but in actual sense, the team cheated and did not win. This win is overturned after sometime. Popovic argues that this individual had knowledge that the team won, but it was later proven that this was false. Popovic's example was considered erroneous because he uses the term, 'win' in two different senses in the same argument. In the first sense, he uses it to mean a false belief and in the second, to make reference to the actual state of affairs.

Tolliver argues that knowledge does not necessarily require truth because one can still have knowledge even when their belief is not comparable with any state of affairs. He proposes adoption of reliability as a replacement for the correspondence theory of truth. His claims, however, are erroneous because reliability alone is insufficient to guarantee knowledge. Information may be manipulated to be consistent and yet it does not represent any actual state of affairs.

Finally, Jetli argues that we can never be justified in believing that we know something is true because truth exists outside the knower and it is not possible for the knower to confirm it. He also claims that knowledge is not a conscious state of mind, but a process towards attainment of truth. In refutation of Jetli's assertions, the researcher demonstrated that it is fallacious to argue that there are truths which exist without knowers because for truth to exist, there must be a knower who actively seeks to compare an idea or belief with reality. In the absence of consciousness, truth cannot be. It is also fallacious to argue that knowledge exists outside the mind of the knower.

It is only plausible to make this statement in reference to reality, not knowledge or truth.

In essence, truth is necessary for knowledge because when we claim knowledge of something, we must demonstrate that we really know it and the only way to do this is by proving that our belief is in agreement with the state of affairs. False propositions cannot constitute knowledge because they do not represent any state of affair, but misrepresent them.

The justification condition asserts that in order for a belief to constitute knowledge, there must be evidence in support of it. This condition is important because it gives one a rational basis on which to accept or reject beliefs. Justification plays a normative role because it provides logical grounds for the acceptability of beliefs. There are various theories of justification, including; foundationalism, coherentism, Reliabilism and evidentialism.

Claims that knowledge can exist without justification may be supported by arguments such as; in some instances, we understand reality intuitively and without valid or compelling reasons to prove that our beliefs are the actual state of affairs. This may occur in instances of educated guesses. However, this assertion is wrong because in the absence of evidence, it is only logical to defer judgment until such a time when one can be convinced that a belief is true.

In some counter-examples, such as those offered by Gettier, the claim that knowledge may still be absent even when the three conditions are present. However, upon closer inspection of these counter-examples, one notices that the counter-examples are based on false belief which cannot be justified. Gettier's claims to fulfil the justification condition are mistaken because his counter-examples contains errors, false propositions, and one would not be compelled to accept them regardless of their seemingly validity. Justification must involve infallible support to beliefs and these beliefs must be necessarily true to constitute knowledge.

Justification cannot be wished away because it is what makes our beliefs worth having. In its absence, it would not be possible to distinguish between a belief that is worth holding and one that should be discarded because there would be no reason whatsoever to reject any belief or conviction.

The study found out that these tripartite conditions are all individually and collectively necessary for knowledge. However, they are not individually sufficient for knowledge. They can only be termed sufficient if all of them are present. This means that if at least one of them is absent, then we cannot have knowledge. If, however, all of them are present, they offer adequate circumstances that guarantee knowledge.

The following were the findings of the second objective of this study which sought to examine the conception of truth in scientific inquiry.

Science employs the inductive method of research and deals with physical existence. An explanation in science is acceptable if theories that describe it are tested and the observations of the test are in agreement with the predictions of these theories. This means that, in science, a theory is true if and only if its predictions are noted to work or have a practical value. Various philosophers of science are worth mentioning in this discourse; Karl Popper, Thomas Kuhn and Imre Lakatos.

Popper seeks to rid empirical science of the epistemic uncertainty that arises when scholars use induction to arrive at scientific knowledge. The goal of science is to observe nature, formulate explanations for it and predict the course of future events. Popper presents a pragmatic account of science which involves creation of theories to explain the world. He argues that these theories must be testable (by way of inductive methods) and be falsifiable. A theory should be accepted as accurate until such a time when it is disapproved (falsified). Popper's conception of science is that it cannot give us certainty because it relies on empirical methods, which are defective and can only account for what is perceived at a given time. His assumption that falsification can remedy the problem of induction is mistaken because falsification relies on induction.

Kuhn, in his *Structure of Scientific Revolutions,* demonstrates that scientific progress is evolutionary, therefore, a theory serves its purpose until such a time when it is completely abandoned in favour of a new more competent and acceptable theory is adopted in its place. Every theory works within a paradigm and this paradigm dictates the nature of scientific investigations at this time, the questions asked, and the criterion for investigations. This means that the knowledge acquired from scientific investigations is determined by the paradigm's point of view and research tools.

For Kuhn, science is not built on existing knowledge because once a paradigm has been abandoned, its theories, standards, methodology and core principles are abandoned as well. The new paradigm introduces its own principles, methods and theories which will be the new normal. An investigation into the work of Kuhn demonstrates that it is common in scientific progress to abandon theories that had been held true. This demonstrates that scientific truth, at any given time, is a matter of opinion where the most popular and effective idea is adopted. This shows that science does not adopt the correspondence conception of truth, rather, it upholds truth as a pragmatic value of propositions.

Lakatos also presents a pragmatic conception of truth by positing that science operates on the principle that we do not have objective explanations for reality and the theory that best explains phenomena at a time is granted. Theories are acceptable until such a time when their counter-examples are found, and even when these counter-examples have been found, the theory should be adjusted to address the gap introduced by these counter-examples. In essence, he does not advocate for truth as objective and static, rather, as dynamic and subject to manipulation to ensure that the intended outcomes are realized.

The works of these three scholars demonstrate that scientific pursuit of knowledge meets the belief and justification conditions, however, the truth condition is envisioned as pragmatic, which is contrary to what most scholars in epistemology advocate. This seemingly contradiction may lead one to argue that scientific knowledge is not knowledge in the proper sense of the term because it allows for adjustment, manipulation and abandonment of information that has been held as true.

The third objective sought to examine the major tenets of the Duhem-Quine thesis and its implications for scientific knowledge. The findings of this objective were discussed this section.

The study found that the Duhem-Quine thesis raises an important concern for researchers in scientific investigations; that empirical tests do not only involve the theory or hypothesis under scrutiny, but its background assumptions as well. It is possible that a theory is rejected because the expected outcomes were not observed, however, we are not always justified to reject it. Quine demonstrates it clearly by positing that a proposition, in isolation, cannot be tested. It must be tested together with others that form a whole theoretical framework.

The fact that a hypothesis cannot be detached from its background assumptions and once a test is done and the outcome is not favourable, the researcher cannot identify the exact background assumption which caused the problem. Duhem limits this problem of under-determination to experimental sciences only whereas Quine encompasses all empirical sciences. It was established that the problem of under-determination is a universal problem in empirical research.

Duhem's introduction of the principle of conservation in matter (matter cannot be destroyed during a physical process within a closed system) implies advocacy for foundationalism which insists on the importance of coherence and consistency in any theoretical framework.

One of the implications that can be drawn from the Duhem-Quine thesis is that scientific theories are intertwined or interconnected and as such, dependent on each other. If one seeks to refute or prove one, they will, to some extent, prove or refute the rest. A second implication is that reductionism, a common way of thinking, is wrong. One cannot simply rely on the data they get from experimentation and observation and make conclusion claims. Duhem and Quine encourage extensive investigations.

Despite the strengths of the Duhem-Quine Thesis, it fails to offer a clear criterion for evaluation and falsification of theories. Without such a theory, we cannot know whether to retain or abandon a theory or revise it. The thesis solely relies on the relationship that exists between a theory or hypothesis and its background assumptions. It ignores other fundamental knowledge creating experiences such as history and sociological factors. If this thesis holds, it will make all other factors irrelevant.

Ultimately, this theory may lead one to epistemic nihilism because it rejects the possibility of falsification of theories on the basis of empirical evidence, no matter how strong and compelling this evidence is. If given, this thesis can make uncertain all knowledge processes and no amount of evidence will be sufficient to render a belief false. This thesis also demonstrates the theory-ladenness of observation. This implies that observations are not objective but are influenced by the condition of one's mind and the theory that guide the researcher in their investigation. This means that our observations are only subjective and cannot be reliable to make conclusive claims on the nature of observed phenomena.

The fourth objective sought to establish the possibility of knowledge acquisition using empirical methods of investigations. The findings were discussed below.

This study established that, in the classical tripartite conditions, the correspondence theory is most acceptable as the criterion of truth. However, this kind of truth is unachievable by the human mind. On the other hand, the pragmatic conception of truth is compatible with scientific methods of inquiry and identifies with the human understanding of reality. If one were to adopt correspondence, therefore, it would be clear that knowledge of the world is impossible for humans. It is therefore important to revise our conditions for knowledge to account for the information in our minds which we are convinced is knowledge.

It is logical to argue that we can acquire knowledge, not of things as they are (Kant's *noumena*), but as they appear to us (Kant's *Phenomena*). We therefore have to modify the conditions for knowledge to suit this kind of understanding. This research

advocated for retention of the three conditions (Belief, Justification and Truth) because they are necessary and sufficient for knowledge. However, the truth condition should not be the abstract and objective conception identical to the correspondence theory. Truth should be more practical, useful, demonstrable through empirical evidence, and also in coherence with a set of proven and established propositions. To this effect, the paper proposed adoption of pragmatism and coherence as complimentary conceptions of truth. Pragmatism ensures that we understand and accurately explain and predict phenomena while coherence protects against violation of logical principles of thought such as non-contradiction, identity and sufficient reason.

Pragmatism and coherence are not sufficient to guarantee the accuracy and validity of scientific knowledge. The justification condition should make reference to both evidentialism and Reliabilism. Evidentialism as a system of justification emphasizes on the indispensability of evidence (that is backed by critical thinking and logical processes) in knowledge acquisition. This notwithstanding, reliability of the methods used to investigate reality is also an important element in our justification processes. Reliabilism ensures that the scientific methods we utilize in our pursuit of knowledge have consistently offered accurate predictions and useful outcomes.

Finally, the study established that the skepticism raised by the Duhem-Quine thesis can be adequately addressed by adopting the Inference to the Best Explanation model in scientific explanation. This model is a form of non-deductive reasoning that is relevant in addressing ambiguous or vague claims to knowledge. This model posits that a theory should be chosen over others if it has more accurate predictions of phenomena, have more predictive power, demonstrate internal consistency and be in agreement with the available empirical evidence. This model greatly helps in inculcating inferential thinking in the minds of scholars and offers a logical and evidential framework on which to select scientific theories and discard them.

The study, therefore, submitted that knowledge of reality in itself (as it is) is an impossible venture for humans. However, things as they are experienced can be known and justified. This may not qualify as knowledge in the strict sense of the term,

however, the conditions for knowledge can be modified to justify knowledge acquisition through empirical methods.

8.3 Conclusion

The conditions for knowledge (Belief, Justification and truth) advocated for by epistemologists are valid. They are individually necessary because their non-existence implies non-existence of knowledge. They are also collectively necessary. Concerning their sufficiency, none of them is adequate to guarantee knowledge on its own. Knowledge can only be present if all the three conditions are met.

Scientific investigation of reality cannot grasp reality as it actually is. It draws conclusions and make predictions based on that which it perceives, either through crucial tests or observation. As such, the conception of truth in empirical disciplines is not correspondence, but pragmatic. Truth in science changes in respect to the methods used, point of view adopted, as well as the evidence available to the researcher at the time of drawing conclusions. When viewed from an epistemological perspective, empirical tests cannot give us knowledge, however, this claim is disputed by the fact that we have an understanding of the universe and how it works.

The Duhem-Quine thesis posits that no hypothesis can be known by itself, it must be understood in connection with its background assumptions, and hence, crucial tests cannot adequately falsify a hypothesis. Duhem and Quine introduce a skeptical perspective which categorically states that regardless of the convincing power of empirical evidence, we cannot prove a theory wrong. The implication of this kind of reasoning is that our knowledge is under-determined by evidence. The study found out that there is a possibility of using empirical evidence to determine the best theory to explain phenomena.

Knowledge is possible when empirical methods of research are used. This knowledge is not objective and abstract (as presented by correspondence theory), but pragmatic and coherent. It is knowledge of the world as it presents itself to us and as we perceive it. It is therefore dependent on evidence, reliable data collecting and analysis methods, as well as internal coherence in accordance with logical principles such as non-

contradiction, sufficient reason, and identity. The study concluded that inference to the best explanation is a model that is useful in identifying and adopting scientific theories that are better placed in explanation of reality.

8.4 Recommendations of the Study

The study, having established that reality in itself (as it is) cannot be known by humans due to the limitations of our cognitive processes, made the following recommendations:

i. That the classical definition of truth as a condition for knowledge be revised to accommodate pragmatic conception due to the realization that correspondence of ideas in our mind with reality cannot be achieved.

ii. That the Duhem-Quine thesis should not be considered as an impediment to knowledge acquisition because it only raises objection to achievement of certainty through falsification, not proving a hypothesis right.

8.5 Suggestions for further Studies

This study proposed the following studies to be done in order to widen the scope of our knowledge in the disciplines of Philosophy of Science and Epistemology:

i. The possibility of compatibility between 'armchair' research and empirical research.

ii. The possibility of knowledge through reason alone (as espoused by rationalism).

REFERENCES

Adams, F. (2024). No Knowledge from Falsity. In *Illuminating Errors* (pp. 44-58). Oxfordshire: Routledge.

Aggarwal, R., Louie, A. K., Morreale, M. K., Balon, R., Beresin, E. V., Coverdale, J., ... & Brenner, A. M. (2022). On the art and science of peer review. *Academic Psychiatry*, *46*(2), 151-156.

Alcoff L. M. (2018). *Real Knowing: New Versions of the Coherence Theory*. New York: Cornell University Press.

Alves, H. N. (2021). Inductivism and Legal Science. *Revista Brasileira Estudos Politicos, 123(1),* 299-351.

Anand, G., Larson, E. C., & Mahoney, J. T. (2020). Thomas Kuhn on Paradigms. *Production and Operations Management*, *29*(7), 1650-1657.

Anand, G., Larson, E. C., & Mahoney, J. T. (2020). Thomas Kuhn on Paradigms. *Production and Operations Management*, *29*(7), 1650-1657.

Anderson, C., & Hetherington, S. (2018). The Gettier problem and Fallibilism. *The Gettier Problem*. Cambridge: Cambridge University Press.

Angier, T. (2010). *Techne in Aristotle's Ethics: Crafting the Moral Life*. London: Bloomsbury Academic.

Arabatzis, T. (2016). The Structure of Scientific Revolutions and History and Philosophy of Science in Historical Perspective. *Shifting Paradigms: Thomas S. Kuhn and the History of Science*, Conference Proceedings. 191-201.

Aristotle. (2013). *The Metaphysics.* New York: Dover Publications.

Arp, R. (Ed.). (2016). *Revisiting Aquinas' Proofs for the Existence of God* (Vol. 289). Boston: Brill.

Arrington, R. L. (2019). *Rationalism, Realism, and Relativism: Perspectives in Contemporary Moral Epistemology*. New York: Cornell University Press.

Arthur, A. (2003). A Utility Theory of Truth'. *Organization*, *10*(2), 205-221.

Audi, R. (2010). *Epistemology: A Contemporary Introduction to the Theory of Knowledge*. London: Routledge.

Ayoob, R. (2021). The Truth behind the Solar System in the Universe. *Advances in Aerospace Science and Technology*, *6*(3), 158-169.

Barceló-Aspeitia, A., & González-Varela, E. (2023). Plato on False Judgment in the Theaetetus. *Journal of the History of Philosophy*, *61*(3), 349-372.

Baumann, P. (2019). Knowledge requires Belief – and it Doesn't? On Belief as such and Belief Necessary for Knowledge. Inquiry: *An Interdisciplinary Journal of Philosophy* 62 (2):151-167.

Beddor, B. (2015). Evidentialism, Circularity, and Grounding. *Philosophical Studies, 172 (2),* 1847-1868.

Berent, I., & Platt, M. (2021). Empiricism is Natural. *Oxford Studies in Experimental Philosophy*. 4 (4), 112.

Bergmann, M. (2021). *Radical Skepticism and Epistemic Intuition*. Oxford: Oxford University Press.

Binoy, S. (2019). Significance of Hypothesis in Research. *Indian Journal of Holistic Nursing (ISSN: 2348-2133)*, *10*(1), 31-33.

Bird, G. (2013). *The Revolutionary Kant: A Commentary on the Critique of Pure Reason*. Chicago: Open Court.

Blackburn, S. (2018). *On Truth*. Oxford: Oxford University Press.

Boge, F. J. (2021). Incompatibility and the Pessimistic Induction: A Challenge for Selective Realism. *European Journal for Philosophy of Science*, *11*(2), 46.

Bolisani, E. & Bratianu, C. (2018). The Elusive Definition of Knowledge. *Emergent Knowledge Strategies: Strategic Thinking in Knowledge Management*, 1-22.

BonJour, L. (2020). Can Empirical Knowledge have a Foundation? In *Arguing About Knowledge* (pp. 217-232). Oxfordshire: Routledge.

Boudreault, J., & Charles, S. (2017). Simon Foucher's Academic Scepticism: Between Truth and Probability. *Academic Scepticism in the Development of Early Modern Philosophy*, 221 (2), 245-258.

Boyd, R. (1980). Scientific Realism and Naturalistic Epistemology. In *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*,1980 (2), 613-662. Cambridge: Cambridge University Press.

Bozza, I. (2020). *The Nature of Knowability and the Knowability Paradox* (Doctoral dissertation, University of Miami).

Brenner, A., Needham, P., Stump, D.J. et al. (2011) New perspectives on Pierre Duhem's *The Aim and Structure of Physical Theory*. *Metascience* 20, 1–25.

Brown, L. (Ed.). (2014). *Theaetetus*. Oxford: Oxford University Press.

Burch-Brown, J. (2021). Reflection and Synthesis: How Moral Agents Learn and Moral Cultures Evolve. *Journal of Philosophy of Education*, *55*(6), 935-948.

Capps J. (2019). A Common-Sense Pragmatic Theory of Truth. *Philosophia: Philosophical Quarterly of Israel* 48, 463–481.

Care, W. S. W. (2017). Inference to the Best Explanation. *Best explanations: New essays on inference to the best explanation*. Oxford: Oxford University Press.

Carnap, R. (2003). *The Logical Structure of the World and Pseudoproblems in Philosophy*. United States: Open Court.

Carter, J. A., Littlejohn, C. (2021). *This Is Epistemology: An Introduction*. New Jersey: Wiley.

Cartwright, N. (1983). *How the Laws of Physics Lie*. Oxford: Oxford Academic.

Cartwright, N. (2022). *A Philosopher Looks at Science*. Cambridge: Cambridge University Press.

Champagne, M. (2022). A Pragmatic-Semiotic Defence of Bivalence. *History and Philosophy of Logic*, *43*(2), 143-157.

Chang, H. (2019). Pragmatism, Perspectivism, and the Historicity of Science. In *Understanding Perspectivism* (pp. 10-27). New York: Routledge.

Cherryholmes, C. H. (1992). Notes on Pragmatism and Scientific Realism. *Educational Researcher*, *21*(6), 13-17.

Chukwunyeaka, B. N. (2022). One Or Two Kants: A Revaluation of Some Foundational Tenets in Kant's Epistemology. *International Scholar Journal of Arts and Social Science Research*, *5*(1), 435-447.

Climenhaga, N. (2017). *Knowledge and Certainty* (Doctoral dissertation, Notre Damme: University of Notre Damme.

Comesaña, J. (2010). Evidentialist reliabilism. *Noûs*, *44*(4), 571-600.

Comesaña, J. (2011). Reliabilism. In *The Routledge Companion to Epistemology* (pp. 176-185). Oxford: Routledge.

Condé, M. L. (2023). Thomas Kuhn's Legacy for the Historiography of Science. In *Handbook for the Historiography of Science* (pp. 121-144). Cham: Springer International Publishing.

Condit, C. M., & Railsback, L. B. (2016). Science and Communication. In *Oxford Research Encyclopaedia of Communication*. Oxford: Oxford University Press.

Copi I. (2018). *Introduction to logic*. Oxford: Routledge.

Copi, I. M., Cohen, C., & Rodych, V. (2018). *Introduction to logic*. Oxford: Routledge.

Copleston F. C. (1977). *A history of philosophy. Bentham to Russell*. Vol 8. New Jersey: Paulist Press.

Cornford, F.M. (2018). *Theaetetus.* New York: Dover Publications.

Dagen, M. (2020). History of Malaria and its Treatment. In *Antimalarial Agents* (pp. 1-48). Massachusetts: Elsevier.

David, M. (2023). *Correspondence and Disquotation: An Essay on the Nature of Truth.* Oxford: Oxford University Press.

De Broglie, L., Vuillemin, J., Wiener, P. P., & Duhem, P. M. M. (2021). *The Aim and Structure of Physical Theory*. New Jersey: Princeton University Press.

de Broglie, L., Vuillemin, J., Wiener, P. P., & Duhem, P. M. M. (2021). *The Aim and Structure of Physical Theory*. New Jersey: Princeton University Press.

Derksen, M. (2019). Putting Popper to work. *Theory & Psychology*, *29*(4), 449-465.

Descartes, R. (2017). *Descartes: Meditations on First Philosophy: With selections from the Objections and Replies*. Cambridge: Cambridge University Press.

Devitt, M. (2020). An Ignored Argument for Scientific Realism. *Filozofia Nauki*, *28*(2 (110)), 5-24.

Dewey, J. (2022). *The collected works of John Dewey*. DigiCat.

DeWitt R. (2018). *Worldviews: An Introduction to the History and Philosophy of Science* (Third). New Jersey: John Wiley & Sons.

Dodd, D. (2012). Evidentialism and Skeptical Arguments. *Synthese*, *189*(2), 337-352.

Dreamson, N., & Khine, P. H. H. (2022). Abductive Reasoning: A Design Thinking Experiment. *International Journal of Art & Design Education*, *41*(3), 403-413.

Ducasse, C. J. (1966). Critique of Hume's Conception of Causality. *The Journal of Philosophy*, *63*(6), 141-148.

Duhem, P. M. M. (1954). *The Aim and Structure of Physical theory*. Princeton: Princeton University Press.

Eames, E. R. (2013). *Bertrand Russell's Theory of Knowledge*. Oxford: Routledge.

Einstein, A. (2008). *The Principle of Relativity*. Hawthorne: BN Publishing.

Emina, K. A., & Ukwamedua, N. U. (2020). System and Systematic Stinkers and the Question of the Two Dogmas of Empiricism by Quine. *Cogito: Multidisciplinary Res.*.7 (2), *12*, 40.

Epstein, R. L. (2018). *Propositional Logics*. Hagerstown: Advanced Reasoning Forum.

Evans, P. W., & Thébault, K. P. (2020). On the Limits of Experimental Knowledge. *Philosophical Transactions of the Royal Society A*, *378*(2177), 20190235.

Ezebuilo, H. C. (2020). Descartes, Leibniz and Spinoza: A Brief Survey of Rationalism. *AMAMIHE journal of Applied Philosophy*, *18*(6), 95-118.

Fairweather A. (2012). Duhem-Quine Virtue Epistemology. *Synthese: An International Journal for Epistemology Methodology and Philosophy of Science, 187(2),* 673–692.

Farkas, K. (2015). Belief May Not Be a Necessary Condition for Knowledge. *Erkenntnis*, *80(1),* 185-200.

Farkas, K. (2016). Know-wh Does Not Reduce to Know-That. *American Philosophical Quarterly* 53(2*),* 109-122.

Feldman, R. (2009). Evidentialism, Higher-Order Evidence, and Disagreement. *Episteme*, *6*(3), 294-312.

Feldman, R., & Conee, E. (2020). Evidentialism. In *Arguing about Knowledge* (pp. 174-191). Oxford: Routledge.

Ferngren, G. B. (2022). Science and Religion. In *The Routledge History of American Science* (pp. 200-214). Oxford: Routledge.

Field, H. (1972). Tarski's Theory of Truth. *The Journal of Philosophy*, *69*(13), 347-375.

Fine, A. (1984). The Natural Ontological Attitude. *Scientific Realism*, 31(1*),* (pp. 83-107).

Fischer, H. E., Boone, W. J., & Neumann, K. (2023). Quantitative Research Designs and Approaches. In *Handbook of Research on Science Education* (pp. 28-59). Oxford: Routledge.

Foley, R. (2012). *When Is True Belief Knowledge?* Princeton: Princeton University Press.

Franks, P. (2014). Skepticism after Kant. *Varieties of Skepticism. Essays after Kant, Wittgenstein, and Cavell*, 19-58. Berlin: Berlin Studies in Knowledge Research.

Frápolli, M. J. (2011). Did Ramsey ever Endorse a Redundancy Theory of Truth? *Tópicos (México),* (41), 315-329.

Frise, M. (2017). Preservationism in the Epistemology of Memory. *The Philosophical Quarterly*, *67*(268), 486-507.

Fumerton, R. (2022). *Foundationalism*. Cambridge: Cambridge University Press.

Gascoigne, N., & Bacon, M. (2023). Taking Rorty Seriously: Pragmatism, Metaphilosophy, and Truth. *Inquiry*, *66*(10), 1773-1792.

Gava, G. (2023). *Kant's Critique of Pure Reason and the Method of Metaphysics*. Cambridge: Cambridge University Press.

Gava, G. (2023). *Kant's Critique of Pure Reason and the Method of Metaphysics*. Cambridge: Cambridge University Press.

Genesereth, M., Kao, E. J. (2022). *Introduction to Logic*, Third Edition. Cham: Springer International Publishing.

Gettier, E. L. (1963). Is Justified True Belief Knowledge? *Analysis*, *23*(6), 121-123.

Glanzberg, M. (Ed.). (2018). *The Oxford Handbook of Truth*. Oxford: Oxford University Press.

Goldman, A. (2020). Reliabilism: What is Justified Belief? In *Arguing about Knowledge* (pp. 157-173). Oxford: Routledge.

Goldman, A. (2021). A Different Solution to The Generality Problem for Process Reliabilism. *Philosophical Topics*, *49*(2), 105-112.

Goldman, A. I., & McGrath, M. (2015). *Epistemology: A Contemporary Introduction*. Oxford: Oxford University Press.

Goldman, A. I. (2012). Reliabilism and Contemporary Epistemology: Essays. Oxford: Oxford University Press.

Gorton, W. A. (2012). *Karl Popper and the Social Sciences*. New York: State University of New York Press.

Gower, B. (2015). AJ Ayer: Language, Truth and Logic. In *Central Works of Philosophy v4* (pp. 195-213). Oxford: Routledge.

Griffiths, D. (2017). Martin Heidegger's Principle of Identity: On Belonging and Ereignis. *South African Journal of Philosophy= Suid-Afrikaanse Tydskrif vir Wysbegeerte*, *36*(3), 326-336.

Haack, S. (1976). The Pragmatist Theory of Truth. *The British Journal for the Philosophy of Science*, *27*(3), 231-249.

Habing H. J. (2019). *The Birth of Modern Astronomy*. New York: Springer.

Haig, B. D. (2018). An Abductive Theory of Scientific Method. *Method matters in psychology: Essays in Applied Philosophy of Science* 10(4), 35-64.

Hale, B., & Wright, C. (2017). Putnam's Model-Theoretic Argument against Metaphysical Realism. *A Companion to the Philosophy of Language*, 703-733.New Jersey: John Wiley & Sons Ltd.

Harding S. G. (1976). *Can Theories be Refuted? Essays on the Duhem-Quine Thesis*. Heidelberg: Springer Netherlands

Harman, G. H. (1965). The Inference to the Best Explanation. *The philosophical review*, *74*(1), 88-95.

Hayes, B. K., & Heit, E. (2018). Inductive Reasoning 2.0. *Wiley Interdisciplinary Reviews: Cognitive Science*, *9*(3), e1459.

Hedge, C., Powell, G., & Sumner, P. (2018). The Reliability Paradox: Why Robust Cognitive Tasks do not Produce Reliable Individual Differences. *Behavior Research Methods, 50*, 1166-1186.

Heidemann, D. H. (2018). Hegel: Philosophy as a Kind of Skepticism. *Skepticism: From Antiquity to the Present. London: Bloomsbury*, 430-41.

Hennink, M., Hutter, I., & Bailey, A. (2020). *Qualitative research methods*. Los Angeles: Sage Publications.

Hetherington, S. C. (Ed.). (2018). *The Gettier Problem*. Cambridge: Cambridge University Press.

Hetherington, S. C. (2016). *Knowledge and the Gettier Problem*. Cambridge: Cambridge University Press.

Hookway, C. (2002). *Truth, Rationality, and Pragmatism: Themes from Peirce*. Oxford: Oxford University Press.

Hookway, C. (2012). *The pragmatic maxim: Essays on Peirce and pragmatism*.Oxford: Oxford University Press, USA.

Horsten L. & ebrary Inc. (2011). *The Tarskian Turn Deflationism and Axiomatic Truth*. Cambridge: MIT Press.

Hosseinpour, G. (2022). Strawson and the Performative Theory of Truth. *Logical Studies*, *12*(2), 85-107.

Howard, S. (2012). Why Pluto Is Not a Planet Anymore or How Astronomical Objects Get Named. *Journal of the Washington Academy of Sciences*, 98(4) 3-14.

Huenemann, C. (2014). *Understanding Rationalism*. Oxford: Routledge.

Hughes, P. (2010). Paradigms, Methods and Knowledge. *Doing Early Childhood Research: International Perspectives on Theory and Practice, 2*, 35-61.

Ivanova, M. (2021). *Duhem and Holism*. Cambridge: Cambridge University Press.

James, W. (2020). Pragmatism. In *Pragmatism* (pp. 53-75). Oxford: Routledge.

Jenks R. (2010). *How Plato's Theory of Truth Explains the Socratic Method: Consistency is the Test of Truth*. New York: Edwin Mellen Press.

Jetli, P. (2008). Knowledge without Truth. In *Proceedings of the XXII World Congress of Philosophy* ,53, 97-103).

Justus, J. (2021). Verificationism. In *The Routledge Handbook of Logical Empiricism* (pp. 157-167). Oxford: Routledge.

Kaiser, D. (2016). Thomas Kuhn and the Psychology of Scientific Revolutions. *Kuhn's Structure of Scientific Revolutions at Fifty: Reflections on a Science Classic*, 71-95. Chicago: University of Chicago Press.

Kant I. (2005). *The Critique of Pure Reason* (1st ed. 2005). Digireads Pub.

Kant, I., Pluhar, W. S., & Kitcher, P. (1996). *Critique of Pure Reason.* Indianapolis: Hackett Pub.

Kant, I. (1953). *Immanuel Kant's Critique of Pure Reason*. Kolkata: Ripple Publishing.

Kant, I. (2022). The Critique of Pure Reason. Czechia: DigiCat.

Kant, I., Haywood, F., Araille, E. d. (2008). Critique of Pure Reason. London: Living Time Press.

Katzner, D. W. (2023). The Problem with Probability. *Journal of Post Keynesian Economics*, *46*(3), 379-399.

Kuhn T. S. (1996). *The Structure of Scientific Revolutions* (3rd ed.). Chicago: University of Chicago Press.

Kuhn, T. S. (1997). *The Structure of Scientific Revolutions* (Vol. 962). Chicago: University of Chicago press.

Kuhn, T. S. (2012). *The structure of scientific revolutions*. Chicago: University of Chicago press.

Kumaar, S. S. (2022). Chronology of Calendar: Human Evolution Journey. *International Journal of History*, *4*(1), 17-22.

Kvanvig, J. L. (2006). *The Knowability Paradox*. Oxford: Clarendon Press.

Ladyman, J. (2018). Scientific realism again. *Spontaneous Generations: A Journal for the History and Philosophy of Science*, *9*(1), 99-107.

Lakatos, I. (2015). *Proofs and refutations: The Logic of Mathematical Discovery*. Cambridge: Cambridge university press.

Lakatos, I., & Feyerabend, P. (2019). *For and Against Method: Including Lakatos's Lectures on Scientific Method and the Lakatos-Feyerabend Correspondence*. Chicago: University of Chicago Press.

Lam, D. (2021). Being Pessimistic about the Objective Present. *Synthese*, *198*(12), 11311-11326.

Lange, M. (2011). Hume and the Problem of Induction. In *Handbook of the History of Logic* (Vol. 10, pp. 43-91). Amsterdam: North-Holland.

Larvor, B. (2013). *Lakatos: An Introduction*. Oxford: Routledge.

Lauer, Q. (2020). *Essays in Hegelian Dialectic*. New York: Fordham University Press.

Lawlor, K. (2022). Modest Foundations for Perceptual Knowledge. In *New Perspectives on Epistemic Closure* (pp. 24-42).Oxford: Routledge.

Lederman, N. G., & Lederman, J. S. (2015). What is a Theoretical Framework? A Practical Answer. *Journal of Science Teacher Education*, *26*(7), 593-597.

Lehrer, K. (1979). The Gettier Problem and The Analysis of Knowledge. In *Justification and Knowledge: New Studies in Epistemology* (pp. 65-78). Dordrecht: Springer.

Lemos, N. (2020). *An Introduction to the Theory of Knowledge*. Cambridge: Cambridge University Press.

Leplin, J. (2017). Realism and Instrumentalism. *A Companion to the Philosophy of Science*, 393-401. Massachusetts: Blackwell.

Leplin, J. (Ed.). (1984). *Scientific Realism* (Vol. 323). Oakland: University of California Press.

Lipton, P. (2017). Inference to the Best Explanation. *A Companion to the Philosophy of Science*, 184-193. Oxford: Routledge.

Lisi, F. (2020). Heraclitus, Protagoras and Plato: Theaetetus 155d1–160e4. *Plato's Theaetetus Revisited, Berlin*, 53-64.

Liu, Z., & Adams, C. S. (2019). Experimental Tests of Bertrand's Question and the Duhem–Quine Problem. *European Journal of Physics*, *40*(6), 065801.

Locke, J. (2004). *An Essay Concerning Human Understanding.* New York: Barnes & Noble Books.

Longino, H. E. (2013). Subjects, Power, and Knowledge: Description and Prescription in Feminist Philosophies of Science. In *Feminist Epistemologies* (pp. 101-120). Oxford: Routledge.

Longino, H. E. (2017). Feminist Epistemology. *The Blackwell Guide to Epistemology*, 325-353. New jersey: Wiley Online Library.

Lynch, M. P., Wyatt, J., Kim, J., & Kellen, N. (Eds.). (2021). *The Nature of Truth: Classic and Contemporary Perspectives*. Cambridge: MIT Press.

Ma, J., Liu, W., Dubois, D., & Prade, H. (2010). Revision Rules in the Theory of Evidence. In *2010 22nd IEEE International Conference on Tools with Artificial Intelligence*,1, 295-302.

Marchesan, E. (2019). Context, *Truth, and Objectivity: Essays on Radical Contextualism*. Oxford: Routledge Taylor and Francis Group.

Marcuse, H. (2020). Philosophy and Critical Theory. In *Critical Theory and Society* (pp. 58-74). Oxford: Routledge.

Marušić, B. (2010). Skepticism Between Excessiveness and Idleness. *European Journal of Philosophy*, *18*(1), 60-83.

Massey, G. J. (2011). Quine and Duhem on Holistic Hypothesis Testing. *American Philosophical Quarterly*, *48*(3), 239-266.

Massimi, M., & Pritchard, D. (2014). What is this Thing Called Science? A very Brief Philosophical Overview. In *Philosophy and The Sciences for Everyone* (pp. 1-13). Oxford: Routledge.

Matsui, A., Chen, E., Wang, Y., & Ferrara, E. (2021). The Impact of Peer Review on The Contribution Potential of Scientific Papers. *PeerJ*, *9*, e11999.

Maxwell N. (2017). *Karl Popper: Science and Enlightenment*. London: UCL Press.

McCain, K. (2014). *Evidentialism and Epistemic Justification*. Oxford: Routledge.

McCain, K.T. (2017). *Best Explanations: New Essays on Inference to the Best Explanation*. Oxford: Oxford University Press.

McIntosh, C. A. (2020). *Rational Foundationalism*. New York: Cornell University.

McMaster, R., & Novarese, M. (2016). Neuroeconomics: Infeasible and Underdetermined. *Journal of Economic Issues*, *50*(4), 963-983.

Meltzoff, J., & Cooper, H. (2018). *Critical Thinking about Research: Psychology and Related Fields*. Washington: American Psychological Association.

Michel, C. (2019). The Liar Paradox in the Predictive Mind. *Pragmatics & Cognition*, *26*(2-3), 239-266.

Miller, J. W. (2015). *The Structure of Aristotelian Logic*. Oxford: Routledge.

Mircică, N. (2011). Husserl on the Relationship between Intentionality and Knowledge. *Review of Contemporary Philosophy*, (10), 184-189.

Mitra, S. (2020). An analysis of the Falsification Criterion of Karl Popper: a Critical Review. *Tattva Journal of Philosophy*, *12*(1), 1-18.

Mizrahi, M. (2016). Why Gettier Cases are Misleading. *Logos & Episteme, 7*(1), 31-44.

Moore, G. E. (2020). Certainty. In *Arguing About Knowledge* (pp. 462-465). Oxford: Routledge.

Morgan, D. L. (2022). Paradigms in Mixed Methods Research. In *The Routledge Handbook for Advancing Integration in Mixed Methods Research* (pp. 97-112). Oxford: Routledge.

Morrison, J. (2011). Skepticism about Inductive Knowledge. In *The Routledge Companion to Epistemology* (pp. 445-452). Oxford: Routledge.

Mosley A. Baltazar E. & Open Textbook Library. (2019). *An Introduction to Logic from Everyday Life to Formal Systems*. New York: Smith College Open Educational Resources.

Moti, M. (2017). Why Gettier Cases are Still Misleading: A Reply to Atkins. *Logos and Episteme* 8 (1):129-139.

Mounce, H. (2002). *The Two Pragmatisms: From Peirce to Rorty*.Oxford: Routledge.

Mousavi, S. (2024). Classical Foundationalism and the Justification Structure of Historical Knowledge. *Methodology of Social Sciences and Humanities*, 29 (117), 77-95.

Mukhopadhyay, R. (2019). Knowledge, Intentionality and Language. *Philosophical Papers*,VX(1), 60-65.

Munro, B. (2016). The Philosophical Significance of Quine's D-Thesis. (PhD Thesis). Ontario: University of Waterloo.

Murphy, N. (2016). Reductionism And Emergence: A Critical Perspective. In *Human Identity at The Intersection of Science, Technology and Religion* (pp. 79-96). Oxford: Routledge.

Musavi Karimi, M. (2022). The Pessimistic Meta-Induction Argument and Scientific Realism: The Referential Approaches. *Metaphysics*, *14*(34), 57-84.

Myers-Schulz, B., & Schwitzgebel, E. (2013). Knowing that P without Believing that P. *Noûs, 47*, 371–84.

Neto, J. R. M. (1997). Academic Skepticism in Early Modern Philosophy. *Journal of the History of Ideas*, 58(2), 199-220.

Newton, I., Motte, A. (1962). *Sir Isaac Newton's Mathematical Principles of Natural Philosophy and His System of the World*. Oakland: University of California Press.

Newton-Smith, W. H. (2017). Hume. *A Companion to the Philosophy of Science*, 165-168, 532-536. Oxford: Wiley-Blackwell.

Nickles, T. (2017). Lakatos. *A Companion to the Philosophy of Science*, 207-212. Oxford: Blackwell Publishing Ltd.

Nickles, T. (Ed.). (2003). *Thomas Kuhn*. Cambridge: Cambridge University Press.

Nuzzo, A. (2016). Hegel's Metaphysics. *Hegel and Metaphysics: On Logic and Ontology in the System, 7*, 119. Boston: De Gruyter.

Nweke, V. C., & Asiegbu, M. F. (2022). An Appraisal of Duhem-Quine's thesis on Crucial Experiments in Physics: An Essay in Philosophy of Science. *AQUINO| Journal of Philosophy*, *2*(2), 12-20.

O'brien, D. (2016). *An Introduction to the Theory of Knowledge*. New Jersey: John Wiley & Sons.

Ochomo, B. (2022, July 13). *57 per cent of road accidents caused by human error - kura*. The Star. https://www.the-star.co.ke/news/2022-07-13-57-per-cent-of-road-accidents-caused-by-human-error-kura/

O'Connor D. J. (2021). *The Correspondence Theory of Truth*. Oxford: Routledge.

O'Connor, D. J. (2023). *The Correspondence Theory of Truth*. New York: Taylor & Francis.

Ogundele, E. A., & Ogunyomi, A. I. (2020). A Critical Assessment of Thomas Kuhn's Understanding of Scientific Progress. *Caribbean Journal of Philosophy* 12 (2):62-77.

Okasha, S. (2002). *Philosophy of Science: A Very Short Introduction*. Oxford: Oxford University Press.

Okasha, S. (2003). Probabilistic Induction and Hume's problem: Reply to Lange. *The Philosophical Quarterly*, *53*(212), 419-424.

Okoye, C. A. (2011). Evaluation of Descartes' Rational Foundationalism. *UJAH: Unizik Journal of Arts and Humanities*, *12*(1), 34-54.

Ollson, E. & Dellsén, F. (2017). Understanding Without Justification or Belief. *Ratio*, *30*(3), 239-254.

Olsson, E. J. (2022). *Coherentism*. Cambridge: Cambridge University Press.

O'Shea, J. (2011). *Kant's Critique of Pure Reason: An Introduction*. Oxford: Routledge.

Pantazakos, T. (2021). Problems of Empirical Solutions to The Theory-Ladenness of Observation. *Synthese*, *199*(5), 12985-13007.

Park, S. (2018). The Grand Pessimistic Induction. *Review of Contemporary Philosophy*, 17 (1), 7-19.

Parusniková, Z. (2019). Popper and Hume: Two Great Sceptics. *The Impact of Critical Rationalism: Expanding the Popperian Legacy through the Works of Ian C. Jarvie*, 207-223. New York: Springer.

Peacocke, C. (2017). Holism. *A Companion to the Philosophy of Language*, 357-374. West Sussex, UK: Wiley-Blackwell.

Peddle, L. (2021). *The Mystery Beyond Knowledge: Scepticism, Intentionality, and The Non-Conscious*. Dyfed, United Kingdom: Cambria Books.

Peirce, C. S. (1997). Pragmatism as a Principle and Method of Right Thinking: *The 1903 Harvard Lectures on Pragmatism*. New York: State University Of New York Press.

Peirce, C. S. (2020). *How to Make Our Ideas Clear:* Washington: Amazon Digital Services LLC - KDP Print US.

Philips-Gary, M. (2020). Correspondence Theory as a Genuine Theory of Truth. *Ephemeris, the Undergraduate Journal of Philosophy*, *20*(1), 4.

Plato, P. (2019). *Theaetetus*. Norderstedt: BoD–Books on Demand.

Poincare, H. (2022). *The foundations of science: Science and hypothesis, the value of science, science and method*. DigiCat.

Pollock, J. L. (2015). *Knowledge and Lemoscation*. New Jersey: Princeton University Press.

Popovic, N. (2015). Why Truth is Not a Necessary Condition for Knowledge. In *Philosophical Forum* 46 (4):397-401.

Popper K. R. & Schilpp P. A. (1974). The Philosophy of Karl Popper. *Journal for General Philosophy of Science / Zeitschrift Für Allgemeine Wissenschaftstheorie*, 9 (2):413-422.

Popper K. R. (2002). *Conjectures and Refutations: The Growth of Scientific Knowledge*. Oxford: Routledge.

Popper, K. R. (2015). The logic of Scientific Discovery. *Central Works of Philosophy v4: Twentieth Century: Moore to Popper*, *4*, 262.Oxford: Routledge.

Potolsky, M. (2023). Verisimilitude: A Reintroduction. *MLN*, *138*(5), 1422-1437.

Potter, A. (2020, January). The Rhetorical Structure of Modus Tollens: An Exploration in Logic-Mining. In *Proceedings of the Society for Computation in Linguistics*, 3(18), 70-79.

Preston J. (2008). *Kuhn's "The Structure of Scientific Revolutions": A Reader's Guide*. London: Bloomsbury Publishing.

Priest G. Beall J. C. & Armour-Garb B. P. (2006). *The Law of Non-Contradiction: New Philosophical Essays*. Oxford: Clarendon Press.

Pritchard, D. (2023). *What is this Thing Called Knowledge?* London: Taylor & Francis.

Quine, W. V. O. (2000). Two Dogmas of Empiricism. *Perspectives in the Philosophy of Language: A Concise Anthology. Peterborough (Canada): Broadview*, 189-210. Ontario: Broadview Publishers.

Radford, C. (1966). Knowledge: By Examples. *Analysis*, *27*(1), 1–11. https://doi.org/10.2307/3326979

Radford, C. (1990). Belief, Acceptance, and Knowledge. *Mind*, *99*(396), 609–617. http://www.jstor.org/stable/2255025

Ramsey, F. P. (2012). *On truth: Original Manuscript Materials (1927–1929) From the Ramsey Collection at the University of Pittsburgh* (Vol. 16). Nairobi: Springer Science & Business Media.

Ramsey, F. P., Rescher, N., & Majer, U. (1991). The Nature of Truth. *On Truth: Original Manuscript Materials (1927–1929) from the Ramsey Collection at the University of Pittsburgh*, 6-24.

Ravetz, J. R. (2020). *Scientific Knowledge and its Social Problems*. Oxford: Routledge.

Redding, P. (2020). Hegel's "Actualist" Idealism and the Modality of Practical Reason. In *Hegel and Contemporary Practical Philosophy* (pp. 27-49). Oxford: Routledge.

Rescher N. (2003). *Epistemology: An Introduction to the Theory of Knowledge*. New York: State University of New York.

Rescher, N. (2005). Pragmatism at the Crossroads. *Transactions of the Charles S. Peirce Society: A Quarterly Journal in American Philosophy*, *41*(2), 355-365.

Rescher, N., & Vinci, T. C. (1975). On the Truth-Relevancy of the Pragmatic Utility of Beliefs. *The Review of Metaphysics*,28(3), 443-452.

Richards, R. J., & Daston, L. (Eds.). (2019). *Kuhn's' Structure of Scientific Revolutions' at Fifty: Reflections on a Science Classic*. Chicago: University of Chicago Press.

Riga, F. (2020). Pragmatism—John Dewey. *Science Education in Theory and Practice: An Introductory Guide to Learning Theory*, 227-239.New York: Springer.

Riggs, W. D. (2002). Reliability and the Value of Knowledge. *Philosophy and Phenomenological Research*, *64*(1), 79-96.

Roelli, P. (2021). *Latin as the Language of Science and Learning* (Vol. 7). Berlin: Walter de Gruyter GmbH & Co KG.

Rorty, R. (2020). Pragmatism, Relativism, and Irrationalism. In *The New Social Theory Reader* (pp. 147-155). Oxford: Routledge.

Rorty, R., Putnam, H., Conant, J., & Helfrich, G. (2004). What is Pragmatism? *Think*, *3*(8), 71-88.

Rosenberg, A., & McIntyre, L. (2019). *Philosophy of Science: A Contemporary Introduction*. Oxford: Routledge.

Russell B. (1912). *The Problems of Philosophy*. London: Oxford University Press.

Russell, B. (2020). William James's Conception of Truth 1. In *William James Pragmatism in Focus* (pp. 196-211). Oxford: Routledge.

Russell, B. (2022). *The Problems of Philosophy*. Czechia: DigiCat.

Salmon, W. C. (2017). *The Foundations of Scientific Inference*. Pittsburgh: University of Pittsburgh Press.

Sanfilippo, G., Pfeifer, N., & Gilio, A. (2017). Generalized probabilistic modus ponens. In *Symbolic and Quantitative Approaches to Reasoning with Uncertainty: 14th European Conference, ECSQARU 2017, Lugano, Switzerland, July 10–14, 2017, Proceedings 14* (pp. 480-490). Cham: Springer International Publishing.

Sankey, H. (2016). *Scientific realism and the rationality of science*.Oxford: Routledge.

Sartwell, C. (2011). Knowledge without justification. Digital

Schafer, K. (2016). Hume on Practical Reason. *The Oxford Handbook of Hume*, 356.New York: Oxford University Press.

Schantz, R. (Ed.). (2011). *What is Truth?* (Vol. 1). Berlin: Walter de Gruyter.

Schlick, M. (1936). Meaning and Verification. *The Philosophical Review*, *45*(4), 339-369.

Schukraft, J. (2017). *An Analysis of Edmund Gettier's, Is Justified True Belief Knowledge?* London: Macat Library.

Schwartz, J. (2016). Quine and the Problem of Truth. *Journal for the History of Analytical Philosophy*, *4*(10), 1-25.

Schwartz, J. (2016). Quine and the Problem of Truth. *Journal for the History of Analytical Philosophy*, *4*(10), 1-25.

Scott, D. (2006). *Plato's Meno*. Cambridge: Cambridge University Press.

Sfetcu, N. (2019). Science and Pseudoscience-Falsifiability. *Sfetcu, Nicolae," Science and pseudoscience-Falsifiability", SetThings (January 27, 2019), MultiMedia Publishing (ed.), DOI, 10*.

Shioyama T. (2021). *Newton Faraday Einstein: From Classical Physics to Modern Physics*. London: World Scientific Publishing Co. Pte.

Shook, J. R. (2023). *Pragmatism*. Massachusets: MIT Press.

Singh, P., Mazumder, P., Rai, P., & Namboodiri, V. P. (2021). Rectification-Based Knowledge Retention for Continual Learning. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition* (pp. 15282-15291). Delhi: Indian Institute of Technology.

Sinnott-Armstrong, W. (Ed.). (2004). *Pyrrhonian Skepticism*. London: Oxford University Press.

Sleeper, R. W. (2001). *The necessity of Pragmatism: John Dewey's Conception of Philosophy*. Champaign: University of Illinois Press.

Sloman, S. A., & Lagnado, D. (2005). The Problem of Induction. *The Cambridge Handbook of Thinking and Reasoning*, 95-116. Cambridge: Cambridge University Press.

Smart, J. J. C. (2014). *Philosophy and Scientific Realism*. Oxford: Routledge.

Smithies, D. (2019). *The Epistemic Role of Consciousness*. New York: Oxford University Press.

Snelgrove, D. (2022). Pragmatism and the Absolute: The Problem of Truth. *Journal of Philosophy & History of Education*, 72 (1), 37-54.

Søberg, M. (2005). The Duhem-Quine Thesis and Experimental Economics: A Reinterpretation. *Journal of Economic Methodology*, *12*(4), 581-597.

Sosa, E. (2001). Goldman's Reliabilism and Virtue Epistemology. *Philosophical Topics*, *29*(1/2), 383-400.

Sosa,E. , Fantl, F., McGrath ,M. (2019). *Contemporary Epistemology: An Anthology.* New Jersey: John Wiley & Sons.

Stern, J. P. (2021). *On realism*. Oxford: Routledge.

Stern, R., & Hartmann, S. (2018). Two Sides of Modus Ponens. *The Journal of Philosophy*, *115*(11), 605-621.

Stojnić, U. (2017). One's Modus Ponens: Modality, Coherence and Logic. *Philosophy and Phenomenological Research*, *95*(1), 167-214.

Stokes, G. J. (2023). *The Objectivity of Truth*. Creative Media Partners, LLC.

Stoutenburg, G. (2017). Unger's Argument from Absolute Terms. *Philosophical Papers*, *46*(3), 443-461.

Stoutenburg, G. (2020). Traditional Internalism and Foundational Justification. *Erkenntnis*, *85*(1), 121-138.

Stratmann, J. (2023). The Grounds of a Critique of Pure Reason. *Australasian Journal of Philosophy*, *102*(2), 354–371.

Strawson, P., & Allais, L. (2018). *The bounds of sense: An essay on Kant's critique of pure reason*. London: Routledge.

Sun, J., & Wen, B. (2018). Study on the Popper's Scientific Demarcation Criterion. In *2nd International Conference on Culture, Education and Economic*

Development of Modern Society (ICCESE 2018) (pp. 923-926). Paris: Atlantis Press.

Szałek, P. K. (2020). The Duhem-Quine Thesis Reconsidered. *Studies in Logic, Grammar and Rhetoric*, *62*(1), 73-93.

Tarski, A. (1983). *Logic, Semantics, Metamathematics: Papers from 1923 to 1938*. Indianapolis: Hackett Publishing.

Tarski, A. (2021). *The Semantic Conception of Truth and the Foundations of Semantics*. Cambridge: MIT Press

Tolliver, J. T. (1989). Knowledge Without Truth. *Philosophical studies,*56 (1), 29-51.

Turnbull, M. G. (2018). Underdetermination in Science: What It Is and Why We Should Care. *Philosophy Compass*, *13*(2), e12475.

Tulodziecki, D. (2021). Theoretical Continuity, Approximate Truth, and the Pessimistic Meta-Induction: Revisiting the Miasma Theory. *Contemporary Scientific Realism: The Challenge from The History of Science*, 11-32. New York: Oxford University Press.

Turnbull, M. G. (2018). Underdetermination in Science: What It Is and Why We Should Care. *Philosophy Compass*, *13*(2), e12475.

Ulatowski, J. (2015). Defending the Correspondence Theory of Truth. *Polish Journal of Philosophy*, *9*(2), 83-87.

Urbatsch, R. (2023). Hasty Generalization as a Source of Misleading Survey Responses. *International Journal of Public Opinion Research*, *35*(4), edad041.

Usberti, G. (2023). The Paradox of Knowability. In *Meaning and Justification. An Internalist Theory of Meaning* (pp. 345-377). Cham: Springer International Publishing.

Van Fraassen, B. C. (2017). Misdirection and Misconception in the Scientific Realism Debates. *Varieties of Scientific Realism: Objectivity and Truth in Science*, 95-108.Cham: Springer.

Vanzo, A. (2016). Empiricism and Rationalism in Nineteenth-Century Histories of Philosophy. *Journal of the History of Ideas*, *77*(2), 253-282.

Verhaegh, S. (2017). Quine's 'Needlessly Strong' Holism. *Studies in History and Philosophy of Science Part A*, *61*, 11-20.

Verhaegh, S. (2023). Justified True Belief: The Remarkable History of Mainstream Epistemology.

Vision, G. A. (2023). *Modern anti-realism and manufactured truth*. New York: Taylor & Francis.

Voparil, C. (2021). Rorty and Experience. In *The Ethics, Epistemology, and Politics of Richard Rorty* (pp. 148-167). New York: Routledge.

Voparil, C. (2022). *Reconstructing Pragmatism: Richard Rorty and the Classical Pragmatists*. New York: Oxford University Press.

Walker, R. C. (2017). Theories of Truth. *A Companion to the Philosophy of Language*, 532-555. Oxford: John Wiley & Sons Ltd.

Walker, R. C. (2018). The Coherence Theory of Truth. In *The Oxford Handbook of Truth* (pp. 219-237). Oxford: Oxford University Press.

Way, J. (2016). Two Arguments for Evidentialism. *The Philosophical Quarterly, 66*(265), 805-818.

Westphal, K. (2018). Grounds of Pragmatic Realism: Hegel's Internal Critique and Reconstruction of Kant's Critical Philosophy. In *Grounds of Pragmatic Realism*. Leiden: Brill.

Woleński, J. (2019). Semantic Theory of Truth—Formal Aspects. *Semantics and Truth*, 223-269. Cham: Springer.

Wieland, J. W. (2014). *Infinite Regress Arguments*. Berlin: Springer International Publishing.

Williams, M. (1999). *Groundless Belief: An Essay on the Possibility of Epistemology.* Princeton: Princeton University Press.

Wills, J., & Lake, R. W. (2020). Introduction: The power of Pragmatism. In *The Power of Pragmatism* (pp. 3-52). Manchester: Manchester University Press.

Winkler, K. (2016). Hume's Skeptical Logic of Induction. *The Oxford handbook of Hume*, 191-227. New York: Oxford University Press.

Wiredu, K. (2004) "*Truth and an African Language." African Philosophy: New and Traditional Perspectives*. Oxford: Oxford University Press.

Wiredu, K. (2013). Truth and Dialogue. *From Ontos Verlag: Publications of the Austrian Ludwig Wittgenstein Society-New Series (Volumes 1-18), 3*. Frankfurt: Austrian Ludwig Wittgenstein Society.

Wittgenstein, L. (2021). *Tractatus Logico-Philosophicus (Logisch-Philosophische Abhandlung)*. BoD–Books on Demand.

Woleński, J. (2019). *Semantics and Truth*. Springer. Cham: Springer.

Woodward, J., & Zalta, E. N. (2017). Scientific Explanation. *The Stanford*. Uzoigwe, E. I. E. (2022). A Synthesis of the Rationalist Ideas of Plato, Descartes, Spinoza, and Leibniz and Its Implications for 21st Century Philosophical Discourse. *GPH-International Journal of Social Science and Humanities Research*, *5*(07), 27-35.

Xu, Y. (2019). There are no Justified True Beliefs in Gettier Cases. *Fudan Journal of the Humanities and Social Sciences*, *12(1)*, 407-421.

Zagidullin, M. I., Stenyashina, N. L., & Nazmutdinova, R. N. (2020). Civilizations: Challenges and Answers of the Modern World. In *First International Volga Region Conference on Economics, Humanities and Sports (FICEHS 2019)* (pp. 321-323). Dordrecht: Atlantis Press.

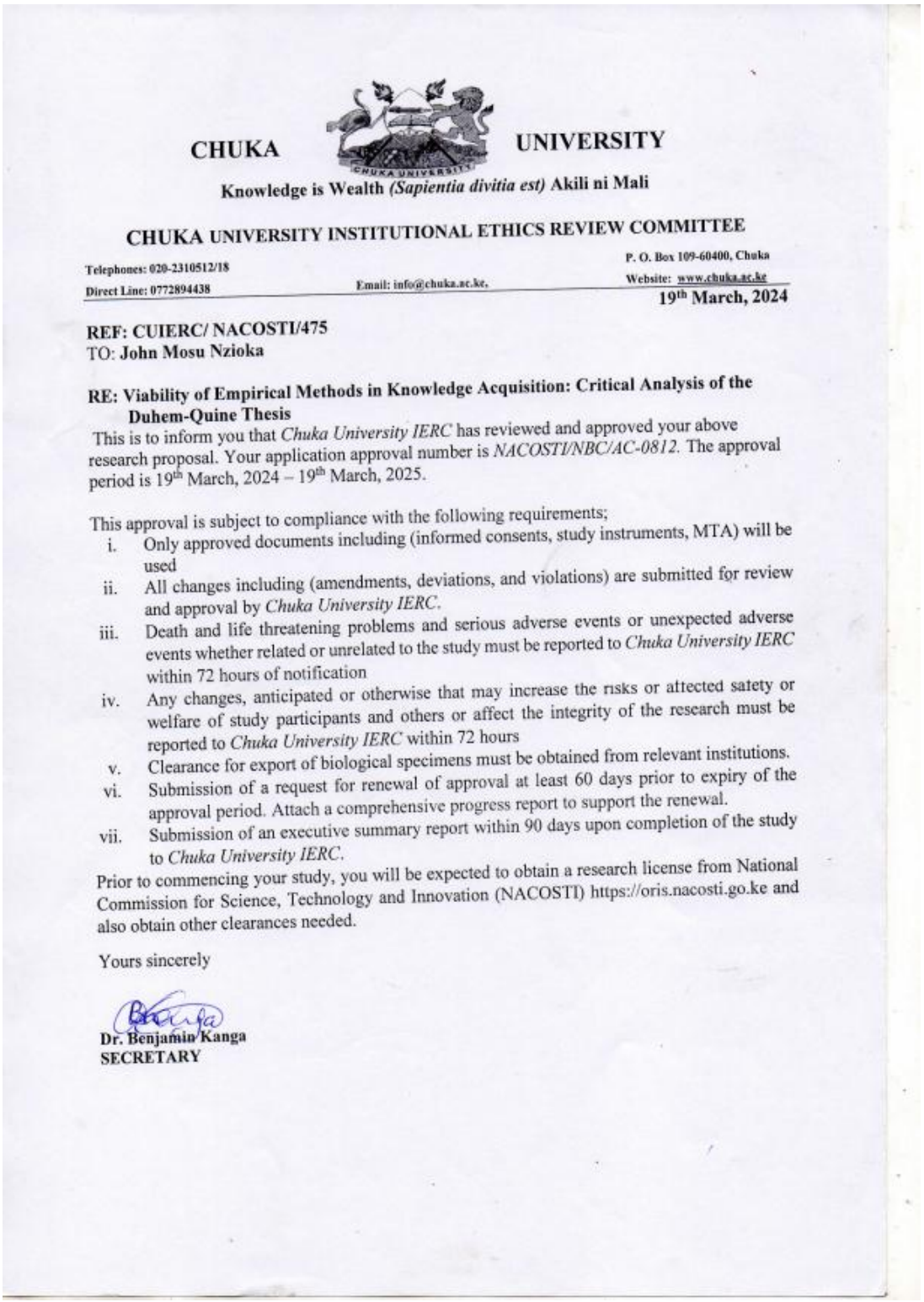
Zagzebski, L. (2017). What is Knowledge? *The Blackwell Guide to Epistemology*, 92-116. Massachusetts: Wiley.

Zeng, W. (2022). Lakatos' Quasi-Empiricism Revisited. *KRITERION–Journal of Philosophy*, *36*(2), 227-246.

Zimmerman, A. (2021). Bain's Theory of Belief and the Genesis of Pragmatism. *Transactions of the Charles S. Peirce Society: A Quarterly Journal in American Philosophy*, *57*(3), 319-340.

APPENDICES

Appendix 1: Approval from Chuka University's Ethics Review Committee



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19th March, 2024

REF: CUIERC/ NACOSTI/475
TO: **John Mosu Nzioka**

RE: Viability of Empirical Methods in Knowledge Acquisition: Critical Analysis of the Duhem-Quine Thesis

This is to inform you that *Chuka University IERC* has reviewed and approved your above research proposal. Your application approval number is *NACOSTI/NBC/AC-0812*. The approval period is 19th March, 2024 – 19th March, 2025.

This approval is subject to compliance with the following requirements;

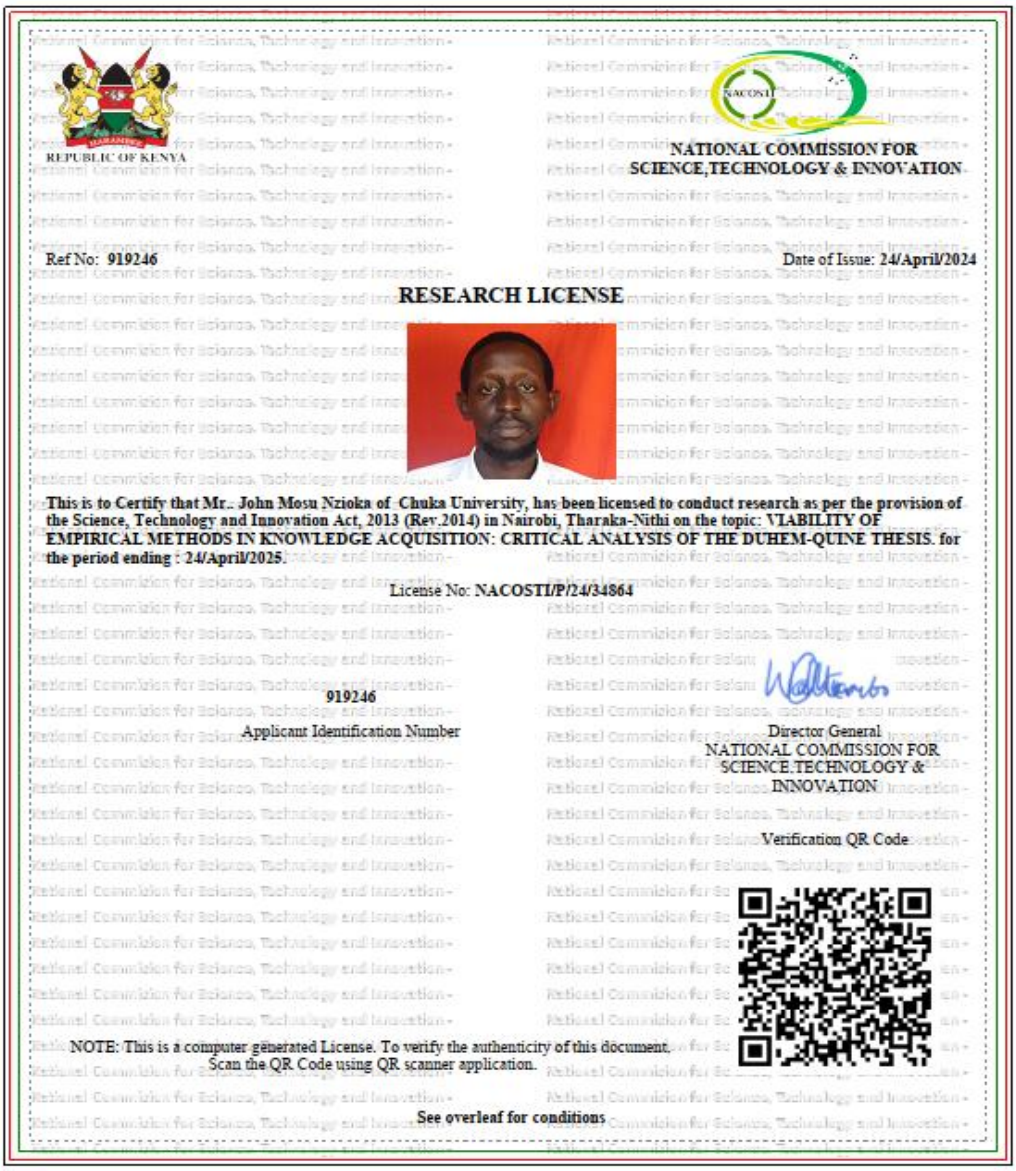
i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *Chuka University IERC*.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *Chuka University IERC* within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to *Chuka University IERC* within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to *Chuka University IERC*.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely

Dr. Benjamin Kanga
SECRETARY

Appendix 2: NACOSTI Research Permit



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