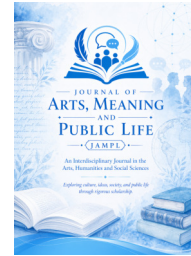


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Critical rationalism and its implications for the development of knowledge

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ABSTRACT

Critical Rationalism is an epistemological theory that emphasises the critical assessment and continual testing of beliefs and theories. It holds that all knowledge is fallible and cannot be considered absolutely true. Karl Popper popularised Critical Rationalism in response to the inductive method promoted by Logical Positivists as a route to true knowledge through experimental or observational verification. This paper argues that an approach to knowledge acquisition and development driven by attempts to falsify and improve theories and beliefs has considerable potential for societal development. By encouraging people to question and challenge existing ideas, Critical Rationalism promotes intellectual growth and innovation. In academia, it challenges scholarly hegemony and requires claims to be defended through reason and evidence, creating an environment in which ideas can be continually refined. In science, empirical testing and falsification enable outdated or incorrect theories to be replaced by more accurate explanations. More broadly, Critical Rationalism offers a framework for knowledge development based on critical thinking, intellectual humility, and a commitment to rigorous inquiry. Through textual analysis of primary and secondary sources, this paper examines its implications for knowledge development in society, education, and marginalised Indigenous knowledge systems.

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1. INTRODUCTION

Critical Rationalism is associated with Karl Popper. He believed that human society develops through resolving problems by trial and error. For Popper, progress in the natural and social sciences has occurred by subjecting potential theories to testing and criticism. He advocated a society that permits this approach to the development of knowledge: one in which audacious conjectures and theorising are allowed, followed by unreserved rational criticism, and one that is receptive to criticism. He calls such a society

“the open society” [Ormerod \(2009\)](#). The implications for the development of knowledge are extensive. Science, philosophy, and social policy become revolutionary processes in which error correction takes precedence over confirmation.

Popper was critical of the inductive method adopted by the natural sciences, which draws general conclusions from observing, testing, or experimenting with a limited number of instances. He believed that theories emerging from such endeavours, no matter how bold or universal in their application, can be falsified by a single instance that contradicts their claims. For example, the statement “All swans are white” was widely accepted and held to be true because all observed swans were white. Popper held that a finite number of observed white swans cannot verify this

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claim, so it should be regarded as probable. It can, however, be falsified by a single swan that is not white. The discovery of black swans in Australia falsified the theory [Lester \(2012\)](#). Popper's position is that such theories should be regarded only as bold guesses, with no pretence that they are ultimate truths, and should be subjected to further observational testing and criticism. If they are found wanting, they must be discarded rather than defended. This principle holds considerable promise for the development of knowledge and, by extension, society.

The prevailing models of knowledge development in academia, science, technology, and policy are generally built on positivist assumptions that knowledge grows through the verification of theories, the accumulation of data, and/or authority and tradition. In this context, knowledge produced by marginalised and Indigenous communities is often described as non-scientific, superstitious, local, or folklore. Consequently, such knowledge may be excluded from formal knowledge systems or extracted without due credit and validation, giving these communities little opportunity to develop it through testing and refinement. This breeds epistemic injustice because such knowledge systems are not given equal standing as sources of testable claims about the world. Their methods of experimentation, observation, and critique are overlooked because they do not meet the "standard" verification model.

There is a need for an epistemological approach that treats all knowledge assertions, whether from a university laboratory or an Indigenous elder, according to the same critical standards without demanding conformity to a single method or worldview. How can knowledge develop in a way that is both critical and inclusive, creating room for Indigenous and marginalised knowledge systems to participate as equal contributors rather than merely as objects of mention? Critical Rationalism can prove valuable here. Instead of seeking to translate all knowledge forms into Western science before they can be considered valid, it provides an environment for internal and external criticism. The Indigenous community itself can propose conjectures, identify problems, and revise theories. This protects such knowledge from being frozen as "heritage" while retaining the community's right to act as its primary critic. Critical Rationalism can support not only the development of knowledge in academia and policy formulation but also knowledge systems that have previously been relegated. By shifting the criterion of validity from authority and verification to criticisability and error correction, marginalised knowledge systems can participate in an open and global process of knowledge development.

This paper adopts textual analysis as its methodology. It examines primary texts by Karl Popper, including *The Logic of Scientific Discovery* [Popper \(1959\)](#) and *Conjectures and Refutations* [Popper \(1963\)](#), alongside secondary scholarship on Critical Rationalism and on Indigenous and marginalised knowledge systems. Through a systematic analysis of the main concepts, arguments, and thematic patterns identified in these texts, the paper considers how the core principles of Critical Rationalism can be applied to the development of alternative and inclusive knowledge.

2. FINDINGS AND DISCUSSION

2.1. UNDERSTANDING CRITICAL RATIONALISM

The Wurzburg School of Psychology undertook research to advance a deductivist philosophy of science. The Wurzburg School led by Oswald Kulpe initiated the systematic experimental investigation of higher mental processes, and found evidence of imageless thought. Their main finding was that judgments occur devoid of accompanying sensory images, feelings or associations [Boring \(1929\)](#). Karl Popper had no direct association with Wurzburg School, but their project influenced his uncovering of the non-justificationist theory of science. For him, scientific claims must be publicly testable and falsifiable. Popper called this theory 'Critical Rationalism'. He emphasised the growth of knowledge without proof or justification. He sought to replace justificationism with criticism.

Popper believes that the problems of science and philosophy are the same. He argues against language analysts who believe that "the problems of philosophy, if any, are problems of linguistic usage or of the meaning of words" ([Popper, 1959](#), p. xix). He opens the preface to the 1959 edition of *The Logic of Scientific Discovery* by stating that he believes all thinking people are interested in cosmology. For him, the need to understand the world and our place in it is a concern of both philosophy and science. Science and philosophy lose their relevance if they lose interest in cosmology. He disagreed with philosophers who specialised in analysing ordinary language and who claimed so much knowledge of cosmology that they were persuaded that philosophy had no part to play in it. He was frustrated by the attitude of philosophers who placed philosophy in a position where it could not contribute to the growth of knowledge about the world. Philosophers who believe that the nature and task of philosophy are limited to the analysis of language have lost touch with the optimism and inspiration that characterise the rationalist tradition. They have left the growth of knowledge to scientists, and their definition of philosophy gives it no role in knowledge of the world [Popper \(1959\)](#).

Logical Positivism had gained ascendancy through a group of philosophers who called themselves the Vienna Circle, led by Moritz Schlick. Most members of the group were scientists, and they rejected metaphysics in its entirety. They held that a proposition is valid only insofar as it can be verified. Propositions judged meaningful must be logically necessary (analytic) or verifiable in experience. Any proposition that fails to meet these criteria must be considered meaningless, effectively putting the final nail in the coffin of metaphysics [Hamlyn \(1988\)](#). Karl Popper was acquainted with members of the Vienna Circle and critically examined the thesis they vigorously defended. He faulted the position that any proposition not supported by experience or argument should be discarded, arguing that the principle itself should be discarded because it is not supported by experience or argument.

Popper referred to this principle as "comprehensive" or "uncritical" rationalism. He therefore advanced Critical Rationalism, which recognises that the essential attitude of rationalists arises from "faith in reason". Popper uses the term rationalism not as the opposite of empiricism but as the opposite of irrationalism. For him, Critical Rationalism embraces both empiricism and traditional rationalism, such as Cartesian intellectualism. He argues that rational conversation is critical conversation aimed at identifying and eliminating as many mistakes as possible in the

pursuit of true knowledge [Keuth \(2005\)](#).

After Karl Popper, two of his students, Joseph Agassi and William Bartley, sought to develop the project further. Agassi was concerned with how metaphysics could guide scientific research without absorbing or subordinating it. He sought to show that metaphysics could support empirical knowledge without diminishing it. He extended Popper's theory to include the use of metaphysical theories to guide scientific research [Internet Encyclopedia of Philosophy \(n.d.\)](#). Agassi argues that Popper's conception of science as the hallmark of Western criticism is novel and states that he is willing not merely to advocate it but to apply it to a different and more practical problem [Agassi \(2008\)](#).

Like Popper, Agassi was critical of a scientific tradition that was unreceptive to criticism. He argues that attempts to dilute criticism produce hostility towards critical views. This results in a lack of scholarship and creates fear of criticism among students, leading to frustration. He directs this criticism at scientists who work in a field that is highly critical by nature but whose adherents nevertheless remain unaware of its critical character ([Agassi, 2008](#), p. 6). Agassi also believes that knowledge can grow only when theories are subjected to constant criticism with the aim of falsifying them and making room for better theories. When applied to metaphysics, this critical attitude can facilitate research in the empirical sciences and deepen knowledge of the world. He notes that Faraday developed his physical field theories using metaphysical field theory as a precursor ([Agassi, 2008](#), p. 9).

Bartley, by contrast, was concerned with defending rationality rationally. Popper had conceded that rationality is limited because it begins from a pre-rational state. For Bartley, a failure to defend rationality rationally amounted to a failure to show why the rational method should be preferred to other methods of problem solving. He disagreed with Popper and argued that because rationality uses rational methods to solve problems by requiring all theories to be exposed to criticism, rationality itself can be exposed to criticism and therefore defended rationally. Bartley called his version "comprehensive critical rationalism" to distinguish it from Popper's. For Bartley, Critical Rationalism should also apply to the theory of rationality itself [Internet Encyclopedia of Philosophy \(n.d.\)](#).

David Miller, a Critical Rationalist and friend of Karl Popper, argues that rationality is exclusively a matter of method and does not inhere in the products of intellectual activity. Theories and beliefs are not themselves rational; what is rational is the manner in which they are handled. Critical Rationalism is therefore concerned not only with methodology but with how theories are investigated: critically and negatively [Miller \(2006\)](#). In Miller's formulation, Critical Rationalism investigates theories negatively with the aim of falsifying them. This attitude makes room for better theories that provide more advanced knowledge of the phenomenon under study. A new and better theory must also remain open to suspicion rather than be treated as an end in itself. This attitude supports the advancement of knowledge by encouraging continuous research, testing, and the questioning of established notions of truth.

2.2. CRITICAL RATIONALISM AND THE DEVELOPMENT OF KNOWLEDGE

To consider how Critical Rationalism contributes to the development of knowledge, this section applies its basic principles to areas of human endeavour in which the growth and development of knowledge are important. Popper's project sought to apply the rational and critical attitude to both the natural and social sciences. This implies that nothing is exempt from the method. Because the general development of human societies is driven by knowledge, the following discussion highlights how Critical Rationalism can contribute to the development and advancement of knowledge.

2.2.1. Development of Knowledge in Society

Critical Rationalism can be a valuable social approach to developing knowledge about how best to improve social well-being. Dryzek states that Popper's Critical Rationalism and its adherents support piecemeal social reform, social experimentation, and the decentralisation of power. These measures create an environment conducive to fallibilist and falsificationist approaches to knowledge, while maintaining a rational and objective attitude. What individuals, policymakers, investigators, or groups do can therefore be regarded only as tentative. Dryzek further argues that Critical Rationalism is distinctive in connecting abstract epistemological and rational concepts with concrete social issues [Dryzek \(1990\)](#).

The principles of Critical Rationalism can therefore be applied to concrete social issues. For example, they can help shape policies intended to improve citizens' lives by exposing each policy to scrutiny in order to identify weaknesses that could reduce its effectiveness during implementation. The purpose of politics is to solve problems in society, and a rational approach to doing so requires an environment in which unrestricted conjecture and criticism can be directed at public policies [Dryzek \(1990\)](#).

Policymakers may be naturally inclined to defend defective policies because each policy is entangled with the interests of those involved in its development. This is one reason why it can be difficult to expose government and organisational policies to rational and critical testing. However, if the goal is to ameliorate social problems, policies must be opened to testing aimed at falsifying their provisions, as Critical Rationalism requires. In this way, knowledge of what works best for society can develop continually. Theories should have real-life applications rather than remain purely abstract concepts. Critical Rationalism aims to move theories from the abstract realm into the physical realm, where they can be applied to human problems.

Robert Hoppe supports the view that applying Critical Rationalism in society can shape policy direction through learning from trial and error. He argues that policy analysts with a Critical Rationalist orientation regard knowledge acquisition and societal progress as evolving through trial and error: comparing what worked with what did not, discarding the latter, and subjecting the former to the same process [Hoppe \(2011\)](#). The effects of policy implementation can accordingly be understood as experimentation or trial. When an error is identified, the policy should be subjected to rational and critical examination in order to refine or improve it. Deane Galbraith similarly argues that Popper was right to insist that theories about society be subjected to constant criticism [Galbraith \(2022\)](#). This process leads to knowledge ac-

quisition and development in relation to the policy or issue under examination. Tuomo Peltonen argues that Critical Rationalism can help society prepare more effectively for unexpected events. Popper's concept of risky prediction offers foresight by providing hypothetical frameworks for possible future crisis situations [Peltonen \(2023\)](#).

2.2.2. Development of Knowledge in Academia

The principles of Critical Rationalism, when applied to education, hold considerable promise for the development of knowledge. Gerhard Zecha argues that the method of criticism is central to Critical Rationalism. Criticism should be applied not only to the natural sciences but to all fields of human endeavour in which problems are identified and solutions are required. It is therefore striking that, despite the many problems identified in education, educators and philosophers of education have yet to appreciate and appropriate the pedagogical implications of Popper's epistemology [Zecha \(1999\)](#). The goal of education should be problem solving, which depends on the growth of knowledge. The approach through which knowledge is acquired or developed is therefore imperative. Zecha believes that applying Popper's method of Critical Rationalism can have a substantial effect on education and improve society's capacity to solve problems.

Stephanie Chitpin, who also supports the Popperian method and its positive educational implications, describes Popper as one of the most outstanding philosophers of science. His influence extends beyond that field and bears significantly on educational issues, yet educators have not fully recognised it [Chitpin \(2016\)](#). Both Zecha and Chitpin identify the positive contribution that applying the principles of Critical Rationalism in education can make to the development of knowledge.

For Zecha, the Popperian dream school is one in which students identify problems that fascinate them and attempt to solve them. It is a place where fallible teachers and students participate in open dialogue about significant problems [Zecha \(1999\)](#). Such an environment would help students develop critical-thinking abilities and equip them with the skills required to identify problems and propose solutions, while keeping an open mind about the possible falsification of those solutions when better ideas emerge. This disposition would open a space in which knowledge can grow and develop.

Teachers, lecturers, and professors working within this educational orientation would not impose theories, ideas, and beliefs on their students. Instead, they would introduce students to them and create opportunities for new perspectives on the subject matter. Encouraging students to apply critical and rational attitudes to their studies without undue interference would enable them to analyse problems and propose solutions. As Zecha notes, Joseph Agassi extends this argument to graduate research. Graduate students should be encouraged to explore their chosen topics freely through continuing conversation and interaction with their supervisors. Technical requirements should not take centre stage in the research process [Zecha \(1999\)](#).

Research should focus on identifying students' interests and helping them, through a dialectical process, to arrive at solutions to the problems they set out to address. Popper believes that the overbearing influence of authoritarian sources is a setback to the growth of knowledge. He argues instead that every theory and

conjecture, whether one's own or another's, should be criticised if the goal is genuinely to solve problems in the real world [Chitpin \(2016\)](#). The relationship between teachers, lecturers, or professors and students should not be limited to transmitting information and expecting it to be reproduced. It should enable students to contribute to the growth of knowledge.

Chitpin adds that twenty-first-century teaching has moved away from what was common in the past. It is not merely a matter of collecting information and passing it on to students. Acquiring relevant teaching skills is also insufficient. A deep and personal knowledge of students is necessary because it facilitates fruitful engagement, builds critical-thinking skills, and develops problem-solving capabilities [Chitpin \(2016\)](#).

At the core of Critical Rationalism is the idea that knowledge grows. It does not hold that knowledge is impossible. Karl Popper argues that knowledge and science grow by learning from mistakes, through bold guesses and attempts to refute or falsify them. The process is moderated by criticism. Even a conjecture that survives criticism cannot attain the status of certainty [Popper \(1963\)](#). This quality of Critical Rationalism positions it to advance the growth and development of knowledge in academia. When knowledge is approached with humility, its growth and development can follow naturally. Adopting this posture can create a vibrant environment that fosters knowledge development and, in turn, positively affects society.

2.2.3. Critical Rationalism and Marginalised Indigenous Knowledge Systems

Over a prolonged period, Western epistemology has presented itself as universal, rational, and scientific while treating other forms of knowledge as myth and superstition. The accumulated practices, theories, and cosmologies of Native American, Aboriginal, African, and other Indigenous communities have been denied inclusion in universities and research funding and, in some cases, have been criminalised. Colonialism has also disrupted their transmission to the point of endangering some knowledge systems. The contemporary challenge is not merely to preserve Indigenous knowledge but to develop, document, test, and innovate with it, allowing it to contribute to solving real problems affecting humanity and the environment.

Popper's Critical Rationalism offers a possible way forward. It holds that knowledge grows not through proof, authority, or induction but through conjectures and refutations [Popper \(1963\)](#). If applied reflexively and interculturally, it can help develop marginalised knowledge systems by protecting them from dogmatism, making their claims testable and fundable, and creating dialogue with Western epistemology without forcing them into a Western mould. Can Critical Rationalism work with Indigenous knowledge systems that are relational, oral, and spiritually grounded? For instance, Tiv indigenous knowledge and technology are interwoven with the Tiv traditional religion. Blacksmithing (iwya varen) the main stay of Tiv technology was practiced as an appendage of Tiv religion ([Agber et al., 2015](#), p. 217). Colonial forces classified such practices as superstitious sought and to destroy them instead of learning how such practices have helped indigenous communities solve their problems. Rather than leave indigenous knowledge as untouchable and tradition, Critical Rationalism will treat it as conjecture rather than revelation,

allowing for internal criticism. Critical Rationalism is fallibilist, meaning that no belief is immune from criticism. This disposition protects Indigenous knowledge from becoming static by treating its claims as conjectures. CITE IN PRgraph

Research-funding organisations consider testable hypotheses, cultural value, benefits to target communities, and impacts, among other factors. These criteria can make Indigenous knowledge feasible as a subject of research. Critical Rationalism can give Indigenous knowledge an advantage when applied. Cases in which Indigenous knowledge has been tested have demonstrated its potential value. For example, *Artemisia annua*, used by Chinese healers to treat malaria, was tested through methods comparable to Critical Rationalism. The resulting discovery of artemisinin was recognised by the 2015 Nobel Prize Youyou (2015). The Intergovernmental Panel on Climate Change compares Indigenous observations and predictions with scientific and meteorological evidence IPCC (2022). Aboriginal “cultural burning” has moved from being treated as folklore to empirical examination and may significantly reduce wildfire severity Kimberly Land Council (2026).

The value that Critical Rationalism adds is its insistence that Indigenous knowledge be tested continually, bringing claims to a point of corroboration: not necessarily to truth, but to survival under criticism. This can make Indigenous knowledge more eligible for research funding and thereby support its growth and development.

Critical Rationalism is therefore not necessarily opposed to Indigenous knowledge. It can help Indigenous knowledge remain adaptive, gain legitimacy, and interact with Western science without losing its relational ontology. The goal is not to Westernise Indigenous knowledge systems but to make tools available through which they can defend and develop themselves authentically, without subjugation. Popper states that “all life is problem solving” Popper (1999). His approach begins with problems rather than paradigms. Many Indigenous knowledge systems are problem-oriented and address matters such as water scarcity, soil health, and conflict resolution. If this is their approach to life, then Indigenous knowledge, although marginalised for centuries, must be recognised as containing solutions relevant to contemporary social problems.

By focusing on error correction, Critical Rationalism provides a method through which this potential can be realised. It can help undo stereotypes about Indigenous knowledge by enabling it to evolve publicly, absorb new evidence, and abandon practices that no longer work while retaining cultural continuity.

3. CONCLUSION

Critical Rationalism holds considerable potential for the development of knowledge. It promotes intellectual humility and a willingness to revise one’s theories in light of new evidence. This can produce a dynamic and adaptive society that is better able to address complex challenges and make informed decisions based on the best available information. Applying Critical Rationalism to society can further support knowledge development by fostering a culture of critical inquiry in which individuals scrutinise ideas, challenge assumptions, and seek better options. This can strengthen the knowledge base and contribute to social progress and development. By emphasising the importance of question-

ing assumptions and remaining open to new knowledge, Critical Rationalism can create a learning environment that fosters intellectual growth and innovation and empowers students to become independent thinkers, effective problem solvers, and lifelong learners.

The application of Critical Rationalism in Nigerian society and its educational system can foster innovation, progress, and intellectual growth. By upholding critical thinking, evidence-based decision-making, and a willingness to challenge existing beliefs and policies, it can support more informed and effective governance. Individuals and policymakers who adopt its principles can approach problems with a spirit of inquiry and openness to new ideas, leading to more adaptive policy frameworks.

In education, Critical Rationalism can help develop a generation of thinkers equipped to question, analyse, and synthesise information in pursuit of deeper understanding. Educational policymakers can thereby shape a system that encourages intellectual curiosity, creativity, and independent thought. Critical Rationalism can also support the development of Indigenous knowledge by elevating it from the status of myth and superstition imposed on it by the West to the status of an authentic knowledge system better positioned to address contemporary social problems. Indigenous knowledge could thereby gain greater entry into universities and contribute to the development of human societies.

This approach can also equip Indigenous students with knowledge relevant to local, context-specific problems and challenges. It can give policymakers access to knowledge and information capable of improving service delivery, governance, and social development. It can enrich decision-making processes, improve problem-solving capacity, and promote sustainable social development. Most importantly, stakeholders should press the government to implement policies and recommendations that position education to enhance the growth and development of knowledge and to contribute positively to society. This commitment must be clear, persuasive, and consistent until a shift in paradigm occurs.

DATA AVAILABILITY

No new data were generated or analysed in this study.

COMPETING INTERESTS

The author declares that there are no known competing financial or personal interests that could have appeared to influence the work reported in this article.

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ETHICAL CONSIDERATIONS

This study did not involve human participants, animals, confidential personal information, or sensitive data. Therefore, ethical approval and informed consent were not required.

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