Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms

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Abstract

This paper explores the philosophical underpinnings of three major educational research paradigms: scientific, interpretive, and critical. The aim was to outline and explore the interrelationships between each paradigm's ontology, epistemology, methodology and methods. This paper reveals and then discusses some of the underlying assumptions of educational research. Consequently, this paper is relevant to every English language teacher who is a reader of research.

Keywords: critical paradigm, epistemology, interpretive paradigm, ontology, positivism, scientific paradigm

1. Introduction

What knowledge is, and the ways of discovering it, are subjective. This paper explores the subjectivity of educational research. It is important for English language teachers to understand the underlying ontological and epistemological assumptions behind each piece of research that they read. Teachers need to be able to recognize how these assumptions relate to the researcher's chosen methodology and methods, and how these assumptions connect to the findings which are presented in journal articles. This understanding will enable improved: comprehension of research, application of theory to classroom practice, engagement in academic debate, and presentation of their own research findings. This paper gives an overview of what a paradigm consists of, and then explores and discusses the assumptions behind the scientific, interpretive, and critical paradigms.

2. What Is a Paradigm?

A paradigm consists of the following components: ontology, epistemology, methodology, and, methods. Each component is explained, and then the relationships between them are explored.

Ontology is the study of being (Crotty, 1998, p. 10). Ontological assumptions are concerned with what constitutes reality, in other words *what is*. Researchers need to take a position regarding their perceptions of how things really are and how things really work.

Epistemology is concerned with the nature and forms of knowledge (Cohen et al., 2007, p. 7). Epistemological assumptions are concerned with how knowledge can be created, acquired and communicated, in other words *what it means to know.* Guba and Lincon (1994, p. 108) explain that epistemology asks the question, what is the nature of the relationship between the would-be knower and what can be known?

Every paradigm is based upon its own ontological and epistemological assumptions. Since all assumptions are conjecture, the philosophical underpinnings of each paradigm can never be empirically proven or disproven. Different paradigms inherently contain differing ontological and epistemological views; therefore, they have differing assumptions of reality and knowledge which underpin their particular research approach. This is reflected in their methodology and methods.

Methodology is the strategy or plan of action which lies behind the choice and use of particular methods (Crotty, 1998. p. 3). Thus, methodology is concerned with why, what, from where, when and how data is collected and analyzed. Guba and Lincon (1994, p. 108) explain that methodology asks the question: how can the inquirer go about finding out whatever they believe can be known?

Methods are the specific techniques and procedures used to collect and analyze data (Crotty, 1998, p. 3). The

data collected will either be qualitative or quantitative. All paradigms can use both quantitative and qualitative data.

Research methods can be traced back, through methodology and epistemology, to an ontological position. It is impossible to engage in any form of research without committing (often implicitly) to ontological and epistemological positions. Researchers' differing ontological and epistemological positions often lead to different research approaches towards the same phenomenon (Grix, 2004, p. 64). This will become evident as the scientific, interpretive, and critical paradigms are explored.

3. Explanation of the Scientific Paradigm

The scientific paradigm rose to prominence during the Enlightenment. Comte popularized the term positivism (Crotty, 1998, p. 19) when he sought to apply the scientific paradigm, which originated studying the natural world, to the social world (Cohen et al., p. 9).

The ontological position of positivism is one of realism. Realism is the view that objects have an existence independent of the knower (Cohen et al., 2007, p. 7). Thus, a discoverable reality exists independently of the researcher (Pring, 2000a, p. 59). Most positivists assume that reality is not mediated by our senses. Language fulfills a representational role as it is connected to the world by some designative function; consequently, words owe their meaning to the objects which they name or designate (Frowe, 2001, p. 176).

The positivist epistemology is one of objectivism. Positivists go forth into the world impartially, discovering absolute knowledge about an objective reality. The researcher and the researched are independent entities. Meaning solely resides in objects, not in the conscience of the researcher, and it is the aim of the researcher to obtain this meaning. Crotty (1998, p. 8) elaborates,

"A tree in the forest is a tree, regardless of whether anyone is aware of whether anyone is aware of its existence or not. As an object of that kind, it carries the intrinsic meaning of treeness. When human beings recognize it as a tree, they are simply discovering a meaning that has been lying in wait for them all along."

Thus, phenomena have an independent existence which can be discovered via research. Positivistic statements are descriptive and factual. The scientific paradigm is foundational as scientific propositions are founded on data and facts (House, 1991, p. 2). This discoverable knowledge is considered to be absolute and value free; it is not situated in a political or historic context.

During the 20th century, post-positivism emerged from positivism. Post-positivism has similar ontological and epistemological beliefs as positivism; however, it differs in several ways. Firstly, the truth produced by the scientific paradigm is simply our belief in the truth of current tested hypotheses (Popper, 1959, p. 415-9). Secondly, the principle of falsification argues that scientific theories can never be proven true (Ernest, 1994, p. 22). Only when all attempts to refute them fail can they tentatively be accepted. Thus, "every scientific statement must remain tentative forever" (Popper, 1959, p. 280). Finally, in order to understand some scientific theories more than empirical data is needed. For example, Heisenberg's uncertainty principle states that it is impossible to know both the exact position and velocity of a subatomic particle at the same time (Crotty, 1998, p. 29). Post-positivism claims that post-positivistic knowledge is more certain and objective than knowledge which originated from other paradigms.

Positivist methodology is directed at explaining relationships. Positivists attempt to identify causes which influence outcomes (Creswell, 2009, p. 7). Their aim is to formulate laws, thus yielding a basis for prediction and generalization. A deductive approach is undertaken. Correlation and experimentation are used to reduce complex interactions their constituent parts. Verifiable evidence sought via direct experience and observation; this often involves empirical testing, random samples, controlled variables (independent, dependent and moderator) and control groups. True-experiments are preferred over quasi-experiments. Cohen et al. (2007, p. 8) identifies that an approach which is characterized by procedure and methods which are designed to discover general laws is nomothetic. Positivists view their methodology as value neutral, thus the knowledge generated is value neutral.

Similarly, post-positivists seek to understand causal relationships; thus, experimentation and correlational studies are used. However more than sense-data is collected, participants' perspectives are often sought. Furthermore, as knowledge is tentative, hypotheses are not proved but simply not rejected (Creswell, 2009, p. 7).

The scientific paradigm seeks predictions and generalizations; thus, methods often generate quantitative data. Examples include: standardized tests, closed ended questionnaires and descriptions of phenomena using standardized observation tools (Pring, 2000a, p. 34). Analysis involves descriptive and inferential statistics. Inferential statistics allow sample results to be generalized to populations.

Research is deemed good if its results are due to the independent variable (internal validity), can be generalized/transferred to other populations or situations (external validity), and different researchers can record the same data in the same way and arrive at the same conclusions (replicable and reliable). Additionally, research needs to be as objective as possible and robust to empirical refutation.

4. Discussion of the Scientific Paradigm

Since methods developed to understand the natural world are not always directly transferable to the social world, positivism has limitations.

Although positivism attempts to reduce the complex to the simple by simplifying and controlling variables, this is extremely difficult to do in educational research. Often context limits methodology; isolating variables can be difficult. For example, project 'Follow Through' (Abt Associates, 1977) investigated 20 teaching models and involved 20,000 children. Many of the null hypotheses in this study could not be rejected because many of the treatments did not consider all contextual variables (Kennedy, 1978, p. 8-9).

Some variables may be hidden from the researcher and only become known when their effects are evident (House, 1991, p. 6). Examples of fluctuating individual factors include: ordinary life events (headaches) and attitudes (enthusiasm). Therefore, predictions could be correct due to random reasons (Shank & Brown, 2007, p. 28). No scientific explanation of human behavior is ever complete (Berliner, 2002, p. 20).

Inferential statistical tests are often misused and their results are often misinterpreted. Researchers may select an incorrect statistical test. For example, if data is not distributed normally, then a non-parametric test is required. Furthermore, the interpretation of P-values is dependent on whether you are hypothesis testing or significance testing, and the results of tests of statistical significance are dependent upon sample size (Blume & Peipert, 2003, p. 2-4). Thus, the results of inferential statistical tests cannot be taken at face-value.

Deduction from empirical generalization is rarely explanatory (Scriven, 1970, p. 100-101). Positivistic generalizations ignore the intentionality of the individual, thus actions are not fully understood. Two students who may appear to be doing the same thing could be doing different things. For example, two students write the answer to 2x7. Student A memorized the answer, student B added seven together twice. Actions need to be understood from the participants' perspectives, including both process and agency.

Positivists self-delude themselves into thinking that their research is value free. Firstly, throughout the research process researchers make value-laden judgments, for example: selection of variables, actions to be observed, and interpretation of findings (Salomon, 1991, p. 10-18). Secondly, knowledge production is political. Refusing to consider the political connections of produced knowledge is in itself political.

Positivists have contributed to understanding philosophy, adopted high standards of rigor and attempted to formulate methods which yield commonly accepted results (Ashby, 1964, p. 508). Verified observation statements, which are of use to policy makers, have been produced, for example evidence about the long-term positive effects of small class size. Although certainty is elusive, aspects of positivism belong in educational research.

5. Explanation of the Interpretive Paradigm

The ontological position of interpretivism is relativism. Relativism is the view that reality is subjective and differs from person to person (Guba & Lincoln, 1994, p. 110). Our realties are mediated by our senses. Without consciousness the world is meaningless. Reality emerges when consciousness engages with objects which are already pregnant with meaning (Crotty, 1998, p. 43). Reality is individually constructed; there are as many realities as individuals. Language does not passively label objects but actively shapes and moulds reality (Frowe, 2001, p. 185). Thus, reality is constructed through the interaction between language and aspects of an independent world.

The interpretive epistemology is one of subjectivism which is based on real world phenomena. The world does not exist independently of our knowledge of it (Grix, 2004, p. 83). Regarding trees, Crotty (1998, p. 43) elaborates,

"We need to remind ourselves here that it is human beings who have constructed it as a tree, given it the name, and attributed to it the associations we make with trees."

A tree is not a tree without someone to call it a tree. Meaning is not discovered; it is constructed though the interaction between consciousness and the world. Consciousness is always consciousness of something (Crotty, 1998, p. 44). To experience a world is to participate in it, simultaneously molding and encountering it (Heron & Reason, 1997, p. 3). Intentionality refers to the interaction between consciousness and phenomena.

Regarding the same phenomenon, different people may construct meaning in different ways (Crotty, 1998, p. 9) but truth is a consensus formed by co-constructors (Pring, 2000b, p. 251). Therefore, knowledge has the trait of being culturally derived and historically situated. The interpretive paradigm does not question ideologies; it accepts them.

Knowledge and meaningful reality are constructed in and out of interaction between humans and their world and are developed and transmitted in a social context (Crotty, 1998, p. 42). Therefore, the social world can only be understood from the standpoint of individuals who are participating in it (Cohen et al., 2007, p. 19). Interpretivism aims to bring into consciousness hidden social forces and structures.

Interpretive methodology is directed at understanding phenomenon from an individual's perspective, investigating interaction among individuals as well as the historical and cultural contexts which people inhabit (Creswell, 2009, p. 8). Examples of methodology include: *case studies* (in-depth study of events or processes over a prolonged period), *phenomenology* (the study of direct experience without allowing the interference of existing preconceptions), *hermeneutics* (deriving hidden meaning from language), and *ethnography* (the study of cultural groups over a prolonged period).

Individual constructs are elicited and understood through interaction between researchers and participants (Guba & Lincon, 1994, p. 111) with participants being relied on as much as possible (Creswell, 2009, p. 8). Events are not reduced to simplistic interpretations; new layers of understanding are uncovered as phenomena are thickly described. Interpretive theory is usually grounded (inductive), being generated from the data, not preceding it (Cohen et al., 2007, p. 22). Thus, research questions are broad. Cohen et al. (2007, p. 8) identify that an approach characterized by its emphasis on an individual case, in which a relativistic social world is embedded, is idiographic. Interpretivists acknowledge that value free knowledge is not possible. For example, researchers assert their beliefs when they choose what to research, how to research and how to interpret their data (Edge & Richards, 1998, p. 336).

Interpretive methods yield insight and understandings of behavior, explain actions from the participant's perspective, and do not dominate the participants. Examples include: open-ended interviews, focus groups, open-ended questionnaires, open-ended observations, think aloud protocol and role-playing. These methods usually generate qualitative data. Analyses are the researchers' interpretations; consequently, researchers need to make their agenda and value- system explicit from the outset.

Research is deemed good if it: provides rich evidence and offers credible and justifiable accounts (internal validity/credibility), can be made use of by someone in another situation (external validity/transferability), and the research process and findings can be replicated (reliability/dependability) (Richie & Lewis, 2003, p. 263-286; Cohen et al, 2007, p. 133-149).

6. Discussion of the Interpretive Paradigm

Although the interpretive paradigm is sensitive to individual meanings that can become buried within broader generalizations (Samdahl, 1999, p. 119), it has shortcomings.

Interpretive research rejects a foundational base to knowledge, bringing into question its validity. Interpretive research cannot be judged using the same criteria as the scientific paradigm. Legitimacy and trustworthiness need to be achieved without claiming uncontested certainty. However, reaching a consensus is problematic. If reality is subjective and differs from person to person, then research participants cannot be expected to arrive at exactly the same interpretations as researchers (Rolfe, 2006, p. 305). Therefore, validity adding criteria such as triangulation, member checking and peer review are ineffective as they assume an underlying objective reality which can be converged upon (Angen, 2000, p. 384).

Knowledge produced by the interpretive paradigm has limited transferability as it is usually fragmented and not unified into a coherent body. Generalizations which are deemed useful to policy makers are often absent because its research usually produces highly contextualized qualitative data, and interpretations of this data involve subjective individual constructions. Consequently, policy makers are often reluctant to fund interpretive research, for example, the US No Child Left Behind Act of 2001 predominately promoted research based on the scientific paradigm (Berliner, 2002, p. 18-20).

Participants' autonomy and privacy can be compromised as the methods of interpretive research are more intimate and open-ended than scientific research. Intimacy and open-endedness may facilitate the unintended discovery of secrets, lies and oppressive relationships (Howe & Moses, 1999, p. 40). Researchers may have to decide if they have an ethical responsibility to reveal their participants or intervene in their lives, for example, protecting students from abusive teachers. Additionally the more information that researchers give when

constructing a thick description, the greater the risk of participant exposure. Researchers may have to tone-down their contextualization in order to protect participants' identities.

Participants have limited control and are vulnerable to researchers imposing their own subjective interpretations upon them. Interpretive researchers produce theorized accounts that represent participant's sociological understandings (Danby & Farrell, 2004, p. 41). This raises issues of: who owns the data, how will the data be used and how much control over the findings do participants have? Even though participants are often given a voice, it is usually the researcher who decides on: the direction that the research takes, the final interpretation of the data, and which information is made public.

The pre-existing meaning making system which we are born into distorts our understanding of phenomena and we are unaware of this. Interpretive research often neglects external structural forces which influence behavior (Cohen et al., 2007, p. 26). Understandings are "structured historically in the traditions, prejudices and institutional practices that come down to us" (Taylor, 1993, p. 59). Therefore, participants might not be aware of invisible ideology which guides their actions. As participants might not fully understand the forces which are acting on their agency, their explanations of phenomena are incomplete.

7. Explanation of the Critical Paradigm

The ontological position of the critical paradigm is historical realism. Historical realism is the view that reality has been shaped by social, political, cultural, economic, ethnic, and gender values; reality that was once deemed plastic has become crystallized (Guba & Lincon, 1994, p. 110). Realities are socially constructed entities that are under constant internal influence.

Language does not passively label objects but actively shapes and moulds reality (Frowe, 2001, p. 185). Reality is constructed through the interaction between language and aspects of an independent world. However, the critical paradigm takes the view that language contains power relations so it is used to empower or weaken.

Critical epistemology is one of subjectivism which is based on real world phenomena and linked with societal ideology. Knowledge is both socially constructed and influenced by power relations from within society. Cohen et al. (2009, p. 27) explain that, "what counts as knowledge is determined by the social and positional power of the advocates of that knowledge." Regarding knowledge on trees, different organizations have differing beliefs. For example, the World Wildlife Fund and logging companies have differing agendas; therefore, they often dispute what constitutes an endangered tree.

Social constructionism argues that we are born into a world in which meaning has already been made; we are born into culture. "We come to inhabit a pre-existing system and to be inhabited by it," (Crotty, 1998, p. 53). This pre-existing system consists of consensuses about knowledge that have already been reached and are still being reached. Furthermore, it is stratified and marked with inequality. Research interests are influenced by culture, race, gender and location (Siegel, 2006, p. 5). Academic and scientific communities, which validate and legitimize knowledge claims, unwittingly contribute to systems of oppression. For example, much of the social and psychological theory which underpins the scientific paradigm was developed by white, able-bodied males (Mertens, 2005, p. 17). As knowledge claims are always embedded in regimes of truth, consideration should be given to domination, exclusion, privilege and marginalization (Ceci et al., 2002, p. 714).

The critical paradigm is anti-foundational; it attacks this reality. People are not only *in* the world but also *with* it (Crotty, 1998, p. 149). Reality is alterable by human action. The critical paradigm seeks to address issues of social justice and marginalism. The emancipatory function of knowledge is embraced. Different theoretical perspectives of critical inquiry include: Marxism, queer theory and feminism.

As it is culturally derived, historically situated and influenced by political ideology, knowledge is not value free. The critical paradigm asks the axiological question: what is intrinsically worthwhile? Thus, the critical paradigm is normative; it considers how things ought to be; it judges reality. The utopian aspirations of the critical paradigm may never be realized but a more democratic society may materialize.

Critical methodology is directed at interrogating values and assumptions, exposing hegemony and injustice, challenging conventional social structures and engaging in social action (Crotty, 1998, p. 157). Inquiry is inseparable from politics. Its aim is to emancipate the disempowered. Researchers embrace their ideology as they recognize that "no research methodology is value free" (Pring, 2000b, p. 250). Therefore, the starting point of a critical researcher is often preconceived. Finding out is the means, change is the underlying aim. This involves making people critically aware of their situation (conscientization), then realizing change through a praxis, which is repeated action informed by reflection (Freire, 1970, p. 48). Thus, there is an emergent, recursive relationship between theory, data, research questions and interpretation (Talmy, 2010, p. 130).

Participants and researchers are both subjects in the dialectical task of unveiling reality, critically analyzing it, and recreating that knowledge (Freire, 1970, p. 51). Researchers do not carry out transformation *for* participants but with *them* (Freire, 1970, p. 49). Consequently, participants are involved in the research process, for example designing questions, collecting data, analyzing information and benefiting from research (Creswell, 2009, p. 9). Critical methodologies include: *critical discourse analysis* (examines how social and political domination is realized in text and talk), *critical ethnography* (an ideologically sensitive orientation to the study of culture (Canagarajah, 1993, p. 605)), *action research* (a cyclical process of investigation, action and evaluation which results in a change in practice), and *ideology critique* (exposes hidden ideology by revealing participants' places in systems which empower or disempower them.)

Critical methods enable realities to be critically examined from a cultural, historical and political stance. Examples include: open-ended interviews, focus groups, open-ended questionnaires, open-ended observations, and journals. These methods usually generate qualitative data. Similar to interpretivism, analysis often involves thematic interpretation of data; however, explicit values are now placed on these interpretations.

Critical research should fully acknowledge its context (culturally, historically and politically) and promote dialogical relations of equality between the researchers and participants. Additionally, research must create an agenda for change or reform, enhancing the lives of the participants. It must have catalytic validity (Cohen et al., 2007, p. 139).

8. Discussion of the Critical Paradigm

The critical paradigm exposes how political ideology is inextricably interwoven with knowledge, but problems exist.

Critical research has an agenda of change; therefore, it is often not supported by existing regimes. Giroux (Giroux, 2011) argues that neoliberal and neoconservative forces are currently transforming American universities into anti-democratic public spheres; consequently, the right of faculty to work in an autonomous and critical fashion is under attack. One way to control research is through funding, for example the US No Child Left Behind Act (Berliner, 2002, p. 18-20). Knowledge production is influenced by politics. Often the critical paradigm is not favored by existing policy makers.

A dialogue of equals is virtually impossible as power differentials between researchers and participants exist. For example, action research carried out in secondary schools might encounter the following problems. Teachers control the research agenda, thus participants may not be involved in the research design. A high degree of obligation will exist for students to participate; it would be difficult for a student to refuse a teacher on whom they are dependent for grades and access to resources (Nolen & Putten, 2007, p. 402). If participants try to please the researcher, the data given may not be accurate and the research findings may not be credible. Consequently, issues of collaboration, consent, coerciveness, and autonomy must be considered.

Emancipation is not guaranteed. The change in the participants' lives may be negligible or non-existent. Does the majority of action research make an emancipatory difference? There is little evidence to suggest so. Furthermore, once participants become critically aware of their situation, change may not be possible. Despondency may ensue as blissful ignorance is shattered. Alternatively, some participants' lives may be changed for the worst. For example, Rushton, a Canadian psychologist, attempted rationalize racist policy by linking race to intelligence and moral behavior (Howe, 2009, p. 436).

The critical paradigm stereotypes participants in two ways. Firstly, it often labels participants as belonging to a particular marginalized group; therefore, homogeneous notions of identity are superimposed. Secondly, the critical paradigm does not acknowledge that different participants enter the research with varying levels of conscientization. It naively assumes that populations blindly do the bidding of powerful regimes, further enslaving themselves in the process.

Most of the leading authors in the critical paradigm have been male, prompting feminists to criticize the critical paradigm as excluding the voices and concerns of marginalized groups (Burbules & Berk, 1999). Ironically, the critical pedagogy can be accused of maintaining societal status-quos.

9. Conclusion

What knowledge is, and ways of discovering it, are subjective. Regarding educational research, the scientific paradigm seeks to generalize, the interpretive paradigm seeks to understand, and the critical paradigm seeks to emancipate. Each paradigm has its own ways of realizing its aims. Understanding the philosophical assumptions that underpin each paradigm and how these assumptions manifest themselves within methodology and methods will enable English language teachers to better comprehend, question, and apply the research that they read.

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