People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

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Faculty of Letters and Languages

Department of English

Introduction to Research Methods

for First Year Master students of Applied Linguistics

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Objectives of the course

By the end of the first semester, students should be able to:

-Demonstrate knowledge of the philosophical origins of the different modes of reasoning available to scientists

-Recognize and recall some key terms, notions and concepts in applied linguistics research.

-Compare and contrast two alternative major research methods in applied linguistics in terms of their underlying paradigms, processes, and implications.

-Choose the suitable research method using the knowledge and skills gained in this course.

Content

The Philosophical Origins of the Scientific Method

> "A brief, and sufficiently accurate, description of the intellectual life of the European races during the succeeding two centuries and a quarter up to our own times is that they have been living upon the accumulated capital of ideas provided for them by the genius of the seventeenth century.
> N. Whitehead, Science and the Modern World" (As cited by Chomsky (2009:56)

> "Nor was the role of the medieval Islamic scientist purely one of collection and preservation. In the medieval Middle East, scientists developed an approach rarely used by ancients—the experiment. Through this and other means they brought major advances in virtually all the sciences."
>
> Lewis (2002: 79)

Introduction

The purpose of this introductory lecture is to explore 'the subversive' ideas that marked one of the most dramatic eras in western history, the enlightenment, which revolutionized the universal conception of the relationship between man and the world as well as the basic notions of knowledge and scientific truth. This movement which still exercises a strong influence on scientific reasoning was brought about by the original thought of a few great philosophers who dared to subject the received wisdom in the sciences of their age to the critical view of reason.

1. Science: Etymology of the English Word

Before dealing with the currents of thought that led to the development of the scientific method, it is, perhaps, more appropriate first to break down the story of the English word 'science' itself because the evolution of the meaning of this word in the English language sketches , to a great extent, the evolution of the scientific method. Due to the fact that England was the cradle of this method and the ensuing scientific revolution, the intimate relationship between the evolution in the meaning of the word science and the scientific method is unparalleled in any other language to the point that the translation of some uses of this word still poses some serious problems even in one of the closest European languages, namely French (Williams, 1976).

Indeed, 'science' has become so mundane and widely used a term in modern times that it may lure us into a deceiving simplicity in defining accurately its meaning .To paraphrase Williams (1976: 215),the meaning (s) of word science which was introduced to English in the fourteenth century from the French word 'science' or the Latin word 'Scientia' has underwent, due to several sociocultural factors, a series of changes and did not acquire its stable actual meaning until the nineteenth century .Initially, the word referred to knowledge in general and ,as such ,it was contrasted with the word conscience: science denotes theoretical knowledge about something,

whereas conscience denotes knowledge that involves also conviction and commitment. Thus conceived, science was used interchangeably with art to refer to any type of knowledge or skill. But, starting from the seventeenth century, an interesting distinction was set between the two: science denotes a skill that requires theoretical knowledge and art referred to any skill that is acquired only through practice. The remarkable growth of the scientific revolution that has taken place in Britain since the seventeenth century has led to yet another more important and defining distinction which augured a new era in the history of science-that between experience and experiment. While the former may refer to either practical knowledge or inner (subjective) knowledge, the latter defined as 'an arranged methodical observation of an event' came to refer exclusively to external-and, hence, objective knowledge. As Williams (1976: 216) puts it:

> Changes in ideas of NATURE (q.v.) encouraged the further specialization of ideas of method and demonstration towards the 'external world', and the conditions for the emergence of science as the theoretical and methodical study of nature were then complete.

Therefore, this distinction marks the coming of age of an epistemological argument that assigned to the word 'science' a complete, stable and specialized meaning in the English language. Following this argument, terms such as scientific, scientific method and scientific truth came to refer exclusively to the methods that have proven their success in the natural sciences like physics, chemistry and biology. As a result of confining the sense of the word science to the pursuit of causal knowledge in the systematic investigation of the laws of nature, other kinds of experience such as metaphysical, religious, social, political, feelings, and any type of inner life have been simply dismissed as existing outside the realm of science and any attempt to transfer the methods of enquiry from 'physical' to 'the human sciences' was discredited as being some kind of 'scientism'. The problematic of the applicability of the term science to 'the human sciences' has lingered on until modern times as Lyons (1981) so aptly puts it as far as the use of the word 'science' in the field of linguistics is concerned:

> " The first point that must be made is that the English word 'science' is much narrower in its coverage than many of its conventionally accepted translation-equivalents in other languages: such as 'Wissenschaft' in German,'nauka' in Russian and even 'science' in French. Linguistics suffers more than most disciplines do from the very specific implications of the English words 'science' and 'scientific', which refer, first and foremost, to the natural sciences and the methods of investigation characteristic of them." Lyons (1981: 37)

This exceptional etymological evolution of the word 'science' in the English language was only possible thanks to the specific, intimate, and lasting rapport it has developed through time in

relation to the systematic investigation of truth in the causal knowledge about natural phenomenon conventionally known as the scientific method. This method has been brought about by a maturing of a hot epistemological debate between two major schools of thought that appeared in seventeenth century Europe: the rationalists and the empiricists.

2. Branches of Philosophy

There are three major branches of philosophy: ontology, ethics, and epistemology. Each branch deals with a specific area of philosophical knowledge and, hence, seeks to answer specific types of questions.

2.1. Ontology

From the search for the universe and its reason ontology was found**.** This branch deals with the questions of existence. As Tavakoli (2012:433) defines it,

> 'Ontology refers to the study of being or reality. In classical and speculative philosophy, ontology was the philosophical science of being. Its general aim was to provide reasoned, deductive accounts of the fundamental sorts of things that existed. It was not concerned with the specific nature of empirical entities, but rather with more basic questions of the universal forms of existence. Examples of classical ontological questions are as follows: 'Are bodies the only things that exist, or are immaterial forms real? Is there a supreme intelligence in the universe, or is all activity reducible to mechanical motion? Are individuals alone real, or are collectivities independently real? Are there real objects of universal terms, or are universals simply names that humans give to mental abstractions?'.

2.2. Ethics

From the search for beauty, good, and ugliness came the philosophy of ethics. According to Tavakoli (2012:198),

> "The word ethics is derived from the Greek word ***ethos*** meaning a person's character, nature or disposition. Ethics is a branch of philosophy which is concerned with thinking about morality, integrity and the distinction between right and wrong."

2.3. Epistemology

While the two aforementioned branches, ontology and ethics, are as ancient as philosophy itself, epistemology is relatively recent because its emergence has been delayed until the seventeenth century. The emergence of epistemology as a third major branch in philosophy took place in the seventeenth century Europe due to some interesting social and historical reasons. At that time, European society was undergoing big upheavals that have led to the decline of the church authority and the weakening of trust in religion in general and religious authorities in particular. A good example of the most important 'subversive' ideas that triggered an enormous wave of change that swept over Europe, transformed it irreversibly, and led to the emergence of yet more revolutionary philosophical thoughts is the idea of helo-centerism articulated by Copernicus, who asserted that it is the sun rather than the earth which is the center of the universe.

During this tumultuous period, the traditional institutions lost their credibility, and, thus, were perceived to be incapable of answering man's basic questions about the nature of life and existence. As in any age, however, men continued to raise this type of questions and to look for any one perceived to be credible enough to answer them. Europe managed to emerge completely transformed from this century thanks to the contribution of some philosophers who volunteered to answer those essential questions.

One of the issues that have attracted a great deal of attention at that time concerned the nature of scientific knowledge itself: the way it comes into being, its means, and the extent to which it is true. The seventeenth century French philosopher René Descartes felt the need for the creation of a third branch of philosophy called epistemology, the aim of which was to develop compelling answers to these important issues. Tavakoli (2012 :190-191) offers the following definition to this branch:

> **'epistemology[is a]**… term which is made up of the Greek-derived terms *episteme*, knowledge or science, and *logos*, knowledge, information, theory or account. Epistemology is the theory of knowledge, or as it is sometimes taken to mean, an analysis of the conditions, possibilities, and limits of our knowledge-gaining processes...Epistemology is often concerned with the nature, sources and justification of the major kinds of knowledge, for example how we may come to know things through the senses in the form of empirical knowledge, or apriori knowledge that we may have from other sources or via logic.'

2.4 Schools of Thought

Two major schools in epistemology developed opposing arguments with regard to the origins of human knowledge, the nature of scientific truth, and, accordingly, the appropriate method to use to reach them.

2.4.1 The Rationalists

Although he was educated in one of the best education systems of his era, René Descartes (1596-1650)(1637/2006) felt a growing discontent with the type of knowledge that he has received. However, while his critical assessment of the scientific and moral education of his era led him to conclude that this education did not have the stable foundations that would enable it to ensure access to truth; he also realized that by yielding to skepticism he runs the risk of admitting that everything is uncertain. This realization incentivized him to set for himself a highly challenging goal: to reconstruct the whole edifice of scientific knowledge into a unified science built on the basis of primary principles the truthiness of which is beyond any sort of doubt.

Since an early age, he cultivated a determined mistrust of all knowledge emanating from the senses and was convinced that the achievement of his goal depends on the development of a general method of 'scientific' enquiry, based on the use of intuition and logic, which is capable of enabling anyone who uses it to reach truth. What has made this conviction grew even stronger is

that notwithstanding the fact that all humans seem to share equally good sense- the intuitive ability to make correct judgments and to tell true from false- not all humans are able to use this good sense in the right way. Hence, the need for a method that provides all human beings with a set of clear and unquestionable principles and rules to guide them in the gradual building of their knowledge until they reach truth. This method (of systematic doubt) should consist of precepts that are certain and simple that would enable their users to distinguish what is true from what is false without deploying much or unnecessary effort. A sound thinking process should follow a series of planned and controlled steps. This process, however, should not start from scratch; it should use, as input, intuitions, which represent the god-given direct and immediate knowledge that allows the perception of something as true. Although intuitions are necessary for triggering the thinking process, they are by no means sufficient by themselves for reaching the truth .A process of deduction is needed in order to reach new conclusions on the basis of other things that are known with certitude. This process, according to Descartes, should be made of four steps, which make up the method. Descartes (1637/2006:17) summarizes the four precepts of his method that should serve as a tool for sifting through falsehoods to reach truth as follows:

1- The first step aims at reaching intuitive truth being the clearest and the distinctive of all truths. In it, the truth seeker engages in an extremely demanding process of systematic rejections of all sorts of 'prejudice' and 'premature conclusions'. In this arduous process, the standards of truth are set so high that nothing is accepted as true unless it has been proven to be so clear, so distinct, and firmly beyond the least of all doubt.

2- To break up the difficulties under scrutiny into a manageable number of smaller parts that allows the finding of an optimal solution for each part.

3- To proceed following the order of increasing difficulty starting from 'the simplest' and 'the most easily understood' objects and gradually moving towards 'the most complex'. This order of increasing difficulty should be imposed on any issue including those which never came under examination.

4- To ensure that the scrutiny has been thorough and detailed enough so that nothing worthy of consideration has been overlooked.

Once he put this method into practice, Descartes (1637/2006) made his first discovery, which he considered to be the first principle on which his philosophy is built, namely that he himself did exist:

> "…I resolved to pretend that everything that had ever entered my head was no truer than the illusions of my dreams. But immediately afterwards I noted that, while I was trying to think of all things being false in this way,

> it was necessarily the case that I, who was thinking them, had to be something; and observing this truth: *I am thinking Therefore I exist,** was so secure and certain* that it could not be shaken by any of the most extravagant suppositions of the skeptics, I judged that I could accept it without scruple, as the first principle of the philosophy I was seeking.*"
> Descartes (1637/2006:28)

The development of this method has enabled Descartes to have a long lasting influence on scientific reasoning. Indeed, one of the modes of reasoning which is still widely used in the humanities to elaborate theories and system of ideas is deductivism. This method- that the invention of which is attributed to Aristotle- involves the movement from the general principles to the prediction of specific results using the rules of syllogism, a process in logic in which two general statements lead to a particular statement. For example,

All humans are mortal

Socrates is human

Socrates is mortal

This method of reasoning has been reintroduced in modern science by René Descartes who maintained, as has been explained above, that true knowledge cannot be based on our senses. Knowledge, according to him, is innate and certitude results only from deduction (the application of the rules of logic).Intuitions (premises) should serve as stepping stones in the process of building more complex systems of knowledge.

2.4.2. The Empiricists

Led by Francis Beacon (1561-1626), John Locke (1632-1704), and David Hume (1711-1776) ,another equally important school of thought appeared in England around roughly the same era and presented a radically opposed point of view to the ideas advanced by Descartes and followers concerning the nature of scientific truth, the origins of human knowledge and the method to be used to obtain scientific knowledge. While Cartesian rationalism argued that knowledge of reality is not possible without the use of-the god-given- innate ideas as an intermediary, the empiricist philosophers rejected completely this idea arguing that the acquisition of knowledge depends exclusively on the perception of either the external world or the activity of our inner spirit through the use of our senses.

Restating the founding ideas advanced earlier by Francis Beacon (1620/2000) in his essay entitled the New Organon, Locke argued that the human mind is born as a blank slate or "tabula

rasa" and that the overwhelming amount of 'understanding' or knowledge that any human being happens to possess afterwards comes from one and only one source: experience. Locke (1689 /2018) succinctly explains this idea as follows:

> "All ideas come from sensation or reflection. Let us then suppose the mind to be, as we say, white paper, void of all characters, without any ideas: — How comes it to be furnished? Whence comes it by that vast store which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, from EXPERIENCE…"

The Scientific Reasoning Process

The rejection of "innate ideas" as the mediatory tool for accessing to scientific truth pushed the empiricist to develop a new set of supposedly more explanatory constructs to account for the reasoning process whereby humans manage to construct more complex systems of ideas on the basis of simple ones.

The Notion of Idea

The first notion that they grappled with was the notion of 'idea' itself. Locke (1689/2004: 03) defines the term "idea' as 'whatever is the object of the understanding when a man thinks." Hume (/2004: 08) sets a distinction between impressions and ideas,

> "So we can divide the mind's perceptions into two classes, on the basis of their different degrees of force and vivacity. The less forcible and lively are commonly called 'thoughts' or 'ideas'. The others have no name in our language or in most others, presumably because we don't need a general label for them except when we are doing philosophy. Let us, then, take the liberty of calling them 'impressions', using that word in a slightly unusual sense. By the term 'impression', then, I mean all our more lively perceptions when we hear or see or feel or love or hate or desire or will. These are to be distinguished from ideas, which are the fainter perceptions of which we are conscious when we reflect on our impressions"

The Association between Ideas

Thinking is possible, Hume (2004: 11) observes, because 'the mind's thoughts or ideas are obviously connected inter-connected in some systematic way'. In this regard, the mind moves from one idea to the other following one of the three principles of connection
: Resemblance, Contiguity [= nextness] in time or place, and Cause or Effect."

Causality (Inferring causality)

Hume (2004:37) singles out 'cause and effect' as being the most important relation worthy of consideration.

> "If there is any relation between objects that it matters to us to know perfectly, it is that of cause and effect. It is the basis for all our reasonings about matters of fact or existence; it alone assures us about objects that are

> not now present to memory or senses. The only immediate use of all the sciences is to teach us how to control and regulate future events through their causes. So our thoughts and enquiries are at every moment concerned with the relation of cause to effect''

These are some of the key constructs that lay at the foundation of what is commonly called the scientific method, which has been accepted with some modifications by scientists from the seventeen century up to the twentieth century and to the application of which is attributed much of what is called science today. Magee (1974:18-19) offers the following depiction of the series of steps that the scientist who adheres to this method usually follow to discover truth:

> "The scientist begins by carrying out experiments whose aim is to make carefully controlled and meticulously measured observations at some point on the frontier between our knowledge and our ignorance. He systematically records his findings, perhaps publishes them, and in the course of time he and other workers in the field accumulate a lot of shared and reliable data. As this grows, general features begin to emerge, and individuals start to formulate general hypotheses-statements of a law like character which fit all the known facts and explain how they are causally related to each other. The individual scientist tries to confirm his hypothesis by finding evidence which will support it. If he succeeds in verifying it he has discovered another scientific law which will unlock more of the secrets of nature. The new seam is then worked-that is to say the new discovery is applied wherever it is thought it might yield fresh information. Thus the existing stock of scientific knowledge is added to, and the frontier of our ignorance pushed back. And the process begins again on the new frontier."

This mode of reasoning used for searching for natural laws, regarded as the main task of science, following this method is known as inductivism. As opposed the deductive method, inductive reasoning proceeds from the observation and documentation of data concerning single instances in view of formulating general principles that would apply to all similar cases. The degree of authenticity and correctness of the resulting general principle depends largely on the number of cases subjected to observation and study.

Conclusion

The enlightenment movement of seventeen century Europe witnessed the birth of a third branch in philosophy called epistemology, which deals with the nature of human knowledge, within which two schools of thought were born: the rationalists and the empiricists .These two schools , which hold opposing views about the nature of reality and the origin and nature of human knowledge, have exercised a marked influence of scientific reasoning till the present through the two modes of reasoning that they have developed and made available to the scientists. The rationalists developed the reasoning procedure known as deductivism, whereas the empiricist developed the procedure known as inductivism. Moreover, the Anglo-Saxon school, i.e., the empiricists, has established the foundations of the scientific method thanks to which most of what is known as science today has come into existence. This dramatic development in particular has conferred on the English word ' science' a special hue in that, compared to the words closest in

meaning in other languages including those which it shares the same Latin origin, it limited its meaning to knowledge resulting from the application of 'the scientific method'.

The Scientific Method and the Notion of the Variable

Introduction

Any piece of research in education, in general, and, in applied linguistics in particular, is supposed to be conducted in an orderly and systematic series of actions that correspond-broadly speaking- to the different steps of 'the scientific method'**.** Due to the huge success it has achieved in the study of natural phenomena in the 'hard' sciences, this method has become the hallmark used for setting a line of demarcation between scientific and nonscientific knowledge. While preserving a set of core principles that have been established by the empiricist philosophers in England in the eighteenth century, this method has also undergone some interesting modifications.

1. Research in Education: a Definition

Anderson (1998:8) defines research in general terms as any "…disciplined attempt to address questions or solve problems through the collection and analysis of primary data for the purpose of description, explanation, generalization and prediction." Apprehending educational research from an empiricist perspective, Anderson (op.cit.8) argues that this type of research aims at discovering the laws that govern human behavior in an educational setting:

> 'Research is a scientific process which assumes that events in the world are lawful and orderly and, furthermore, that the lawfulness is discoverable. This the meaning of determinism and the researcher acts in the belief that the laws of nature can be understood and ultimately controlled to at least some degree. In a nutshell, educational research is the systematic process of discovering how and why people in educational setting behave as they do.'

2. The Role of Applied Linguistics in Educational Research

In the brief words of Brumfit and Mitchel (1990:4), the role of applied linguistics in educational research is defined as follows:

> **"**Understanding educational processes are…an important part of understanding what makes us distinctive creatures. And central to the educational process is the role of language, and the learning of new languages, dialects and modes of discourse. Understanding language teaching and learning will contribute to our understanding of language, of education, and of the human condition."

3.Objectives of Applied Linguistics Research

For Phakiti (2014:8), the objectives of applied linguistics research include the following objectives:

> "-exploring individual and environmental aspects associated with language learning or use
> -describing characteristics of language learning phenomena
> -explaining how language learning develops and why language development differs among different individuals
> - predicting language learners' future learning behaviors, steps, performance or success
> -testing or assessing language learning or use, as well as evaluating an effectiveness of a language instruction or program
> - applying current knowledge or theory in classroom practice.
> Any particular research study can have more than one of these aims."

4. The Notion of the Variable

Because of the efficiency it has displayed in the study of natural phenomena, the scientific method has been implemented in the human sciences starting from the nineteenth century to study human phenomena. Like any other natural phenomena, the proponents of the use of this method in the humanities argue, human phenomena are quantifiable and measurable. In order for any human phenomenon to be quantifiable, Levon (2010:68) states two conditions: "(a) what you want to count must itself be 'countable'…, and (b) what you want to count must have the potential to be *Variable."* Levon (op.cit.69) stresses that "The condition of variability, however, is a more abstract and basic one."It is because of this variability trait that the quantifiable phenomena are called variables.

4.1. Definition of Variables

The first step in the study of any problem in the humanities from a psychometric stance consists of the definition of the main variables. Variables , according to Brown (1988:07),"…[are] human characteristics or abilities that differ over time or among individuals.' Similarly, Anderson (1998:12) defines a variable as a "…characteristic that can assume any one of a range of values."

4.2. Types of Variables

Variables can be assigned to different types from a variety of perspectives**.**
From the perspective of the cause and effect relationship, for example, variables can be classified into three types, dependent, independent, and intervening variable, depending on the role that each variable plays in this relationship.

4.2.1 The Dependent Variable

According to Brown (1988: 10), "a dependent variable is observed to determine what effect, if any, the other types of variables may have on it."In other words, the dependent variable represents the effect or the phenomena under study.

4.2.2 The Independent Variable

Brown (op.cit.10) defines independent variables as "…variables selected by the researcher to determine their effect on or relationship with the dependent variable."To put it differently, the independent variable represents the cause in the cause and effect relationship and it is, therefore, the variable that is manipulated by the researcher in an experiment so as to determine effect on the phenomenon under study or the dependent variable. For example, consider the following research question:

-Does genre-based writing instruction enhance students' writing performance?

In this example, "students 'writing competence" is the phenomenon under study and, thus, represents the effect or the dependent variable whereas "genre-based instruction" represents the cause or the independent variable.

4.2.3 The Intervening Variable

Brown (op.cit.12) points out that "intervening variables are hard to grasp because they are abstract, theoretical labels applied to the relationship or process that links the dependent and independent variables." Unlike the study of natural phenomena, the study of human phenomena is fraught with difficulties and pitfalls. One source of this difficulty emanates from the fact that an important number of these phenomena are abstract and, thus, not accessible to observation. In this case, the researcher labels a theoretical construct to explain the relationship between the independent and the dependent variable. In language learning for example, much of the hardship experienced by learners is attributed to mental processes that are not accessible to observation. In the research example stated above, the researcher may resort to the use of "learning strategies" as an intervening variable to explain individual differences with regard to the effect of the independent variable ,"genre-based instruction", on the dependent variable ,"students 'writing performance». However, there is no insurance that the invented explanatory construct "learning strategies" is only an artifact of some theory of questionable validity adhered to by the researcher in question.

4.2.4 Variables versus Constructs

A construct refers to an invisible psychological entity supposed to cause certain human behavior. As Brown (op.cit.8) puts it,

> " both variables and constructs vary over time or among individuals. However, a variable is essentially what we can observe or quantify of the human characteristics or abilities involved, whereas a construct is the actual characteristic or ability that it represents in human beings."

For example, proficiency in English is a construct because it is believed to exist inside learners of English' minds, but is not accessible to observation and, thus, measurement. In psychometric research involving this type of concepts, constructs should be defined both theoretically and operationally. As far as the theoretical definition is concerned, the researcher may refer to one or more existing theories to define the psychological trait under study. As regards, the operational definition should refer to a concrete, hopefully standardized, measure which will be used to turn the construct in question into numbers. For example, he may choose to use the TOEFL test to measure students 'proficiency in English.

In addition to classifying them on the basis of the role they play in the cause and effect relationship, variables can be classified on the basis of their characteristics vis-à-vis the levels of statistical measurement.

4.2.5 Four Types of Scales

Depending on their nature, the quantification of variables in interpreting the data collection process yields distinctive types of variables. For example, the variable proficiency in English can take more than one value when measured using the TOEFL test whereas the variable teacher or gender can have only one value, teacher/not teacher and male/female respectively, when measured in data collected in a questionnaire, for instance. Statistical analysis accounts for this type of differences among variables in terms of scales. Brown (1988: 20) defines scales as '…names for the different ways of observing, organizing, and assigning numbers to data, which makes them important for understanding the entire data collection process. 'Regarding this typology, variables can be assigned to four different types: nominal, ordinal, interval, and ratio scales.

A succinct definition encompassing these four types is offered by Anderson (1998:12):

> 'a variable is a characteristic that can assume any one of a range of values. Nominal variables are those which do not have a numeric or quantitative implication such as eye color, race or gender, Ordinal variables can be rank ordered, but do not imply an equal interval between the levels being ranked. For example, common performance grades on exams such as A,B and C are ordered, but the difference between a B and an A may be different than the difference between a C and a B. Sometimes these are grouped into intervals such as ages 21-30,31-40,etc.These are called interval variables. Ratio variables are those that are created during the research by dividing existing ordinal variables. Cost per pupil is an example. In general, nominal variables are used in the construction of frameworks or the division of samples into comparison groups. Ordinal and ratio variables are used for statistical analysis.'

5. The Scientific Method

As has been mentioned earlier**,** in spite of the fact that a set of its core techniques and principles have been kept unchanged since its inception, the scientific method has underwent some interesting modifications aimed at rendering it more effective in the pursuit of truth in the sciences. One of these modifications is the adoption of the hypothetico-deductive mode of reasoning as a substitute for the inductive method.

5.1 Hypothetico-Deductive Reasoning

This method, which has become the classic procedure of modern science , was put into practice by a brilliant Dutch physicist called Christian Huygens (1629-1695).Following this method, a general question is raised, a tentative answer is formulated, theoretical conjectures are formulated and then put to test so as to verify the veracity of the tentative answer. Verification of a given hypothesis may lead to the confirmation, modification, or rejection of this hypothesis.

5.2 Techniques of the Scientific Method

A stile (1942:14) outlines the techniques of the scientific method as follows:

1. "Recognizing and defining the problem."A research problem is a question about the nature of the relationship between variables. Before raising the question, a phenomenon should be observed so as to determine the variables that are involved.

2. "Formulating a working hypothesis on the basis of limited information." An hypothesis is a tentative answer to the research question consisting of the establishment a kind of relationship between the variables (cause and effect) or (correlation).
3. 'Testing the hypothesis by means of controlled experiments. 'An experiment should be designed so as to allow for an objective and disinterested test of the veracity of the hypothesis.
4. 'Collecting, organizing, and coordinating the data of the experiments for the purpose of discovering relationships.'
5. 'Drawing conclusions.' A rigorously designed study should lead to one of three possible outcomes with regard to the hypothesis under study: confirmation, rejection or modification.

Conclusion

The scientific method, which has proved effectiveness in the study of natural phenomena, has been implemented in the social sciences on the basis of the assumption that, like natural

phenomena, human phenomena represent a law-governed, objective reality that can be studied empirically in order to discover the underlying laws. Once discovered, those laws will, supposedly, render human phenomena predictable and, hence, controllable. The notion of the variable plays a key role in the subjugation of human phenomena-like those involved in language learning- to quantification and experimental study. However, the fact that that language learning involves the use of mental processes that are inaccessible to observation challenges applied linguists to search for adequate procedures to define those phenomena operationally, i.e., to render them measurable.

Key Concepts in Research: Paradigm, Methodology, and Method

Introduction

To avoid falling in the trap of considering research methods in their domain as mere recipes or blue prints that can be selected haphazardly and implemented blindly to arrive at certain conclusions about the research question(s) being raised, students' awareness should be raised to the fact that the choice of method should be preceded by the making of a conscious choice at the levels of paradigm and methodology. This choice involves the adoption of a carefully selected stance concerning primarily the nature of reality, knowledge, scientific truth, and the appropriate methodology to reach this truth. An appreciation of the differences between three terms-paradigm, methodology, and method-is a pre-requisite for the development of the ability to make such a decisive choice.

1. The Concept of Paradigm: a Definition

In his classic essay entitled 'the structure of scientific revolutions', Thomas Kuhn describes the process whereby a new scientific theory or discovery emerges. In his introduction to this very influential work in the philosophy of science, Kuhn (1962) acknowledges the striking fact that it is thanks mostly to his discussions with social scientists and their big divergence over the legitimate objects of scientific enquiry and the right methods to be used rather than to his fellow exact scientists that he managed to mature his reflections about the determining factors that make a given scientific discipline evolve from one stage to another, and more importantly, to discover the pivotal role that his key and influential concept 'paradigm' plays in this transition. Acknowledging the role that the hot controversy among psychologists and sociologists-about the most adequate method to use in academic research-played in maturing his thought, Kuhn (1962:IX-X)) relates the anecdote that led him to stumble upon the concept of paradigm, which

was a defining moment in his monumental work, in the following relatively long excerpt taken from the introduction to his book:

> 'Even more important, spending the year in a community composed predominantly of social scientists confronted me with unanticipated problems about the differences between such communities and those of the natural scientists among whom I had been trained. Particularly, I was struck by the number and extent of the overt disagreements between social scientists about the nature of legitimate scientific problems and methods. Both history and acquaintance made me doubt that practitioners of the natural sciences possess firmer or more permanent answers to such questions than their colleagues in social science. Yet, somehow, the practice of astronomy, physics, chemistry, or biology normally fails to evoke the controversies over fundamentals that today often seem endemic among ,say, psychologists or sociologists. Attempting to discover the source of that difference led me to recognize the role in scientific research of I have called "paradigms». These I take to be universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners. Once that piece of my puzzle fell into place, a draft of this essay emerged rapidly.'

Simply put, a paradigm is, according to LeCompte and Schensul (2010:55),"…a framework for interpretation or a way of viewing the world». In his attempt to find a definition that fits the social sciences, Tavakoli (2012:443) defines paradigm as "…a disciplinary matrix-commitments, beliefs, values, methods, outlooks, and so forth shared across a discipline."Tavakoli (op.cit.:217-218) adds that determining the paradigm that a given disciplinary community operate requires the tackling of the following critical issues:

> " (a) What actually comprises different methodological paradigms or disciplinary matrices in social inquiry? What are the beliefs, assumptions, and values about the aim of social inquiry, self, society, human agency, method, and so forth shared by inquirers committed to postmodern
> versus interpretive ethnography, for example, or (hose committed to feminist theory or philosophical hermeneutics? (b) what way do similar concerns and commitments cut across or overlap paradigms/disciplinary matrices that are often regarded as distinct? (c) How are these paradigms actually accomplished, enacted, or constituted socially and politically?"

2. The Structure of Scientific Revolutions

In his study of the structure of scientific revolutions that have occurred in different scientific disciplines pertaining to the hard sciences, Kuhn (1962) came to the conclusion that scientific progress in any discipline follows a generic cycle consisting of five phases of paradigm shift. Paradigm shift is depicted by LeCompte and Schensul (2010:55) as a "dramatic change in which one scientific/conceptual worldview is replaced by another." First, the initial stage is called the re-scientific stage which is characterized by a great deal of division over the facts, the theories, the methods, and the terminology as well as over the appropriate research designs to be used in

scientific enquiry. Second, maturation into a 'normal science' entails reaching a consensus on a certain paradigm become dominant and proves its 'effectiveness' in solving the scientific puzzles that occupy a centre stage in the interests of a given scientific community. Towards the end of this stage, however, certain anomalies and inconsistencies in the use of the prevailing paradigm begin to emerge, but the members of the scientific disciplines attributes them to errors in measurement rather than to weaknesses in the paradigm itself. Third, the growing discontent over the chronic failure to account for an increasing number of discrepancies observed in the data sparks a crisis among the members of the disciplinary community. Fourth, in this phase the paradigm shift occurs as a result of the community becoming conscious enough about the need to introduce a new, more adequate paradigm on the basis of scrupulous and meticulous scrutiny of the entire field. In the fifth phase, the place of the new paradigm becomes so established that the field re-enters the phase of normal science again where the efforts of the scientific community are engaged in solving puzzles using the new paradigm as a theoretical framework.

3. The Cycle of paradigm shifts in Applied Linguistics

Over the years, the field of applied linguistics has become characterized by many swings of the pendulum as prevailing methods are continuously replaced by new and, supposedly, more adequate ones. Unlike in the hard and natural sciences, however, the old theories are never completely abandoned because their adherents always manage to find a way of reintroducing them under a new theoretical guise after ensuring, of course, that the fad with the new paradigm is over. This anomalous situation, which attests to fragility of the scientific texture of the field, is detrimental to all the shareholders of the language teaching enterprise. Sheen (1994:128) so aptly captures the cycle of these shifts in pendulum:

> "Past revolutions have occurred largely when the established paradigm was criticized and advantages of the replacement were extolled. As these revolutions have failed to produce the promised progress, it would seem that this process of criticism and advocacy may be flawed. On the one hand, the criticism is often overstated and based on the assumption that there is little of value in the established paradigm; however, the past adherents of that paradigm appear reluctant to protest. On the other hand, there is a tendency to allow the new paradigm to go unchallenged in the first years of its ascendancy. This occurred in the swings to audio-lingual, functional, and communicative methods. It was only after a decade or so, when the new paradigm had become the established one that murmurs of dissent prepared the ground for yet another change of orientation."

Only a careful and rigorous examination of the whole elements of the scientific enterprise in the field is capable of putting it on the right track and allowing it to move in a sustainable, linear progression towards achieving its goals.

4. Differences between Research Methods and Research Methodology

A good description of the essential differences between the concepts research method and methodology is offered by Reddy (2017) as shown in the following tables:

Methods	Methodology
Are defined as the methods or techniques that are used to gather evidence and conduct research.	Provides an explanation and rationalebehind the methods employed in said research.
Involves conducting surveys, interviews, experiments, etc.	Involves the acquisition of knowledge surrounding various techniques used to conduct research such as surveys, interviews, experiments, etc.
The main objective is to discover solutions to research problems.	The main objective is to use the correct procedures to discover solutions to research problems.
Narrow scope of practice (i.e., consists of various research strategies, methods, techniques, tools, etc.)	Much wider scope of practice, which includes the research methods.
Used in later stages of research.	Used in the beginning stages of research.

Table 01: Differences between Research Methods and Methodology (Reddy 2017)

Conclusion

The choice of the adequate research method for tackling a research problem should be done primarily at the levels of paradigm and methodology based an illuminated position vis-à-vis the nature of reality, knowledge, scientific truth, and the methodology amenable to this truth.

Key Concepts in Research: The Falsificationists' Principle

Introduction

Discontent with inductivism, the central idea of which consists of deducing a general principle on the basis of the rigorous, systematic study and documentation of single instances, has led Karl Popper (1902-1994), probably the most important philosopher of science in the twentieth century, to come up with a solution to an old epistemological dilemma commonly known as Hume's problem. This solution is based on two defining elements: the problem of induction and the impossibility of verification.

1. Hume's problem

As has been said in the introductory lecture to this course, the application of the scientific method to the study of natural phenomena was based on a logical mode of reasoning known as inductivism. This procedure which was introduced by Francis Bacon and followers is based on making generalizations in the form of natural laws on the basis of the rigorous and systematic observation of single cases. Although this procedure has gone on long enough unchallenged, some 'murmurs' of doubt have been voiced since the early years when it have been put to use by none other than David Hume, one of the founders of the scientific method. According to him, no matter how large is the number of corroborations that a hypothesis receives from the study of single instances, there is no insurance that this hypothesis represents the absolute truth about a given phenomenon (Magee,1974).The skepticism looming large over the credibility of the inductive procedure of the scientific method has had serious consequences on ,at least, some empirical philosophers and members of the scientific community, Magee (1974:18) reports in a sarcastic tone:

> "It has turned many empirical philosophers into skeptics, or irrationalists, or mystics. Some it has led to religion. Virtually all have felt, bound to admit that, strictly speaking, scientific laws cannot be proved and are therefore not certain."

2. The Impossibility of Verification

Popper joined the critics of what he dubbed "naïve inductivism",and was the first to propose a tangible epistemological solution to Hume's problem. Popper (1968,1972) (as cited by Nunan (1992:13) gave the famous swan example to demonstrate the naivety of inductivism:

> "…we are never entitled to make the claim that 'All swans are white', regardless of the number of sightings of white swans. Though we may have sighted one thousand white swans, there is nothing to say that the one thousand and first sighting will not be a black swan."

In other words, Popper argues that inductivism, which is based on observation without manipulation of reality, is not conducive to absolute truth about the phenomena forming the object of its study. Scientific research based on inductivism will never be certain about the 'universal laws' that it has discovered because there is no guarantee that it will not stumble in the future upon facts that will lead to their refutation. Instead, as a first step towards getting rid of this fallacy, he recommends the shift to the use of a hypothetico-deductive method based on the belief that scientific truth is relative and that the best that science allows us to achieve is to approximate to this truth.

3.TheFalsicationsts' Principle

Chalmers (1982) (cited by Nunan (1992:13) explains the falsificationist's principle as follows:

> "According to falsificationism, some theories can be shown to be false by an appeal to the results of observation and experiment.[…]even if we assume that true observational statements are available to us in some way, it is never possible to arrive at universal laws and theories by logical deductions on that basis alone. On the other hand, it is possible to perform logical deductions starting from singular observational statements as premises, to arrive at the falsity of universal laws and theories by logical deduction…The falsificationist sees science as a set of hypotheses that are tentatively proposed with the aim of accurately describing or accounting for the behavior of some aspect of the world or universe. However, not any hypothesis will do. There is one fundamental condition that any hypothesis or system of hypotheses must satisfy if it is to be granted the status of a scientific law or theory. If it is to form part of science, an hypothesis must be falsifiable."

Given that verification is impossible, scientific reasoning should go into reverse to seek the falsification of hypotheses. In this regard, for a hypothesis to be scientific following this principle: "…all hypotheses should be formulated in a way which enables them to be falsified through a single disconfirming instance" Nunan (1992:13).The belief that scientific truth is tentative entails that even when a hypothesis formulated following this principle resists falsification, it is not accepted as true, but rather as an 'adequate' hypothesis that will certainly be rejected in the future when science develops the required tools for its refutation. Scientific progress, following this vision, is not achieved through confirmation ,but rather through the rejection of existing hypotheses and their substitution with more 'adequate' ones as McLaughlin 1987:17 (as cited by Nunan 1992:14) explains in the following quote:

> "In any scientific Endeavour the number of potentially positive hypotheses very greatly exceeds the number of hypotheses that in the long run will prove to be compatible with observations. As hypotheses are rejected, the theory is either disconfirmed or escapes from being disconfirmed. The results of observation 'probe' but do not 'prove' a theory. An adequate hypothesis is one that has repeatedly survived such probing-but it may always be displaced by a new probe."

4. Falsificationism in Applied Linguistics

As in almost all scientific disciplines, many researchers in the field of applied linguistics have embraced the falsificationists' principle in their research designs. For example, AlAlami (2015:1330) declares that …

> ' Research is not about truth but about explanation and utility, that is to say, there is no absolute truth. We do not need to trust the creditability of all previous studies within our areas of specialization and concern. Instead, we need to gather sufficient data and check it out. Anything we claim to be true should be falsifiable.'

An example of a hypothesis in second language research which is not falsifiable with one instance is offered by Schumann (1993:296) (citing Long (1990:275)) :

-"success and failure in SLA is largely the result of social, psychological, or affective factors, with learner age being irrelevant or only indirectly relevant, in that children often differ in these areas". Schumann (1993:296) remarks that "the precise claim these writers are making is unclear because they do not specify 'in what combinations and to what degree these variables affect learning and why?".

Provided that the researcher provides a clear definition of the involved constructs on the basis of reliable and valid measures, the following hypothesis is falsifiable:

-Self-esteem enhances students' writing performance.

Nunan (1992:14) ,however, observes that

> 'In reality, comparatively few hypotheses in applied linguistics can be demolished by a single disconfirming instance. In most cases we are interested in general trends and statistical tendencies rather than universal statements. Even researchers who claim their research is falsifiable have ways of protecting their theories from attack."

Conclusion

Due to the logical fallacy on which it is based, inductivism has entangled the scientific method in a confirmation bias that has plunged science into uncertainty and engaged it into a futile pursuit of the myth of absolute truth. Based on the belief that truth in science is tentative, Karl Popper managed to solve Hume's problem through the articulation of what has become known as the falsificationsist's principle. This principle stipulates that progress in science occurs when existing hypotheses are refuted rather than confirmed, and that, for a hypothesis to be accepted as

scientific, it should testable and falsifiable with one and only one instance. Although this principle has been adopted by applied linguists who adhere to positivist/postpositivist paradigm, the challenge of falsifiability using one disconfirming instance is still regarded to be an ideal to be sought rather than a firmly established practice.

The Positivist /Post-positivist Paradigm and the Experimental Method

Introduction

Due to the spectacular success it has achieved in the study of natural phenomena, the scientific method has been extended as early as the nineteenth century to the study of human sciences. The experimental method which has been used first in psychology has been adopted by almost all human sciences including applied linguistics. This method, which obeys the principles of quantitative methodology, is based on the assumptions of the positivist/positivist paradigm concerning the nature of reality, scientific truth, and the procedures amenable to this truth.

1. The Positivist /Post-Positivist Paradigm

To paraphrase Phakiti (2014), the objective of scientific inquiry within the positivist/post-positivist paradigm is to discover the universal laws that govern the phenomena under study. The status of reality has evolved and led to a shift from the positivist model, which considers reality to be objective and accessible to observation , to the post-positivist one which considers reality to be merely probilistically knowable. Knowledge, according to this paradigm, is disinterested and objective, which results from an approximation to truth using precise and testable observation and means of measurement.

3. Probability V.s. Non-probability Sampling Procedures

This paradigm is based on the idea of generalizing from sample to population. In this regard, the researcher characterizes the population by establishing the criteria of selection for the study, determines the sample, and establish its size. N'da (2015:36) sets the interesting distinction between the target population and the accessible population. The target population, according to him, refers to the population that the researcher intends to study and on the basis of which to make generalizations, whereas the accessible population is the portion of the population which is within the reach of the researcher. It can be limited to a region, to a town, to an establishment, etc. To ensure that the sample is representative of the population, it should be randomly selected. The size of the sample should be determined on the basis of a statistical formula with reference to the

population in question. The generalizability of the research results depend on the use of significance tests. Anderson (1998:124) provides a list of sampling procedures:

Type	*Description*	*Example*
Convenience	Quick, easy, available	Volunteers at your school
Typical	People who fit the expected norm	An average kindergarten classroom of students
Criterion	Cases which meet a set of predetermined conditions	All 12–16-year-old, female gymnasts who have competed in at least one regional competition, in the past 2 years
Deviant cases	Cases which knowingly go against the norm	Highschool dropouts
Homogenous	As many similar characteristics as possible within a group of people	All gifted children in a special music program
Snowball	A technique used to locate key informants on a referral basis	One university president recommends another, who in turn recommends the president of their professional association, who then suggests a specific program director, and so on
Confirming or disconfirming cases	Specific people or scenarios the researcher identifies to validate, strengthen or cast out emerging themes	Requesting to meet with a group of students who display a certain attitude or behavior towards their peers
Opportunistic	On-the-spot opportunities that become available while in the field	While researching the educational policies of a province, you cross paths with the Minister of Education who is giving a keynote speech at a conference you are attending. You ask for a 15-minute interview and are granted permission
Maximum variation	Purposefully selecting as diverse a population as possible	A group of 30 executive MBA students all with different professional qualifications and backgrounds
Critical case	A case which can yield the greatest results when resources are limited	Evaluating a private school with a consistent track record of student satisfaction and effective resource management
Politically correct	One which satisfies the political climate of the day	A school that has embraced a new policy on integration

Exhibit 13.2: purposeful samples (Anderson (1998:124)

3. Types of Experiments

Al Alami (2015:1333) succinctly summarizes the types of experiments available to the applied linguistic researcher as follows :

> '… pre-experimental design, true experimental design, quasi-experimental design,[and] ex post facto design…A pre-experimental design is not really considered a model experiment because it does not account for extraneous variables which may have influenced the results. A true experimental design has three characteristics: a control group is present, the students are randomly selected and assigned to the groups, and a pre-test is administered to capture the initial differences between the groups. A quasi-experimental design is a practical

> compromise between true experimentation and the nature of human language behavior which a researcher wishes to investigate. An ex post facto design is often used when the researcher does not have control over the selection and manipulation of the independent variable. The researcher in such a case looks at the degree of relationship between the two variables rather than at a cause-and-effect relationship..'

4.Principles of Experimental Design

According to Nunan (1992: 24-25), '…experiments are carried out in order to explore the strength of the relationships between variables.' The design of a true experiment involves a the highest level of control consisting of the isolation of a variable thought to be the cause (the independent variable) and manipulating it against the effect (the phenomenon under study of the dependent variable).This design necessitates the alienation of all the other variables by ensuring that their level is the same for all the selected sample under study. The sample is then divided into (a) control group (s) and (an) experimental group. A pretest should be administered to ensure that the two groups are identical at all research significant levels. Then, during the treatment period, only the experimental group is exposed to the treatment or the manipulation of the independent variable. Once the treatment period is complete, a posttest, which should be equivalent to the prettest, is administered to both groups so as to determine the extent to which the independent variable is responsible for any differences that may be notices in the pretest /posttest results between the experimental group and the control group. Potential differences can only be determined through the use of inferential statistics.

5. The Logic of Inferential Statistics

Once the collection of experimental data is complete, the researcher submits the data to quantitative analysis through the use of statistics. In this regard, a distinction is made between two types of statistics: descriptive and inferential. As stated by Levon (2010:70),"Descriptive statistics are indices that give information about the general shape or quality of the data, and include such things as the ***mean*** (i.e. average) and the ***median*** (i.e. middle)of the data.".In order to determine the existence of significant patterns in the data concerning the strength of the cause and effect relationship, the researcher should resort to the use of the second type, namely inferential statistics. According to Levon (op.cit.:70-71),

> "descriptive statistics allow us to define patterns in the data. Inferential statistics then allow us to determine whether those patterns truly exist in some kind of meaningful way…Experimental hypotheses never exist alone, but are instead always paired up with their polar opposite, what we call the ***null hypothesis***. Null hypotheses are in a sense the counter-claim of experimental hypotheses; null

> hypothesis predict that *no* relationship exists between the dependent and independent variables. For our example, then, the null hypothesis would be that there is no relationship between red shoe buying and wearing earrings. Interestingly, in quantitative analyses, we always test the *null* hypothesis, not the experimental one. In other words, we examine whether there seems to be *no* relationship at all between our dependent and independent variables. If through our analyses of the null hypothesis, we determine that there is *not no* relationship (note the double negative), then we can claim that a relationship between the dependent and independent variable(s) does seem to exist (i.e. that the experimental hypothesis may be true)."

In other words, the first thing that inferential statistics test is the null hypothesis. If the latter is confirmed, this means that the cause and effect relationship stipulated by the research hypothesis is rejected or nonexistent in the population. The basic structure of quantitative analysis is succinctly summarized by Levon (2010:76) as follows:

> '-We identify the variable of interest (dependent variable)
> -We use descriptive statistics to get ideas about potential patterns in the data
> -These patterns then help us to devise experimental and null hypotheses
> -We then use inferential statistics to test the null hypothesis
> -If these inferential statistics return a p-value less than or equal to 0.05, then we have statistical significance and can reject the null hypothesis
> -If the p-value is greater than 0.05, then the null hypothesis cannot be rejected and we are unable to support the claims made by the experimental hypothesis.'

6. Common Statistical Tests used in Applied Linguistic Research

According to Nunan (1992) , there are four mostly used types of statistical analysis in applied linguistics: the t-test ,ANOVA ,Chi-square, and correlation.

6.1 T-Test

Tavakoli(2012 :679) defines this type as follows:

> "a PARAMETRIC TEST which is used to discover whether there are statistically significant differences between the MEANs of two groups (e.g., men and women). The results of applying the *t*-test provide the researcher with a**t-value** (i.e., the score obtained when we perform a *t*-test). That *t*-value is then entered in a special table of *t* values which indicates whether, given the size of the SAMPLE in the research, the *t*-value is statistically significance.When the obtained *t*-test exceeds its appropriate CRITICAL
> VALUE, the null HYPOTHESIS is rejected. This allows us to conclude that there is a high level of PROBABILITY that the difference between the means is notably greater than zero and that a difference of this magnitude is unlikely to have occurred by chance alone. When the obtained *t*-test
>
> does not exceed the critical value, the null hypothesis is retained."

6.2 ANOVA

This type of test is defined by Tavakoli(2012 :13) as follows:

> **"Analysis of variance** also **ANOVA** a term which describes a group of inferential statistical procedures which is used to analyze data from designs that involve *two* or *more* groups. Analysis of variance (for which the acronym ANOVA is often employed)is a *parametric* statistical procedure for comparing two or more group means to see if there are any statistically significant differences among them. ANOVA can be applied to a variety of research designs and takes specific names that reflect the design to which it has been applied. The computational details of the analysis become more complex with the design, but the essence of the test remains the same. The first distinction that is made is in the number of INDEPENDENT VARIABLEs (IVS) in the research design. If there is simply one IV, then the ANOVA is called a ONE-WAY ANOVA. If two IVs have been manipulated in the research, then a TWO-WAY ANOVA can be used to analyze the data; likewise if three IVs have been manipulated, a *three*-way ANOVA is appropriate. The logic of the test extends to any number of IVs. However, for ease of interpretation, researchers rarely go beyond a three-way ANOVA"

6.3 Chi-square

This type of test is defined by Tavakoli(2012 :59) as follows:

> "a NONPARAMETRIC TEST and a test of *significance* (pronounced 'ky' similar to 'by' and symbolized by the lowercase Greek letter χ) which is used to compare actual or **observed frequencies** with **expected frequencies** in SAMPLE DATA to see whether they differ significantly. Observed frequencies, as the name implies, are the actual frequencies obtained by observation. Expected frequencies are theoretical frequencies that would be observed when the NULL HYPOTHESIS is true. The chi-square test is most often used with *nominal* data, where observations are grouped into several discrete, mutually exclusive categories, and where one counts the
> frequency of occurrence in each category. The test works by comparing the *categorically* coded data (observed frequencies) with the frequencies that you would expect to get in each cell of a table by chance alone (expected frequencies). In fact, this procedure is used to test the relationship
> between the variables (how well they go together) rather than how one variable affects another. It does not allow us to make cause-effect claims."

6.4 Correlation

Briefly defined, this test is, according to Tavakoli (2012:114) ,

> 'a measure of the strength of the *relationship* or *association* between two or more two VARIABLEs. By relationship, we mean that variations in one entity correspond to variations in the other.'

Because the master dissertation constitutes only a first initiation to research, students who choose to test the strength of a cause and effect relationship using an experimental design are generally advised to limit the number of variables to one independent and one dependent variable. As far as

the choice of the right statistical test to use, Levon (2010:76) offers ample advice in the form of an algorithm of options:

> '…you should first ask yourself how many dependent and independent variables you have. If you have more than one of either, you cannot use t-tests or chi-squares and would instead need a more sophisticated test (such as an ANOVA or a linear regression). If, however, you only have one of each, you should then ask yourself whether your independent variable is categorical. If not, you also cannot use chi-squares or t-tests and would again
> need a more sophisticated statistical test (such as a Linear Mixed Model).
> Finally, if you have only one dependent and one independent variable, and your independent variable is categorical, you then ask yourself whether your dependent variable is categorical or continuous. If continuous, you would use a t-test to analyze your data; if categorical, you would use a chi-square. With this decision tree in mind, let us now turn to a detailed illustration of how chi-squares and t-tests are used in linguistic research.'

Conclusion

The experimental method, which represents quantitative methodology in line with the axioms of the positisist/post positivist paradigm, is implemented to test the strength of the cause and effect relationship .However, despite its rigorous attempt to model itself after the hard sciences, the experimental method has come under ever-growing skepticism over its adequacy and relevance to the study of social and human phenomena.

The Constructivist Paradigm and the Ethnographic Method

Introduction

Ethnography is a method which has been developed by anthropologists to study, first and foremost, human phenomena. This method, which is represents a qualitative methodology, is based on the constructivist paradigm the assumptions of which concerning the nature of reality, scientific truth, and the most adequate procedure for reaching this truth marks a radical departure from those of the positivist/post-positivist paradigm.

1. The Constructivist Paradigm

According to Phakiti (2014) , this paradigm ,which seeks to apprehend and describe human nature, draws its principles from phenomenology and ecology. Moreover, this paradigm considers reality to be constructed rather than objective .Consequently, knowledge is considered to be subjective and truth is regarded as being context dependent.

2. A Brief Historical View of Ethnography

Ethnography originates from anthropology, a discipline that was for a long time viewed with suspicion in many developing countries because of the close links that this discipline entertained with colonialism. In Algeria, for example, during a conference on sociology held at the university of Algiers in 1974, Mohammed Seddik Ben Yahia, the then minister of higher education, declared ethnology a "colonial pseudoscience" and forbidden in Algerian universities (Bennaoum,2002). In spite of this colonial past, however, ethnography has evolved over time to become an effective humanistic research method that can provide a "thick description" of the life of a cultural group and give its members agency to voice their view about the real struggles they face in their daily lives. Lecompte and Shensul (2014) distinguish between two major eras in ethnographic research. A first period which has lasted until the nineteenth sixties and which was characterized by longitudinal studies where ethnographers immersed themselves in the communities they wished to study for a long periods of time that may last for years so as to be able to provide a comprehensive description of a whole cycle of cultural groups. This immersion approach was greatly influenced by the method of 'participatory observation' developed by Bronislaw Malinowski (1884-1942).After that period ,however, ethnography adopted a new approach based on frequent short visits to the research site to work on issues of a narrower scope that focuses only on aspect of the life of the group under study. As a result ,the field engaged in developing mixed methodologies to cope with the demands of this shift. Consequently, ethnography has been embraced by educationalist and applied linguists to deal with the real problems of teaching and learning as they are experienced by the shareholders themselves. VanLier (1990) argues in favor of the use of quasi-ethnographic methods that can fit easily within the cycle of academic research at the master and doctorate degree. Van Lier (op.cit:41) summarizes as follows the evolution undergone by this method in its quest to adapt to the problems of education:

> 'Gradually, ethnography has expanded its sphere of application from field work among unknown ethnic groups to the investigation of groups of people (however identified) in industrialized countries and urban settings, and from there has moved beyond urban anthropology into the social sciences, and finally into education, where at times the classroom is treated as an identifiable group with its cultural characteristics.'

3.Principles of Ethnographic Research

Anderson (1998: 121) defines ethnography as follows:

> 'The term ethnography generally refers to research which has one or more of the following features: a strong emphasis on exploring phenomena within their natural setting; a tendency to work with data which is not pre-

> coded in terms of its analytic categories; investigation of a small number of cases; and a form of analysis which emphasizes description and explanation rather than quantification and statistical analysis …'

Wilson (1982) (as cited in Nunan (1992:53) relates the roots of ethnography in sociology and anthropology to two hypotheses about human behavior: the Naturalistic ecological hypothesis and the Qualitative phenomenological hypothesis.

3.1 Phenomenology

Phenomenology which was developed by the German philosopher Edmund Husserl (1859-1935) is defined by Anderson (1998: 122) in the following manner:

> 'Phenomenology asks the question,' what is the experience like?' or 'what is the meaning of something?' it is a type of research that attempts to illuminate and explain phenomena rather than classify, taxonomize or abstract it (Van Manen, 1990).it is also inter-subjective ,which means the researcher must develop a dialogic relationship with the phenomenon to validate what is being described. There is neither hidden political agenda nor (any attempt to persuade the reader towards one belief or another. It is purely an attempt to represent the experience of the observed accurately."

According to Nunan (1992), ethnography is hypothesis-generating rather than hypothesis testing and seeks to develop theories that are grounded in data. For Van Lier (1990: 42), this method has been adopted in the field of education because, compared to the experimental method 'modeled on the exact sciences' ,it offers two distinguishing advantages:

(i) an emic view point

(ii) a holistic treatment of cultural facts or, in other words, a concern with context.'

Another crucial distinctive feature of ethnography, Van Lier (1990) adds, lies in the opportunity it offers for teachers and learners participation.

3.2 Grounded Theory

Anderson (1998:122) defines grounded theory as follows:

> "Grounded theory is a general methodology for developing theory that is grounded in data systematically gathered and analyzed" (Straus and Corbin,1994, P.237).It is an inductive approach to theory development that can be thought of as two funnels joined where they narrow, at the center. At the top, new data are collected in multiple stages; emergent themes are identified, interpreted, compared and refined. This process creates a funnel of new information from which constructs and theories are developed (the middle).these theories are then cast out into various sampling groups to determine the strength of the similarities and differences of the theoretical constructs with different populations. The stronger the support for the theoretical propositions, the wider the base at the bottom. What differentiates this research method from its qualitative counterparts is the emphasis on theory development.'

4. Main Features of an Ethnographic Study

Citing Harklau (2005),Dorney (2007:131) considers that ethnography has three main features:

1-'Focusing on Participant meaning…'

2-'Prolonged engagement in the natural setting…'

3-'Emergent nature.'

5.Phases of Ethnographic Research

Dorney (2007:132) describes the complex process of ethnographic research in terms of four phases:

1-the ethnographer enters into a strange environment and attempts to get familiar with it through the help of members of the target community. In this phase starts 'mapping the terrain' and taking field notes.

2.The second phase starts when the researchers feels familiar enough with the new environment .In this phase ,he starts spotting ,contacting, and interviewing key informants in the field so as to develop initial hypotheses.

3-The third phase is the most productive phase because the researcher is now fully knowledgeable about the culture of the target group and consequently he is capable of developing more sophisticated hypotheses through the use of a variety of techniques.

4-In this last phase, the researcher leaves the field in order to be able to sift the findings and to arrive at final conclusions.

Conclusion

Ethnography is a qualitative method based on the principles of the constructionist paradigm, which considers truth to be context dependent and reality socially constructed. This method allows the researcher to apprehend reality from both an insider's and an outsider's perspective so as to be able to develop more adequate theories that are grounded in data .Moreover, this method empowers all the shareholders of the teaching enterprise through giving them the opportunity to voice their views about the reality in which they live. The developments that this method underwent have rendered it more suitable to fit within the academic cycle of master and doctorate degrees.

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