Quantitative Research: From Scholars' Paradigm Debate to Students' Psychological Anxiety

Taye Alamirew[1]

Introduction

People tend to rely on several information sources like *logical reasoning, expert opinion, personal experience, tradition, intuition, common senses and beliefs* to decide what is right or wrong *(*Ary et al, 2010*)*. However, the past experience of others or personal experience may be inappropriate for new problems, experts or authorities may be distant from the realities and complexities of a particular situation, tradition is useful as long as it is not based on a notion of an idealized past, intuition may be subject to bias, logic may be based on false premises, in a nation or community of cultural pluralism, determining what is 'right' may be difficult. In other words, each of these sources is legitimate in some situations and yet, in other situations, each source may be inadequate as the only basis for making true decisions. Research- a systematic process of collecting and analyzing data for some purpose - is another source of information and it is a better source of knowledge than one's own experience, belief or intuition alone. People undertake research with the motive to 1) get a research degree along with its consequential benefits; 2) face the challenge in solving the unsolved problems, i.e., concern over practical problems initiates research;3) get intellectual joy of doing some creative work;4) be of service to society; and 5) get respectability (Kothari, 2004).

Historically, there has been a heavy emphasis on quantification in science. Mathematics is often termed the "queen of sciences" and those sciences like physics and chemistry that lend themselves to quantification are considered as 'hard' sciences (Lincoln and Cuba, 2000). Less quantifiable areas such as biology and particularly social sciences are referred as 'soft' sciences. The received view of science (positivism) focuses on efforts to verify (positivism)

[1] PhD student College of Education and Behavioral Studies, AAU e-mail: taye03ee@gmail.com

or falsify (post positivism) a priori hypotheses most usefully stated as quantitative propositions or propositions that can be easily converted into precise mathematical formulas expressing relationships. However, critics for the conviction that only quantitative data are ultimately valid or high quality emerge from social scientists on the conviction that human behavior like that of physical objects cannot be understood by quantification but with references to meanings attached to their activities.

Quantitative studies have been linked with 'positivism' and qualitative studies with 'interpretivism' paradigms, which are the opposing ends of one continuum. Positivism originates from the natural science model, which insists on neutrality and objectivity, and its purpose is to adhere to what we can observe and measure. The positivists' basic beliefs are that the world is external and objective, observer is independent and science is value free. A positivist researcher focuses on facts i.e. looks for causality and fundamental laws, formulates hypotheses and then tests them (Saeidi, 2002).

Qualitative research is commonly associated with interpretivism which holds a position that we each interpret our view of the world based on our perception of it. This theory stresses that people behave and interact based on how they interpret specific symbols, such as language, in their lives. The basic beliefs of this paradigm are that the world is socially constructed and subjective, observer is part of what is observed and science is driven by human interest. From this perspective, the researcher focuses on meanings by trying to understand what is happening, takes a holistic view of the situation and develops ideas through induction from data (Saeidi, 2002).

The objective of this article, through a thorough literature review, is to:

- summarize the quantitative-qualitative paradigm debates among natural and social scientists;
- discuss psycho-social challenges of doing quantitative research by social science students; and
- suggest possible means for the debates and anxieties students face.

Literature Review

Overview of Paradigm War

The debate about qualitative and quantitative research paradigms has been ongoing since the mid-nineteenth century. A paradigm can be defined as a "set of ideas, assumptions and beliefs that shaped and guided [the activity of a particular scientific community]" (Jackson, 2003, p. 37). The paradigm thus provides a fundamental link between the different research activities in a disciplinary field.

Hitchcock and Hughes (1995, p. 21) suggest that ontological assumptions give rise to epistemological assumptions; these, in turn, give rise to methodological considerations; and these, in turn, give rise to issues of instrumentation and data collection. This view moves us beyond regarding research methods as simply a technical exercise; it recognizes that research is concerned with understanding the world and that this is informed by how we view our world(s), what we take understanding to be, and what we see as the purposes of understanding.

Thomas Kuhn (1970) also argues that the history of science is a history of revolutions wherein scientific paradigms have emerged, suffered crises, and been replaced by competing paradigms. In order for a school of scientific thought to ascend to the status of "normal science," it must meet the criteria for paradigms. That is, it must have generated firm answers to the following questions:

- What are the fundamental entities of which the universe is composed?
- How do these interact with each other and with the senses?
- What questions can legitimately be asked about such entities and what techniques employed in seeking solutions?

Answers to these questions reveal sets of assumptions that distinguish fundamentally different belief systems concerning how the world is ordered, what we may know about it, and how we may know it. Based on Kuhn's notion, Hatch (2002) suggests five research paradigms: positivist, post-positivist, constructivist, critical/feminist, and poststructuralist and tries to present an abbreviated answer to the question: What is the nature of reality? What can be known, and what is the relationship of the inquirer to what is to be known? How is knowledge gained? What forms of knowledge are produced?

Positivist Paradigm

Ontology- What is the nature of reality?

Positivists are realists who believe in an objective universe that has order independent of human perceptions. Reality exists and is driven by universal, natural laws. Positivism treats reality as being componential, that is, consisting of components that can be taken apart for study, separately verified, then put back together again.

Epistemology- What can be known and what is the relationship of the inquirer to the known?

The world has order, and it is possible to discover that order. The world is, in effect, giving off signals regarding its true nature, and it is the job of science to capture that immutable truth. Positivists claim to be objective in their search for the truth. Researchers and the objects of their study are assumed to be mutually independent, so researchers do not influence and are not influenced by the phenomena they study.

Methodology- How can knowledge be gained?

Methods of choice within the positivist paradigm are those that allow for careful measurement, manipulation, and control. A deductive model built on

empirically verifying propositional hypotheses dominates, and experiments, quasi-experiments, correlation studies, and surveys are widely used. Sophisticated sampling and statistical techniques are in place to ensure reliability, validity, and generalizability.

Products- What forms of knowledge are produced?

For positivists, knowledge equals accumulated "facts" that have been scientifically verified and generalizations, theories, and laws based on those facts. Most reports have a cause and effect dimension, and prediction is the ultimate product. If conditions are controlled, positivist science can predict what will happen when certain changes are introduced.

Post positivist Paradigm

Ontology- Post positivists agree with positivists that reality exists, but they operate from the assumption that, because of the limitations of human inquiry, the inherent order of the universe can never be known completely. Reality can be approximated but never fully apprehended.

Epistemology- Post positivist researchers seek to maintain an objective position in relation to the phenomena they are studying. Researchers in this paradigm see themselves as data collection instruments, and they use disciplined research techniques such as "constant comparison or "analytic induction" to ensure that empirical data, and not their impressions, drive their findings.

Methodology- Qualitative methods that prescribe rigorous techniques to improve validity and reliability are used by post positivists. Low inference, systematic procedures dominate data analysis processes, and frequency counts and low-level statistics are sometimes used.

Products - Knowledge forms produced in this paradigm include analytic generalizations, descriptions, patterns, and grounded theory.

Generalizations are induced from systematic analyses of data that take the form of searches for patterns. When potential patterns are discovered, deductive processes are used to verify the strength of those patterns in the overall data set.

Constructivist Paradigm

Ontology- Constructivists assume a world in which universal, absolute realities are unknowable, and the objects of inquiry are individual perspectives or constructions of reality. While acknowledging that elements are often shared across social groups, constructivist science argues that multiple realities exist that are inherently unique because they are constructed by individuals who experience the world from their own vantage points.

Epistemology-constructivist researcher assert that "knowledge is symbolically constructed and not objective; that understandings of the world are based on conventions; that truth is, in fact, what we agree it is". It is through mutual engagement that researchers and respondents construct the subjective reality that is under investigation.

Methodology- Naturalistic qualitative research methods are the data collection and analytic tools of the constructivist (Lincoln & Guba, 1985). Researchers spend extended periods of time interviewing participants and observing them in their natural settings in an effort to reconstruct the constructions participants use to make sense of their worlds.

Products- Knowledge produced within the constructivist paradigm is often presented in the form of case studies or rich narratives that describe the interpretations constructed as part of the research process. Accounts include enough contextual detail and sufficient representation of the voices of the participants that readers can place themselves in the shoes of the participants at some level and judge the quality of the findings based on criteria other than those used in positivist and post positivist paradigms.

Critical/Feminist Paradigm

Ontology- for critical theorists and feminists, the material world is made up of historically situated structures that have a real impact on the life chances of individuals. These structures are perceived to be real (i.e., natural and immutable), and social action resulting from their perceived realness leads to differential treatment of individuals based on race, gender, and social class. Feminist scholars are most interested in exposing material differences gender makes in women's life chances, and critical scholars focus on issues related to race and social class.

Epistemology- Knowledge within this set of assumptions is subjective and inherently political. Knowledge is always "value mediated" in the sense that "the investigator and the investigated object are assumed to be interactively linked, with the values of the investigator inevitably influencing the inquiry" (Guba & Lincoln, 1994, p. 110).

Methodology - one purpose is to raise the consciousness of those being oppressed because of historically situated structures tied to race, gender, and class. Such methods have been called "transformative", in that they require dialogue between researchers and participants that can lead to social change that transforms the lives of the participants in positive ways. Data collection takes many of the same forms as constructivist research, but the emphasis for critical researchers is to improve life chances for individuals at the bottom of the social hierarchy, while feminists' primary focus is on making conditions better for women.

Products- Critical and feminist scholars produce critiques of the perceived material world in an effort to expose the structures that ensure the maintenance of control by those in power (e.g., capitalist economics for critical theorists and male hegemony for feminists). The object is to reveal for others the kinds and extent of oppression that are being experienced by those studied.

Characteristic Feature of Quantitative and Qualitative Research

Following philosophical assumptions highlighted above, educational researchers, in the beginning of the 20th century, try to adopt the "scientific" way to study educational questions. Questions of learning were studied in laboratories under strict control, and statistical analyses were applied. Soon, however, some criticism arose and qualitative approaches started to gain advocates (Mc Kenna et al., 1990). Smith (1997) analyzes the fragmentation of the educational research community into the qualitative and quantitative research camps. According to him, this balkanization is a result of people engaging different vocabularies to tell different stories about research and the work of researchers. The situation has grown into what Snow (1964) describes as them having 'a curious distorted image of each other'. There are several papers which note that the division into two camps - qualitative and quantitative - is by no means clear. Becker (1996) has considered the problem of seeing qualitative epistemology as opposed to quantitative epistemology. Both kinds of research try to see how society works, to describe social reality, to answer specific questions about specific instances of social reality. According to Becker, both rely on the same epistemology but, to some extent, there has occurred a division of social sciences into two scholarly communities that have constituted worlds of their own, with their own languages, journals, organizations, presidents, prizes, and all the other paraphernalia of a scientific discipline. For these reasons, the two methodologies are also considered somehow intrinsically different with their own characteristic features compared in the table below.

Characteristics of quantitative and qualitative research methods

Characteristic	Description	
	Quantitative	**Qualitative**
Underlying paradigm	Positivism/realism	Post positivist/ interpretive
Logic employed	Deductive reasoning: tests theory or hypothesis	Inductive reasoning :may generate theory
Purpose	to study relationships between variables, determine cause and effect, testing theory or hypothesis	To examine a phenomenon in its natural setting in rich detail
Research objective	Description, explanation, prediction	Description, exploration, discovery
View of human behavior	Behavior is regular, predictable and measurable	Behavior is fluid, situational, contextual
Scope of inquiry	Specific questions or hypotheses	Broad, thematic concerns
Design	Developed prior to study and inflexible	Flexible, evolves during study
Sample	Mainly uses large samples depending on research objective	Uses small samples
Instruments and Tools	Uses preselected, structured, and valid instruments like Scales, tests, inventories, questionnaires	In-depth interviews, diaries, questionnaires, field notes, analysis of visual evidence, e.g. films and documents
Nature of reality	Objective (different observers agree on what is observed)	Subjective, personal and socially constructed
Nature of data	Variables	Words, images, categories
Data analysis	Mainly Statistical analysis of numeric data and identify relations	Search for patterns, themes and holistic features
Results	Generalizable findings	Particularistic findings representation of respondents multiple views
Forms of Report	Statistical report substantiated by interpretations	Narrative report with contextual description and direct quotations from participants
Primary disadvantage	Superficial understanding of participants' thoughts and feelings, Controlling other variables	Small sample, not generalizable to the population at large

***Source**: Johnson and Christensen (2004), and Vanderstoep and Johnston (2009)*

In summary, there are some differences between the quantitative and qualitative research methods as shown in Table 1 above. However, there is no justification for grading one approach superior to the other as both perspectives of the world are equally good and each have much to offer. The most appropriate approach should be used based on the research question(s). Both quantitative and qualitative researches originate from rich and varied traditions that come from multiple disciplines and both have been employed to address almost any research topic you can think of. In fact, many researchers consciously combine both qualitative and quantitative methods in what is referred to as a mixed methods approach.

Psycho-social Problem of Social Science Students: Statistics Anxiety

Research has become very significant in all fields of a knowledge-based society. That is why learning of research is one of the most important tasks at the university. Busquin(2001) states that research and development are seen as a generator of knowledge, growth, employment and social cohesion. Greer (2000) points out that the amount of information based on research and statistical analysis is growing. Learning of research is also one of the most challenging tasks. Universities are investing considerable resources to teach students research skills, but the learning outcomes of the methodology courses are often not as good as expected, not even after several courses (Garfield & Ahlgren, 1988).

Quantitative methods and statistics courses in particular have been noticed to cause problems in many disciplines, such as in education (Onwuegbuzie & Daley, 1998), in psychology (Townsend et al., 1998), in sociology (Filinson & Niklas, 1992), in social work (Green et al., 2001), and in social science in general (Zeidner, 1991). Social work educators in general, and teachers of research in particular, “know” from their interactions with students that social work students are highly anxious about taking research and statistics courses (Wilson and Rosenthal ,1992). The research literature also suggests that students’ difficulties do not decrease during education. On the contrary, attitudes toward research become less positive (Siegel, 1983). The

difficulties that students experience in quantitative research courses may result in poor learning and low course grades, but they may also have wider implications. Students with difficulties may not interested to take voluntary courses in quantitative methods, the methods used in their course work may be restricted by the difficulties, and they may have difficulties in completing degrees (Kiley & Mullins, 2005). The difficulties may even be reflected in students' views on their future work and selecting a job (Onwuegbuzie, 2000). It is also possible that the difficulties experienced during university studies have an impact on how prepared someone is to carry out certain tasks when employed and on the quality of the work done.

Motivational and emotional factors: Anxiety about Statistics and Research

The goal of teaching of research at university is to prepare students with research skills to be able to conduct research-related tasks in their future work. Emotional and motivational factors are always present in all learning, but in quantitative methods and statistics courses at university they are particularly visible. While teachers try to teach students the contents of the subject area, students having problems with learning may experience a wide range of emotions that impede learning. According to Gal and Ginsburg (1994), while statistics educators have focused on improving the cognitive side of instruction(i.e. the skills and knowledge that students are expected to develop), little regard has been given to non-cognitive issues, such as students' feelings, attitudes, beliefs, interest, expectations, and motivations.

Anxiety about Statistics

Statistics anxiety has been characterized by extensive worry, disturbing thoughts, mental disorganization, tension, and psychological arousal that arise in people when exposed to statistics content, problems, instructional situations or evaluative contexts (Zeidner, 1991). The questions in statistics-anxiety questionnaires usually concern emotional states, such as feeling

anxious about using statistical tables, reading a formula, or signing up for a statistics course (Zeidner, 1991).

Statistics anxiety has been found to be a serious problem in quantitative methods and statistics courses to many university students, for example in social sciences (Forte, 1995; Townsend et al., 1998). In a study by Wilson and Rosenthal (1992), 51% of the social science students reported moderate anxiety about research and statistics, while 27% reported high or very high anxiety, and 22% low anxiety. Statistics anxiety has been also reported in many other disciplines, such as in biology (Kelly, 1992) and in business (Zanakis & Valenzi, 1997), but it is supposed that especially students in the social sciences, education, psychology and other “human sciences” express more anxiety about mathematical and statistical subjects than, for example, students in the natural sciences (Forte, 1995). Royse and Rompf (1992) found that undergraduate social work students experienced more maths anxiety when compared to students in other disciplines.

For social science, psychology and education students, statistics may be connected to mathematics at first glance because it uses the same symbolic language as mathematics, and also because their prior courses in statistics, for example, in high school it might have been taught as a part of the mathematics curriculum. According to Gal (2000a), some adults, including highly educated ones, decide that they are not “good with numbers”. These types of beliefs may hinder the learning of both mathematics and statistics. The effect of gender in statistics anxiety has been found to be weak (Benson, 1989). In a study by Zeidner (1991) on behavioral science students, females were observed to have higher statistics test anxiety than males, whereas males were found to have higher statistics content anxiety than females.

Negative prior experiences with mathematics, poor prior achievement in mathematics and a low sense of mathematical self-efficacy have been found to be meaningful antecedent correlates of statistics anxiety (Zeidner, 1991). Birenbaum and Eylath (1994) found that a low high school mathematics

grade was connected to education students' experience of anxiety about both mathematics and statistics.

Anxiety about research

Wilson and Rosenthal (1992) have studied "anxiety about research and statistics" which they conceptualized as a specific state-anxiety that involves negative emotional reactions, such as tension and nervousness, occurring upon the contemplation of taking a course in research and statistics. Their method was to ask students to "think about taking a course in research and statistics", and to report their feelings about, for example, comfortable, worried, nervous, calm, relaxed and tense (Wilson and Rosenthal, 1992, 78). Their study was thus very similar to statistics anxiety studies, except that they included the word 'research' in their theme of research.

The pioneering work of Onwuegbuzie (1997) studied statistics anxiety (e.g. fear of statistics language, fear of application of statistics knowledge), research process anxiety (e.g. fear of research language, fear of application of research knowledge), composition anxiety in writing (e.g. content anxiety, format and organizational anxiety), and library anxiety (e.g. perceived library competence, perceived comfort with the library). These all were found to be connected to student's inability to undertake and to write an effective research proposal in an introductory research methodology course. This "research proposal writing anxiety" thus appears to involve a complex array of emotional reactions which can inhibit the ability to formulate a research problem, to conduct an extensive review of the literature, to develop a frame of reference, to formulate research questions and hypotheses, to select a research design, to define the population and sample, to develop a plan for data collection and analysis, and to write the research proposal. On the basis of these findings, one can assume that, in addition to different types of anxieties, difficulties in the learning of research are connected to a wide set of problems involving students' beliefs, fears, views and experiences.

A study by Zeidner (1991) on social science and education students suggests that there would be a weak correlation between statistics anxiety and statistics course performance. Similarly, in a study by Benson (1989), university students' statistical test anxiety was found to be weakly connected to achievement. In a study by Wilson and Rosenthal (1992), US social work students' anxiety about research and statistics was not related to performance on the foundation research and statistics course. Also in Rosenthal and Wilson's (1992) study on a social work master students' research course, it was found that confidence in undertaking the research course was not related to performance. In the study of Birenbaum and Eylath (1994), neither statistics nor mathematics anxiety was connected to the statistics-related course grade.

Students' earlier experiences with mathematics tend to explain university statistics course grades more than anxiety. Townsend et al. (1998) found that university psychology students' mathematics backgrounds did become a significant predictor of overall achievement in a statistics course. The students who had taken more mathematics courses had higher statistics grades than the students with fewer mathematics courses. Although the number of courses taken was connected to success, earlier achievement level did not seem to be so clearly related to success at university. Birenbaum and Eylath (1994) found that the earlier high school mathematics grade was only weakly connected to the statistics course grade at university.

Anxiety seems to be a complex concept, and its components appear to be difficult to measure. Anxieties can be very harmful for learning. According to Onwuegbuzie (1997), statistics high-anxious students tended to give up research proposal writing more easily than their low-anxious counterparts. They also incorrectly believed that they did not have the ability to learn statistical concepts. Onwuegbuzie also concludes that anxious students tended to engage in procrastination, which is in line with the assumption that problems in the learning of research would result in difficulties in completing degrees (Kiley & Mullins, 2005).

In summary, previous research suggests that earlier achievement in mathematics has some correlation with statistics anxiety at university, and is also weakly correlated with achievement in university statistics and methodology courses. However, there seems not to be always a relationship between statistics anxiety and university research and statistics course grades.

Motivation and Approaches to learning

Motivation has been seen as one of the major problems causing difficulties in learning research. Students have been seen as underestimating the value of research skills for their studies and future work, and thus being non-committed to study (Murtonen, 2004) cited in Murtonen (2005). In addition, feelings of difficulty and anxiety can be thought of as hindering the motivation to study. Research courses are often obligatory for social science students. Thus, they have to take these courses, whether they are motivated or not. Effective learning usually follows from good concentration on the task and deep approach to learning. Task-oriented learning focuses cognitively on the given task: attempts are made to solve the task and the effort of the learner or problem solver is directed toward the content features of the task. In the case of learning of quantitative methods at university, some students may not achieve this kind of task-orientation. According to Gal, Ginsburg and Schau (1997), many students are not ready to embrace and function within a problem-solving-oriented learning environment in statistics education. They experience obstacles that hinder their concentration on the task itself.

Views, Beliefs and Conceptions of Research

Students are shown to have differing conceptions about what learning and studying are (Lonka & Lindblom-Ylänne, 1996). According to Entwistle et al (2001), conceptions of learning are derived from the cumulative effects of previous educational and other experiences, and so tend to be relatively stable and to influence, to some extent, subsequent ways of thinking and acting. Thus, in the learning of research methods, students' previous

experiences influence their way of thinking about the learning tasks, and these influence their ways of learning when attending research methodology courses. There is a reasonable body of empirical data showing that the conceptions people hold do have implications for their learning outcomes. For example, students' conceptions of learning have been shown to be related to their study orientations, approaches to learning and study outcomes (Entwistle & Ramsden, 1983).

Lonka and Lindblom-Ylänne (1996) found that conceptions of learning and conceptions of knowledge were related. They also concluded that conceptions of knowledge may guide not only comprehension standards, but also study strategies and orientations. In the study of Lindblom-Ylänne and Lonka (1999), it was found that students' ways of interacting with the learning environment were related to study success.

Students' conceptions of research do not only precede their way of taking a course on research methods at university. The conceptions may have also more longstanding effects, such as directing students when selecting a job, or contributing to how the future work will be undertaken. Students may have unrealistic views of their future job, for example that research skills are not needed in it. Students do not always have a realistic picture of their future work, as shown in a comparison study on experts and novices in the domain of education and computer science, where it was found that professionals rated the need of decision-making skills, problem-solving skills and higher order thinking skills in general higher than students (Tynjälä, Helle & Murtonen, 2002).

Students' beliefs are often thought to arise from their own experiences, such as in the hypothesis bad previous experiences with mathematics, which refers to students' own situations that create the problems. The sources of beliefs, attitudes and expectations can, however, be various. The educating institution, relatives, friends, or the whole society can create and maintain beliefs that may foster or impede learning.

A common belief reflected is the division into scientific and non-scientific or hard/soft sciences. In the social sciences, research is often divided into technical quantitative research and humanistic qualitative methods. Töttö (2000) cited in Murtonen (2005) writes about the tendency of the different camps - qualitative and quantitative - to emphasize their own excellence by inveighing against the other. Especially with the rise of the qualitative tradition, the quantitative tradition has been used as an example of bad research, which is not able to produce new theories but only to test the old ones. However, as Töttö (2000 cited in Murtonen(2005) puts it, both qualitative and quantitative research methods are empirical and both can be equally near to or far from theory. Mayer (2000) has pointed out that the division into quantitative and qualitative should not be considered as a division into scientific and non-scientific, but that both quantitative and qualitative can be scientific or non-scientific depending on other requirements. If scholars tend to divide themselves into two camps, it is also probable that students may make a distinction between the methods. These conceptions of society and the science community may form students' conceptions of what a good scientific method is.

Cognitive Processes in the Learning of Research

The difficulty of learning of statistics and research methodology cannot be explained only by emotional and conceptual factors. Research methodology contains elements that make the learning of it cognitively challenging, such as abstractness and complexity. The rules and conventions of research in society have been developed over a long period of time, and these have raised the level of abstractness of research methodology (Lakoff & Núñez, 1997). When more and more concepts become interrelated, knowledge becomes elevated to a higher level of abstraction (Broers, 2002). According to Watts (1991), a major difficulty that confounds beginning students and inhibits the learning of statistics is that the important fundamental concepts of statistics are typically abstract. The concepts and principles of statistics, such as probability, are not used in everyday life and they can be hard for some students to understand.

Research may also appear abstract because of some of the tools it uses. For example, statistical formulas require skills in the formal symbol system and the language of statistics, which can be hard for students to understand. Onwuegbuzie (1997), in a study concerning university students' anxiety in research proposal writing, found that some students had a fear of statistical language. In particular, formulas, symbols, notation, and the terminology increased the levels of statistics anxiety. The students equated learning statistics with 'learning another language'. In addition to the formal symbol system and the language of statistics, the teachers' way of talking about statistics may not be familiar to students.

Broers (2002) found that psychology students remembered verbal propositions concerning statistics more easily than abstract facts. He proposes that this is because most psychology students do not tend to think mathematically but in terms of concrete verbal theories of reality. If statistics is taught by a person who thinks mathematically, there might be a problem with mutual understanding. For example, if a statistician tries to teach some statistical concepts by using statistical language, it may be inaccessible to students. In addition to the statistics language, teachers may use a specific type of language typical of the scientific community. According to McGinn and Roth (1999), scientific communities are characterized by their specific forms of discourse and disciplines have their own vocabularies. These specific vocabularies may further widen the gap between students' and teachers' understanding. Lehtinen and Rui (1995) suggest that problems in the learning of research methodology appear partly because of the complexity of the domain, i.e. methodological knowledge includes several challenging properties for the learner: the sub domains are highly abstract and partly controversial, the links between them are abstract and based partly on structural analogies, and comprehension of the domain requires that the concrete procedures should be understood within the framework of the whole complex system. In the domain of science, Broers (2002) differentiates knowledge of facts, terms and procedures from conceptual understanding, in which the individual concepts and ideas have been integrated into a network of interrelations. Similarly, in the domain of

research, conceptual understanding could be said to be wider than just knowledge of the meanings of individual concepts. Conceptual understanding of research, of course, includes knowledge of the individual concepts. We can thus examine the understanding of research concepts at different levels or widths. The research on the learning of statistical concepts has indicated that a large portion of university students do not understand many of the basic statistical concepts they have been taught (Marasinghe, 1996. According to Garfield and Ahlgren (1988), inadequacies in prerequisite mathematics skills and abstract reasoning are part of the problem of learning of statistics. Moreover, the ability of students to apply statistical procedures has been found to be low, even after several courses (Gardner & Hudson, 1999). It is probable that students have similar problems to those described above also in the whole area of research skills, i.e. with understanding even the basic concepts, and they also have problems in applying their knowledge.

Summary

Research is the primary tool used in virtually all areas of science to expand the frontiers of knowledge. A research paradigm is a framework for ideas which includes definitions of key terms and the relationships between them. The framework is coherent because the researcher assumes certain things as a starting point and new knowledge is absorbed into this mental ‘map’. Different problems require different approaches and dictate to a large extent which paradigm would be more suited. This is one of the reasons why adopting a single paradigm for the cadastral research field may prove to be difficult. The researcher may also, as a personal preference, feel more comfortable with certain paradigms. It would be difficult, for example, for a researcher from a strong positivist background to attempt to use an advocacy approach. The interrelatedness of paradigm, problem and methodology means that the paradigm guides the selection of methodology, but the problem may require a certain methodology. Thus it would be unwise to select a paradigm that may be in conflict with the requirements of investigating a problem.

The debate about qualitative and quantitative research methods has been ongoing since the mid-nineteenth century, and the two approaches have been distinguished (and thereby defined) on the basis of the type of data used (textual or numeric; structured or unstructured), the logic employed (inductive or deductive), the type of investigation (exploratory or confirmatory), the method of analysis (interpretive or statistical), the approach to explanation (variance theory or process theory), and for some, on the basis of the presumed underlying paradigm (positivist or interpretive/critical; rationalistic or naturalistic) as well as differ primarily in their analytical objectives, the types of questions they pose, the types of data collection instruments they use, the forms of data they produce, the degree of flexibility built into study design etc. University students, in particular social sciences students, face difficulties in learning and doing research associated with inadequate previous mathematical and statistics skills, methodological factors, future job aspirations, dichotic orientation to qualitative and quantitative methods, students study orientations, learning approaches, and their learning outcomes, etc.

Conclusion

Paradigm shifts can and do occur when either a brilliant individual or a team compel others to change their mental map of a particular topic due to the strength of their findings or arguments. Differences in paradigm assumptions cannot be dismissed as mere “philosophical” differences; implicitly or explicitly, since each position has important consequences for the practical conduct of inquiry as well as for the interpretation of findings and policy choices.

Students’ difficulties experienced in quantitative methods courses, research orientations and motivational factors, do constitute an interconnected web that may also have implications for content learning and to students’ views of the importance of research skills for their future work. I believe learning of research and statistics can be made more interesting and easier for many by reducing the mythical features attributed to them, and by trying to get

students to believe that they can learn research, and that it is not as hard as they may think. This can be done by tying elements from real research to courses and concentrating not only on producing results but also on understanding and benefiting from reported research as well as framing the learning of quantitative research from the perspectives of current learning theories that acknowledge psychological, social and cognitive aspects.

References

Ary,D, Jacobs, L.C, & Sorensen,C,K. (2010). **Introduction to Research in Education** (8th ed). Australia: Wadsworth, Cengage Learning.

Becker, B. J. (1996). *A look at the literature (and other resources) on teaching statistics.* **Journal of Educational and Behavioral Statistics***,* 21(1), 71-90.

Birenbaum, M., & Eylath, S. (1994). *Who is afraid of statistics? Correlates of statistics anxiety among students of educational sciences*. **Educational Research***, 36*, 93-98.

Benson, J. (1989). *Structural components of statistical test anxiety in adults: An exploratory model.* **Journal of Experimental Education***, 57*, 247-261.

Blumer, H. (1969) **Symbolic Interactionism: Perspective and Method**. New Jersey, Prentice Hall

Broers, N. J. (2002). *Selection and use of propositional knowledge in statistical problem solving.* **Learning and Instruction***, 12*(3), 323-344.

Busquin, P. (2001). *Preface to: Towards a European research area. Key figures 2001. Special edition.* Indicators for benchmarking of national research policies. European Commission, Research Directorate General. http://europa.eu.int/comm/research/area/ benchmarking2001.pdf

Creswell, J, W. (2009). **Research Design: Qualitative, Quantitative and Mixed Method Approaches** (3rd ed). Los Angeles: Sage Publishers, Inc.

Entwistle, N., McCune, V., & Walker, P. (2001). *Conceptions, styles, and approaches within higher education: Analytic abstractions and everyday life.* In R. J. Sternberg & L. Zhang (Eds.), **Perspectives on thinking, learning, and cognitive styles** (pp. 103- 136). Mahwah, NJ: Erlbaum.

Entwistle, N., & Ramsden, P. (1983). **Understanding student learning**. London: Croom Helm.

Filinson, R., & Niklas, D. (1992). *The research critique approach to educating sociology students.* **Teaching Sociology***, 20*, 129-134.

Forte, J. (1995). *Teaching statistics without sadistics*. **Journal of Social Work Education**, *31*(2), 204-308.

Gal, I. (2000). *The numeracy challenge. In I. Gal (Ed.), Adult numeracy development.* **Theory, research, practice**. Dresskill, NJ: Hampton Press, inc.

Gal, I., & Ginsburg, L. (1994). *The role of beliefs and attitudes in learning statistics: Towards an assessment framework*. **Journal of Statistics Education***, 2*(2). Retrieved from http://www.amstat.org/publications/jse/v2 n2/gal.html

Gal, I., Ginsburg, L., & Schau, C. (1997). *Monitoring attitudes and beliefs in statistics education*. In I. Gal & J. B. Garfield (Eds.), **The assessment challenge in statistics education (**pp.37-51). Amsterdam: IOS Press.

Garfinkel, H. (1967) .**Studies in Ethno-methodology.** Englewood Cliffs, New Jersey, Prentice-Hall.

Gardner, P. L., & Hudson, I. (1999). *University students' ability to apply statistical procedures.* **Journal of Statistics Education***, 7*(1). Retrieved from http://www.amstat.org/publications/jse/secure/v7n1/gardner.cfm

Garfield, J., & Ahlgren, A. (1988). *Difficulties in learning basic concepts in probability and statistics: Implications for research.* **Journal for Research in Mathematics Education**, 19(1), 44-63.

Green, R. G., Bretzin, A., Leininger, C., & Stauffer, R. (2001). *Research learning attributes of graduate students in social work, psychology, and business.* **Journal of Social Work Education***, 37*(2), 333-341.

Greer, B. (2000). *Statistical thinking and learning.* **Mathematical Thinking and Learning***, 2*(1&2), 1-9.

Guba, E. G., & Lincoln, Y. S. (1994). *Competing paradigms in qualitative research.* In N. K. Denzin & Y. S. Lincoln (Eds.), **Handbook of qualitative research** (pp. 105–117). Thousand Oaks, CA: Sage.

Hatch,J.A. (2002). **Doing Qualitative Research in Educational Settings**. Albany: State University of New York

Hitchcock, G., & Hughes, D. (1995). **Research and the Teacher: A Qualitative Introduction to School-based Research.** London: Routledge.

Jackson, M, C. (2003). **Systems Thinking: Creative Holism for Managers.** Chichester: John Wiley & SonsLtd.

Johnson, B and Christensen, L. (2004). **Educational Research: Quantitative, Qualitative and Mixed Approaches** (2nd ed).Boston: Pearson education, Inc.

Kelly, M. (1992). *Teaching statistics to biologists.* **Journal of Biological Education***, 26*(3), 200-203.

Kiley, M., & Mullins, G. (2005). *Supervisors' conceptions of research: What are they?* **Scandinavian Journal of Educational Research***, 49*(3), 245-262.

Kothari,C,R. (2004). **Research Methodology: Methods and Techniques** (2nd ed).New Delhi: New Age International (P) Ltd., Publishers.

Kuhn, T. S. (1970). **The structure of scientific revolutions.** Chicago: University of Chicago Press.

Lincoln, Y. S., & Guba, E. G. (1985). **Naturalistic inquiry.** Beverly Hills, CA: Sage.

Lincoln, Y. S., & Guba, E. G. (2000). *Paradigmatic Controversies, Contradictions and Emerging confluences*. In: Denzin, N,K and Lincoln,Y,S (eds). **Hand book of qualitative research**. Thousand Oaks, CA: Sage.pp, 163-188

Lakoff, G., & Núñez, R. (1997). *The metaphorical structure of mathematics: sketching out cognitive foundations for a mind-based mathematics.* In L. English (Ed.), **Mathematical reasoning: Analogies, metaphors, and images** (pp. 21-89). Hillsdale, NJ: Erlbaum.

Lehtinen, E. & Rui, E. (1995). *Computer supported complex learning: An environment for learning experimental methods and statistical inference.* **Machine Mediated Learning**, *5*(3&4), 149-175.

Lindblom-Ylänne, S., & Lonka, K. (1999). *Individual ways of interacting with the learning environment - are they related to study success?* **Learning and Instruction***, 9*(1), 1-18.

Lonka, K., & Lindblom-Ylänne, S. (1996). *Epistemologies, conceptions of learning, and study practices in medicine and psychology.* **Higher Education***,* 31, 5-24.

Marasinghe, M. G. (1996). *Using graphs and simulations to teach statistical concepts.* **American Statistician***, 50*(4), 342-351.

Mayer, R. E. (2000). *What is the place of science in educational research?* **Educational Researcher***, 29*(6), 38-39.

McGinn, M. K. & Roth, W-M. (1999). *Preparing students for competent scientific practice: Implications of recent research in science and technology studies.* **Educational Researcher***, 28*(3), 14-24.

McKenna, M. C., Robinson, R., & Miller, J. (1990). *Whole language: A research agenda for the nineties.* **Educational Researcher***, 19*(8), 3-6.

Murtonen,M. (2005). *Learning of Quantitative research methods-University students views, motivation and difficulties in learning.* University of Turku, Faculty of education, unpublished dissertation.

Onwuegbuzie, A. J. (1997). *Writing a research proposal: The role of library anxiety, statistics anxiety, and composition anxiety*. **Library & Information Science Research***, 19*(1), 5-33.

Onwuegbuzie, A. J. (2000). *Statistics anxiety and the role of self-perceptions.* **Journal of Educational Research***, 93*(5), 323-330.

Onwuegbuzie, A. J., & Daley, C. E. (1998). *The relationship between learning styles and statistics anxiety in a research methodology course.* A paper presented at the annual conference of the American Educational Research Association, April, 13, San Diego, CA.

Royse, D., & Rompf, E. L. (1992). *Math anxiety: A comparison of social work and non-social work students*. **Journal of Social Work Education***, 28*, 270-277.

Saeidi, S. (2002). *Research Approaches and Data Collection Techniques. Skills for Learning Leeds Metropolitan University.* Retrieved on 10 October from http://www.lmu.ac.uk/lskills/.

Townsend, M. A. R., Moore, D. W., Tuck, B. F., & Wilton, K. M. (1998). *Self-concept and anxiety in university students studying social science statistics within a co-operative learning structure.* **Educational Psychology***, 18*(1), 41-54.

Tynjälä, P., Helle, L., & Murtonen, M. (2002). *A comparison of students' and experts' beliefs concerning the nature of expertise*. In E. Pantzar (ed.), **Perspectives on the age of the information society** (pp. 29-49). Reports of the Information Research Programme of the Academy of Finland, 6. Tampere: Tampere University Press.

Siegel, D. H. (1983). *Can research and practice be integrated in social work education?* **Journal of Education for Social Work***, 19*(3), 12- 19.

Smith, J. K. (1997). *The stories educational researchers tell about themselves.* **Educational Researcher***, 26*(5), 4-11.

Snow, C. P. (1964). **The two cultures: A second look.** Cambridge: University Press.

Vanderstoep, S, W. and Johnston, D, D. (2009). **Research Methods for Everyday Life: Blending Qualitative and Quantitative Approaches**. San Francisco: John Wiley & Sons, Inc.

Watts, D. G. (1991). *Why is introductory statistics difficult to learn? And what can we do to make it easier?* **American Statistician***, 45*(4), 290-291.

Wilson, W. C., & Rosenthal, B. S. (1992). *Anxiety and performance in an MSW research and statistics course.* **Journal of Teaching in Social Work***, 6*(2), 75-85.

Zanakis, S. H., & Valenzi, E. R. (1997). *Student anxiety and attitudes in business statistics.* **Journal of Education for Business***, 73*(1), 10-16.

Zeidner, M. (1991). *Statistics and mathematics anxiety in social science students: some interesting parallels.* **British Journal of Educational Psychology***, 61*, 319-328.