AN EVALUATION OF POSTGRADUATE SOCIAL SCIENCE STUDENTS' KNOWLEDGE OF CONDUCTING RESEARCH RESPONSIBLY IN A SOUTH AFRICAN UNIVERSITY

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DECLARATION

Submitted in partial fulfillment of the requirements for the degree of …….. , in the Graduate Programme in …… , University of KwaZulu-Natal, Pietermaritzburg, South Africa.

I declare that this dissertation is my own unaided work. All citations, references and borrowed ideas have been duly acknowledged. It is being submitted for the degree of ……. in the Faculty of Humanities, Development and Social Sciences, University of KwaZulu-Natal, Pietermaritzburg, South Africa. None of the present work has been submitted previously for any degree or examination in any other University.

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ABSTRACT

Conducting research responsibly is an essential part of ethical research (Steneck & Bulger, 2007). When research is not conducted responsibly, the result is often research misconduct, which may cause harm to research participants (Aita & Richer, 2005). Although numerous methods and policies have been developed, both to prevent and to deal with research misconduct, such effects are ongoing (Howard Stone, 2001). A study conducted in the United States of America (USA) by Heitman, Olsen and Anestidou (2007) suggested that postgraduate biomedical students did not have sufficient knowledge of conducting research responsibly. This study aimed to adapt Heitman *et al.*'s (2007) study to social science postgraduate students at the University of KwaZulu-Natal in South Africa. Although findings indicated that the participants had adequate knowledge of conducting research responsibly, the variables hypothesised to have an impact on the results – such as age, research experience, and research training – did not produce any significant findings.

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INTRODUCTION

Conducting research in a responsible manner is an essential part of ethical research (Steneck & Bulger, 2007). When research is conducted irresponsibly, the result is often research misconduct, which could lead to the harm of research participants and the misrepresentation of knowledge (Aita & Richer, 2005). Despite methods and policies which have been developed to deal with research misconduct, it is still ongoing (Howard Stone, 2001). One of

the ways that research misconduct is prevented is through research instruction and education in the areas of research methodology or research ethics (Macrina, 2007). A study was conducted by Heitman *et al*. (2007) in the USA, which suggested that postgraduate biomedical students did not have sufficient knowledge of responsible research. This study was conducted using a survey design method. The results of the study suggested that postgraduate biomedical students did not have sufficient knowledge of conducting research responsibly.

This study aimed to adapt Heitman *et al.*'s (2007) study to social science postgraduate students at the University of KwaZulu-Natal in South Africa. The choice of social science students was based on a gap in the literature regarding this area, as well as the principle that social science research engages with a broad range of ethical issues, particularly pertaining to human participants (Lutabingwa & Nethonzhe, 2006). Based on the results of the Heitman *et al.* (2007) study, it was hypothesised that social science postgraduate students would not have adequate knowledge of responsible research. It was further hypothesised that a number of variables (age, research experience, research training) could impact on postgraduate students' knowledge of responsible research.

2. LITERATURE REVIEW

2.1 History

2.1.1 Background

Research ethics has been shown to stem from a number of fields including biological, medical and social sciences (Bower & de Gasparis, 1978). Bower and de Gasparis (1978) note that it was mostly through the biomedical field that many of the ethical principles

relating to research with human subjects were developed, whereas principles relating to human rights were established predominantly through the human social sciences field. One of the main reasons that ethical principles were established was in response to a number of "historical experimental research projects that were classified as violating human rights" (Aita & Richer, 2005, p. 120). Examples of some of these cases include: Nazi medical experiments, the Tuskegee Syphilis Study, the Willowbrook Study, the Wichita Jury Study, Milgram Studies of Obedience to Authority*, Tearoom Trade Study* and the Jewish Chronic Disease Hospital Study (Aita & Richer, 2005; Amdur, 2003, 2005; Shea, 2000).

2.1.2 Development of Ethical Codes and Guidelines

The above-mentioned violations of human rights have meant that ethics in research has increasingly become a topic of much global debate over the past few decades (Israel & Hay, 2006). According to Wassenaar (2006, p. 61), the primary purpose of ethical research is to "…protect the rights and welfare of research participants". Many codes and guidelines have been developed in order to prevent unethical research and to guide researchers in making ethical decisions (Israel & Hay, 2006). The following codes exist and are listed in chronological order: the Nuremberg Code; the Declaration of Helinski; the Belmont Report and CIOMS (Council for International Organizations of Medical Sciences) (Israel & Hay, 2006). There are a number of prominent ethical principles within these reports. The main contribution of each these codes will be discussed sequentially below.

The Nuremburg Code was developed in 1948 as a result of appalling experiments that were conducted on prisoners and detainees during the Second World War (Aita & Richer, 2005; Amdur, 2003; CIOMS, 2002 NIH, 2008). It was during the Nuremburg Trials against the physicians who conducted the experiments, that the lack of laws and regulations defining

*Study conducted in the social sciences field.

ethical conduct was identified (Amdur, 2003). The Nuremburg Code therefore attempted to set out predominant principles explicitly for research involving human participants, with direct emphasis on "voluntary consent to research" (CIOMS, 2002, p. 8). It further highlighted issues such as "freedom from coercion and the assurance that there is an appropriate risk/benefit ratio for the subject" (Jonsen, 1996, in Aita & Richer, 2005, p. 121). One of the criticisms levelled against the Nuremberg Code was that it failed to include principles regarding children and the mentally challenged who were unable to give informed consent of their own accord (Aita & Richer, 2005).

The second code that was developed was known as the Declaration of Helinski. It was issued by the World Medical Association in 1964 and most recently amended in 2004 and 2008 (CIOMS, 2002; Aita & Richer, 2005). This code contributed to the development of both legislation and codes of conduct at international, regional and national levels (Amdur, 2003; CIOMS, 2002). Amdur (2003) mentions that this code puts the importance of research participants' best interests above those of society. Furthermore, the code indicates that clinical research participants should be provided with the best treatment available and therefore set out various guidelines for physicians engaged in this type of research (Amdur, 2003; CIOMS, 2002; Portney & Wilkens, 2000, in Aita & Richer, 2005). It also includes a number of guidelines, which acknowledge the need for a legal guardian to provide consent for both children and mentally challenged subjects (Aita & Richer, 2005).

The Belmont report was commissioned and published in 1974 following the Tuskegee case (mentioned above) (Jonsen, 1996, in Aita & Richer, 2005). The Belmont report established three important principles that underlie the responsible conduct of research with humans (Jonsen, 1996, in Aita & Richer, 2005). These include respect for autonomy, beneficence and

justice, which are also associated with specific practices that function to protect these principles, such as "informed consent, risk benefit assessment and fair selection processes" (Jonsen, 1996, in Aita & Richer, 2005, p. 120).

The CIOMS, together with the WHO (The World Health Organisation), first produced a report in 1982 in which a proposal was put forward for "international ethical guidelines for biomedical research involving human subjects" (CIOMS, 2002, p. 4). These extensive guidelines have been continuously updated over the years as new ethical issues have arisen, such as the HIV/AIDS pandemic and the research that followed involving vaccines and drug treatment (CIOMS, 2002). The major principles in CIOMS (2002) are outlined below.

There are in general four major ethical principles that should be adhered to when conducting research. The first ethical principle is known as autonomy, which requires that persons able to consciously reflect on the decisions they make should be respected for their ability to make choices freely and independently. It also requires that those persons with "impaired or diminished autonomy" should be provided with security and protection against both harm and abuse (CIOMS, 2002, p. 11). The second principle is known as nonmaleficence and requires that research should do no harm (CIOMS, 2002; Wassenaar, 2006). Beneficence is the third principle, which recognises the obligations that researchers have to "maximise benefits and minimise harms" through "sound research design…, competent investigators" and benefits that outweigh the risks (CIOMS, 2002, p. 11). The final ethical principle is referred to as justice. This "refers to the ethical obligation to treat each person in accordance with what is morally right and proper and to give each person what is due to him or her" (CIOMS, 2002, p. 11). According to Aita and Richer (2005, p. 123) ethical principles should be included in all stages of the research process – that is, in "the choice of research methodology, the

recruitment of subjects, method of data collection, the analyses and the publication of results".

2.1.3 Social Science Research Ethics

According to Babbie and Mouton (2005, in Lutabingwa & Nethonzhe 2006, p. 695) "in addition to technical and scientific considerations, social science research projects are likely to be shaped by practical, ethical and political considerations". Much of social science research involves human participants, which includes studying individual human behaviour, as well as groups and communities of people (Studer & Chubin, 1977; Terre Blanche & Durrheim, 1999). Social scientists not only have an ethical obligation to their research participants, but they also have an obligation to greater society (Lutabingwa & Nethonzhe, 2006). Findings of social science research studies are often used in policy formation and national sentiment (Lutabingwa & Nethonzhe, 2006; Studer & Chubin, 1977). Furthermore, findings are also used in the development of specific interventions, which means that, if research is conducted irresponsibly, it not only has the potential to affect individuals but communities as well (Lutabingwa & Nethonzhe, 2006).

Initially, social science research methodology was based primarily on an interpretation of the physical sciences and existing technology (Studer & Chubin, 1977). Over the decades, social science research has come into its own, developing its own set of statistics, methodology and research designs (Studer & Chubin, 1977). As credibility of this area has developed, funding and grants for research have increased, which has meant that more research has been conducted in social science areas than previously (Studer & Chubin, 1977).

As with other disciplines, it is vital that research in the social sciences is conducted ethically and responsibly (Wassenaar, 2006). Reese and Fremouw (1984, in Lutbingwa & Nethonzhe,

2006) suggest that there are three broad areas of ethical concern in social science research. These include: "the ethics of data collection and analysis [including avoidance of the manipulation of data to achieve desired results]; the ethics of the treatment of participants [including issues of informed consent, potential harm to participants, deception and privacy]; and the ethics of responsibility to society" (Fremouw, 1984, in Lutbingwa & Nethonzhe, 2006, p. 695).

2.1.4 Brief History of Responsible Research

Despite the early acknowledgement of ethical principles, research has not always been conducted responsibly and acknowledgement of this was only made in the early 1970s by biomedical scientists "under public scrutiny as a consequence of a decade of reports about misconduct in research" (Steneck & Bulger, 2007, p. 829). No steps were taken to correct misconduct at this stage and discovery of it did not affect the way in which students were trained (Steneck & Bulger, 2007). The reasons for this were presumably twofold. Firstly, research misconduct was dealt with in terms of the 'few' who committed it, and energy was spent developing consequences and policies to punish those who had strayed off the path (Steneck & Bulger, 2007). Secondly, it presumed that new researchers obtained responsible research skills through usual research training courses, which meant that there was no need for extra training or development of particular programmes focusing on this area (Steneck & Bulger, 2007). It was only in the late 1980s, when various issues of research misconduct were publicised, that the development of formal education pertaining to the responsible conduct of research was considered (Steneck & Bulger, 2007).

In keeping with the codes of conduct developed by various committees and organisations, it is important that all researchers should avoid causing harms to individuals and society where possible and attempts should rather be made to produce social benefits (Pittenger, 2003;

Resnik, 1998). Furthermore, some authors believe that all scientists (including social scientists) need to be held responsible for the consequences of their research by informing the public about the results of research, whether it be the favoured outcome or not (Pittenger, 2003; Resnik, 1998). Although this sounds simple enough, research has shown that, regardless of interventions put in place, research misconduct still occurs (Resnik, 1998).

2.2 Research Misconduct

2.2.1 What is Research Misconduct?

It is important to understand why research should be conducted responsibly. In order to do this, the notion of research misconduct needs to be understood. Levine and Lutcovich (2003) point out that very little is known about research misconduct. The reason for this is that events of research misconduct are not very often exposed (and more often than not, hidden) so that the reputations of research institutions and individuals are protected (Levine & Lutcovich, 2003). Importantly though, there are those events of misconduct which bring the integrity of research into question (Aita & Richer, 2005). The reason for this is that the notion of conducting research responsibly was only developed through exposure of examples of research conducted in an unethical manner (Emanuel, Wendler, Killen & Grady, 2004).

Traditionally, research misconduct has been defined as those actions which "represent a significant departure from accepted practices, have been committed intentionally, knowingly or recklessly [or are] proven by a preponderance of evidence" (Steneck, 2004, p. 21). This definition emphasises issues relating to research design, review and publication (Breen, 2003). What this definition fails to address are instances when "...misconduct...endangers the lives of human research participants" (Breen, 2003, p. 188). The Medical Research Council of the United Kingdom provides a more thorough definition by not only including what has been mentioned above in terms of research design and publication, but by also including risk

and harms to human participants (Breen, 2003). Further comments are made within this definition about the offense of "colluding with or concealing research misconduct" (Breen, 2003, p. 188). There are other definitions whereby the term research misconduct has specific moral connotations attached to it. In these cases, research misconduct is often defined as an immoral act, whereby the development of appropriate norms and values have not been established within the researcher (Adams & Pimple, 2005).

It is evident that there is a shift or a split in the definition and understanding of what comprises misconduct in research. Plemmons, Brody and Kalichman (2006, p. 578) note that there is often much difficulty distinguishing between "research ethics (as a specific body of knowledge and practice), and individual integrity (as part of a person's individual character or behaviour, or based on some morality of a much broader type)". On the one hand, research misconduct is understood as a lack of knowledge of research ethics and therefore attributed to poor education and training. Some literature, however, views research misconduct as particular to an individual's character and behaviour. This poses a number of dilemmas and causes much debate about the source of misconduct. Livingston (n.d., in Vasgrid, 2007, p. 837) states that "one is apt to think of moral failure as weakness of character; [but] more often it is due to inadequate ideal". Research misconduct cannot be solely attributed to poor education or lack of individual integrity but is more likely to occur as a result of a number of factors (Livingston n.d., in Vasgrid, 2007).

2.2.2 What are the Causes of Research Misconduct?

It has been shown that the incidence of research misconduct is on the rise (Drenth, 2006; Weed, 1998). A postal survey conducted in the US showed that approximately one third of scientists admitted to engaging in some form of research misconduct over the past three years (Dyer, 2005). Reasons for research misconduct, however, are varied.

Breen (2003) suggests that research misconduct has been linked to immoral characteristics. These include "increasing academic expectations, increased need to publish, (personal or professional) gain, mental illness, messianic complex, and lack of moral capacity to distinguish right from wrong" (Breen, 2003, p. 189). Braunschweiger and Goodman (2007) support the above mentioned causes but add characteristics focusing on both the individual and the research environment. They suggest that some of the causes of research misconduct occur because of the research environment, where success depends on the number of publications, greed and need for fame, poor guidance and mentorship, and lack of experience in ethical decision making (Braunschweiger & Goodman, 2007).

It appears that publication pressure is one of the more commonly cited causes of research misconduct (Barrett, Funk & Macrina, 2004). Barrett *et al.* (2004) note that the reason for this is that publication is a central component of scientific research because its purpose is to convey information to other researchers and to provide a forum for credit to be obtained for hard work and discovery. Consequently, publication has developed into a platform for career development and gaining research funding (Barrett et al., 2004). Despite the value of publication to research communities and individuals, findings of a study conducted by Barrett *et al.* (2004) suggest that researchers do not have adequate knowledge of publication guidelines.

Although some of the above mentioned characteristics may play a part in research misconduct, there is every likelihood that it can be attributed to other factors. Howard Stone (2001, p. 96) suggests that causes of research misconduct can be divided into four major areas, which are defined as "sad comment on state of training; an overreliance on self-

policing; too narrow in application and nature; and depth of training". Each of these areas will be discussed in more detail below.

Research indicates that one of the primary reasons for research misconduct is poor training within the area (Howard Stone, 2001). Many institutions appear to be unaware of the value of educating about research misconduct and only do so because policy and laws require it (Howard Stone, 2001). Institutions conducting research are more often than not responsible for 'policing' their own research projects (Howard Stone, 2001). This means that, when there is competition and pressure for investigators to achieve, research misconduct is more likely to take place (Rhodes & Strain, 2004; Vasgrid, 2007). This policing is often done through committees which are internal to the institution's system (Howard Stone, 2001).

Studies conducted on these committees indicate that they

> "are unable to effectively manage the large volume of research they have to review; conduct more thorough reviews of research; have a lack of scientific expertise to make informed judgements about the research they review; have a lack of objectivity and independence because of conflicts of interest and are not adequately trained to conduct reviews on research (Howard Stone, 2001, p. 96).

Another factor which may contribute to research misconduct involves the policies and who they apply to. It seems that the scope of many of these policies is too narrow, and that many policies are specifically geared towards primary investigators and those who receive funding for the research (Howard Stone, 2001). This implies that others who have a role within the project but are not directly related to it may not be obliged to conduct research in an ethical manner (Howard Stone, 2001). These policies are also said to have limited applicability, which means that they are often difficult to implement on a practical level (Howard Stone, 2001). Furthermore, it seems that it is increasingly difficult to teach the policies on an in-depth level because of the way in which they are worded and designed (Howard Stone,

2001). This may therefore contribute to both the applicability and the practicality of the policy issues which have been discussed above.

It can therefore be concluded that research misconduct occurs as a result of factors which can be attributed to the researcher's environment and to some characteristics particular to the individual researcher. Understanding the causes of research misconduct may aid in its diminishment. Training and policy issues are areas where changes can be made and implemented. However, debates regarding causes of research misconduct will probably be ongoing. Vasgrid (2007, p. 835) states that "the public will support science only if it can trust the scientists and the institutions that conduct research". It therefore becomes imperative that a holistic approach is taken when addressing these issues. For the purposes of this project, however, the broader issues of training and individual morality will be discussed under the topic of conducting research in a responsible manner, as opposed to being focused on individually.

Drenth (2006) notes that there are two major ways through which research misconduct can be dealt with. The first way involves what is known as the use of "corrective measures" and includes the implementation and development of "punitive measures or sanctions" (Drenth, 2006, p. 19). Redman and Merz (2008) note that very little is known about the severity of corrective measures and many believe that the punishment meted out for research misconduct is more severe than it deserves. The second method involves the use of "preventative measures", which involve "procedures, regulations, precepts [and] whistle blowers" (Drenth, 2006, p. 19). Although the above two methods have been shown to be effective to some extent, Drenth (2006, p. 19) highlights the importance of the 'development' within the scientific community of a "scientific conscience and a proper sense of values and standards".

One way of doing this is to foster the concept of responsible research. This will be discussed in the following section.

2.3 The Responsible Conduct of Research

2.3.1 What is Responsible Research?

Steneck (2004, p. 6) defines the responsible conduct of research as "good citizenship applied to professional life". He characterises responsible researchers as those who: "report their work honestly, accurately, efficiently, and objectively...Anyone who is dishonest, knowingly reports inaccurate results, wastes funds, or allows personal bias to influence scientific findings is not (Steneck, 2004, p. 6).

Responsible research is not solely concerned with ethics, but also with the way research is conducted and how this should be done in a manner that is dependable.

Four main characteristics that comprise the responsible conduct of research have been developed by the Office of Research Integrity[1] in the USA (United States of America) (Steneck, 2004). The first of these is honesty, which, according to Steneck (2004), means that information and commitments should be upheld and conveyed in a truthful manner. Researchers should not only be truthful in their publications, but should honour any commitments that were made to participants during the research process. The second characteristic is accuracy, and involves reporting research findings in a way which is exact and avoids mistakes as far as possible (Steneck, 2004). Research should be reported as accurately as possible so that knowledge can be furthered. Efficiency is the third characteristic. This involves using resources effectively and not causing unnecessary waste

[1] http://ori.dhhs.gov/

(Steneck, 2004). The final characteristic is objectivity, which entails "letting the facts speak for themselves and avoiding improper bias" (Steneck, 2004, p.9).

Although these core standards of responsible research have been developed by the US Office of Research Integrity, Heitman and Bulger (2007) contend that they are in some ways ill defined. The reason for this is that there appear to be significant differences in the way these standards are translated into courses, which means that differing courses most probably have different content.

Responsible research seemingly comprises a number of factors. As was mentioned in the previous section, research misconduct is either attributed to environmental or individual characteristics. The same can be said for the responsible conduct of research, which can also be considered in terms of individual and environmental factors (Kalichman, 2007).

2.3.2 Individual Factors

Individual factors that are characteristic of responsible research can be widely defined as comprising of 'virtue' (DuBois, 2004). Aristotle (trans. 1998, in Dubois, 2004, p. 386) states that virtue "...facilitates a certain kind of behaviour, just as a certain kind of behaviour reinforces virtue". With this value in mind, DuBois (2004) argues that a professional researcher will have certain characteristics or traits that predisposes them to act in certain ways. Because virtue is inherently internal and linked to characteristics within the professional, actions pertaining to virtue are voluntary (DuBois, 2004). This implies that virtues are considered to "promote moral excellence" if they contribute to human well-being and are therefore considered immoral if they produce harm (DuBois, 2007, p. 387). In terms of responsible research, professional virtue should be developed in such a way that its goal

becomes "...serving human well-being by producing generalisable knowledge..." (DuBois, 2007, p. 387).

Thompson and Thompson (1989, in Aita & Richer, 2005, p. 122) note that, in order for ethics to be applied in research, the researcher needs to "…learn how to reason morally and identify the ethical dimensions that are in conflict". There are a number of psychological processes that should take place before a person is able to behave in a manner that is considered ethical (Rest, 1982, in Aita & Richer, 2005). These include: "moral sensitivity, [the ability to identify moral dilemmas] moral reasoning [thinking about actions to perform when faced with a dilemma], moral commitment [characteristics that allows persons to choose moral over non-moral] and moral perseverance [strength and tenacity to hold out on decisions]" (Rest, 1982, in Aita & Richer, 2005, p. 122). In conjunction with these principles, Smith (2000, in Aita & Richer, 2005) notes that honesty is a vital characteristic which researchers should possess so that the 'scientific truth' is found and portrayed in a justifiable manner.

There have been critiques against this approach, however, because what this moral theory implies is that "bad choices (such as research misconduct) are enacted by bad people" (Adams & Pimple, 2005, p. 227). In support of this critique, Chambers (2000) notes that such a conclusion is often drawn because of the way in which the authors of these theories view ethical mistakes. Theories made with moral implications for the individual tend to focus on creating perfection within the individual, which more often than not is seemingly impossible (Chambers, 2000). Solutions based on this therefore tend to focus on "moral character, educational interventions, and efforts to uncover bad choices and deal with them appropriately" (Adams & Pimple, 2005, p. 227). Interventions focused on changing the moral

nature of the individual to enhance the responsible conduct of research will nonetheless be discussed.

2.3.3 Environmental Factors

It would be simplistic to think that responsible research was the sole responsibility of the individual. Research indicates that part of the responsibility lies with the environment the researcher comes from and works in (Braunschweiger & Goodman, 2007; Drenth, 2006; Kalichman, 2007; Vasgrid, 2007). The researcher's environment is made up of various factors. It has been shown that the culture or ways in which a research community functions allows individual researchers within that particular community to conduct research in a particular way (Edwards, 2002).

If the environment the researcher comes from and works in is supportive, provides adequate education, adheres to policies and guidelines, provides consequences for research misconduct and protection for whistleblowers, there is more likelihood that research will be conducted in a responsible manner (Kalichman, 2007; Rhodes & Strain, 2004). The development of research ethics committees is a practice which is largely believed to promote responsible and ethical research and, as a result, many institutions use them as the primary means of monitoring research (DuBois, 2004).

Recently, however, evidence has shown that "regulations based on the assumption that high risk of harms and high degrees of intrusiveness are the norm" fosters resentment in researchers who feel as though their research is limited and that, despite these limitations, research participants are not provided with increased protection (APA, 2001, in DuBois, 2004, p. 389). This sense of restrictiveness often results in research misconduct or,

alternatively, researchers feeling as though they are coerced to comply because of penalties that are incurred if they do not (DuBois, 2004).

Interventions aimed at this area of responsible research are often conducted through educative and preventative methods. These will be discussed in more detail in the next section.

2.4 The Promotion of Responsible Research

As has been discussed, responsible research is comprised of numerous factors which need to be considered when promoting the conduct of responsible research in research institutions. There are various methods and approaches that can be used to promote responsible research. It is beyond the scope of this research to present a holistic and integrated view of these approaches. For the purpose of clarity, they will be presented under two general sub-headings: issues of integrity and compliance (i.e. individual factors), and education and prevention (i.e. environmental factors).

2.4.1 Issues of Integrity and Compliance

"The role of integrity in science has been an issue throughout the history of science" (Plemmons, Brody & Kalichman, 2006, p. 581). It seems logical that the term research integrity be used as an umbrella term for all factors contributing to research misconduct (Heitman & Bulger, 2007; Vasgrid, 2007). Integrity has the implication and connotation that all parties (researcher and institution alike) involved in the research are obliged to be honest and honour-bound. This has the effect of placing responsibility where it is due and enhancing the understanding of responsible research as a whole (Heitman & Bulger, 2007; Vasgrid, 2007).

With the notion of integrity comes the concept of compliance. There are two ways that compliance can be fostered or enhanced (Plemmons et al., 2006). The first, and possibly the most common, occurs "under threat or penalty" (Plemmons, et al., 2006, p. 581). As has been discussed, this is often initiated through the use of review boards or research ethics committees, which bestow penalties and consequences upon those who do not conduct research in an ethical or responsible manner (DuBois, 2004). This way of enhancing compliance is derived from a theory of law, which suggests that behaviour is better affected by regulations, with associated consequences (DuBois, 2004). It would therefore seem that the greater the cost associated with a behaviour, the less likely it is that the behaviour will be undertaken (DuBois, 2004).

The second way of enhancing compliance has been termed "internalisation of the norm" (DuBois, 2004, p. 390). This goes back to the concept of professional virtue, which is a value that, in theory, should be internalised by researchers (DuBois, 2004). This legal theory focuses specifically on the "...law's ability to influence behaviour by influencing social norms" (DuBois, 2004, p. 39). The premise behind this is that the law has the ability to influence and communicate societal norms by punishing and isolating those who do not obey the law (DuBois, 2004). By ostracising those who violate the norms, it is hoped that the norms of society would eventually be internalised, which would mean that there would be less violation taking place (DuBois, 2004; Greenspan, 1998).

However, there are many who would disagree with the above views of compliance and many who believe that noncompliance is often warranted and even justified in certain circumstances (Douglas n.d., in DuBois, 2004). In this instance, compliance is seen as a way of "polic[ing] science and at worst [will] impede scientific progress" (de Melo-Martin et al.,

2007, p. 900). Although this point of view does seem to be extreme, it is important that "critical ethics" are developed and that, norms are sometimes questioned for the improvement and furthering of knowledge within this area (DuBois, 2004).

It is also evident that many researchers want and require ethical guidelines (Vasgrid, 2007). Although this may be the case it would be naive to assume that compliance and integrity can "simply be hoped for" as this could produce critical results for both researchers and institutions (Vasgrid, 2007, p. 836). Vasgrid (2007) describes elements of compliance which will only be successfully implemented if support is provided. These elements include:

> implementing written policies and procedures; designating a compliance officer and compliance committee; developing effective lines of communication; conducting internal monitoring and auditing; responding promptly to directed problems and undertaking corrective action; enforcing standards through well published disciplinary guidelines (Vasgrid, 2007, p. 836).

Although instructional aspects (i.e. teaching and training methods) will be discussed in depth in the following section, there have been suggestions that compliance should be added to the core areas of responsible research instruction (Heitman & Bulger, 2007). It is thought that if compliance becomes a core instructional area, areas that have been previously neglected in educational material will be addressed and including compliance would "circumscribe the concept of complying with regulations to a sub-area of responsible conduct" (Heitman & Bulger, 2007, p. 223).

Although research integrity is an important element of responsible research, it is a somewhat abstract concept that is difficult to apply practically. It is for this reason that many approaches aimed at increasing responsible research are aimed at a preventive and educative level.

2.4.2 Education and Prevention

Macrina (2007) suggests that there are three ways that scientific societies can promote responsible research. These are "the creation, promotion and enforcement of codes of conduct; publication of guidelines and policies pertaining to scientific misconduct...; and the development and dissemination of relevant educational materials" (Macrina, 2007, p. 865). Education and prevention are two intervention methods which can be said to be focusing on Macrina's (2007) first and last methods of promoting responsible research. These two intervention methods are easy and practical to implement within institutions. Furthermore, these approaches can be aimed at both individual and institutional levels and therefore encompass many aspects of responsible research.

As has been briefly mentioned, many countries using ethical guidelines use research ethics committees as a preventive measure to regulate research (Ethics in Health Research, 2000). In South Africa, many of the research ethics committees are situated at tertiary, research and health institutions (Ethics in Health Research, 2000). Government policy states that research may not proceed unless it has been approved by a research ethics committee (Ethics in Health Research, 2000). The basic functions of research ethics committees include:

> reviewing research proposals and protocols to ensure that research will be conducted in the spirit of endeavouring to promote health and to prevent or cure disability and disease; ensuring that humans involved in research are treated with dignity and that their well being is not compromised and that animals involved in research are treated compassionately; ensuring that informed consent is obtained in the case of human participants; granting approval in instances where research proposals and protocols meet ethical standards (Ethics in Health Research, 2000, p. 10).

These research ethics committees are registered with the National Health Research Ethics Council, which has a monitoring and investigative function in the development of policies, operating procedures, training, capacity building, appeals and sub committees (Ethics in

Health Research, 2000). However, some committees may function independently of this organisation (Ethics in Health Research, 2000).

The premise behind research ethics committees is that poor research and possible harms to participants can be prevented if they are identified and dealt with before the research has been initiated (Ethics in Health Research, 2000). These committees should also monitor research which is in progress and may investigate a situation if it is thought that research is not being conducted in an ethical manner (Ethics in Health Research, 2000). However, research ethics committees are more often than not viewed by researchers as a means of restricting research and stunting intellectual freedom (DuBois, 2004). Wassenaar and Mamotte (2008, p. 3) contest this view, noting that although "academic freedom permits freedom of intellectual inquiry, ...[it] cannot sanction particular research methodologies that impact on the dignity and rights of others".

Even though this may be the case to some extent, to date no better way has been developed to monitor research within an institution and it would seem foolish to dispense with research ethics committees, especially when the incidence of research misconduct is said to be on the rise (Levine & Lutcovich, 2003). Furthermore, research ethics committees in some ways demand compliance and appear presently to be one of the better ways of achieving this important aspect of responsible research (DuBois, 2004). However, Bozeman, Slade and Hirsch (2009) argue that research ethics committees are themselves not faultless, and are dependent on the members who work within them. Despite the development of ethical review boards, research misconduct which resembles earlier cases of misconduct such as the Tuskegee Syphilis Study, has still occurred (Bozeman et al., 2009). This suggests that there is much room for improvement where research ethics committees are concerned, despite them

currently being perceived as one of the better ways of managing research misconduct (Bozeman et al., 2009).

Education has been considered an important element in the conduct of responsible research since 1989, when the US Institute of Medicine (IOM) made a crucial recommendation stating that "universities should provide formal instruction in good research practices" (Steneck & Bulger, 2007, p. 829). Vasgrid (2007, p. 835) defines responsible research education as "...the use of didactic behaviour measures to invoke an overarching philosophy of behaviour conceptually encompassing the four areas of human and animal research protections, research integrity, environmental safety issues and fiscal accountability". Education therefore falls into the internalisation approach mentioned in the sections above where individual factors contributing to research misconduct and issues of integrity and compliance were discussed. If students are educated with the overarching principles of responsible research and if this can be internalised, then much will have been done in the promotion of responsible research. Questions remain, however, concerning the content of instructional material as well as the most effective method for disseminating the information.

Heitman and Bulger (2007) note that, in many ways, responsible research education is ill defined and that although the United States Office of Research Integrity has developed nine core instructional areas, the content of these areas and the way in which it is disseminated varies across institutions. Nonetheless, the nine core areas are worthy of mention and are identified by U.S. Public Health service policy on Instruction in the Responsible Conduct of Research (2000, in Heitman et al., 2007, p. 844) as "data management; sharing and ownership; conflict of human interest and commitment; human subjects; animal welfare; research misconduct; publication practices and responsible authorship; mentor or trainee

responsibilities; peer review; and collaborative science". Heitman and Bulger (2007, p. 222) suggest that there are areas currently neglected by the above mentioned topics, which should also include topics such as "ethical safeguards of the scientific method; professional scepticism and the self correcting nature of science; the role of trust and honesty in the growth of scientific knowledge and the dangers of deception".

Although these instructional areas may seem logical, there are many differing ways that they are interpreted by different institutions, both in content and in application. This means that instruction at one research institution will differ from instruction at another institution. There are also research reports suggesting that current methods of research instruction do not make a difference to a graduate student's life (Plemmons et al., 2006). Furthermore, the importance that various institutions place on educating students about research ethics varies. As a result of this, Plemmons *et al.* (2006) suggests that the content of instructional areas should not merely be the focus of intervention. Rather, the focus should shift to looking at the entire graduate curriculum and attempts should be made to include fully integrated research ethics training (Plemmons et al., 2006). It is suggested that it would be beneficial to implement this despite difficulties in measuring the effectiveness of training in research ethics and differing needs of graduate students (Plemmons et al., 2006). Heitman and Bulger (2007) also argue that the sole responsibility for training in research ethics should not fall only on the trainee and the mentor but also on the institution, as the research institution provides the environment through which mentoring relationships are fostered.

It has been suggested that research experience is an important element to be considered in responsible research education (Heitman et al., 2007). Focus groups conducted by Heitman *et al.* (2007) suggested that postgraduate students regarded practical experience as more

beneficial than other methods of education. No significant difference was found regarding knowledge of responsible research between those students with research experience and those without (Heitman et al., 2007). It did seem that those students with some experience performed better on the questionnaire than those students without research experience (Heitman et al., 2007).

Because of the inconsistency of research instruction between institutions, it has become evident that scientific societies should join forces where possible in order to develop "global codes of ethics and conduct" (Macrina, 2007, p. 868). Steneck and Bulger (2007) define three key areas for development in order to facilitate effective research instruction within research institutions. Firstly, further research needs to be conducted to understand research behaviour and the factors that influence it (such as the research environment) (Steneck & Bulger, 2007). The second area of focus entails the formulation of a common language regarding the development and evaluation of research instruction (Steneck & Bulger, 2007). Finally, as research cannot be conducted effectively without funding, it is important that if knowledge is to be developed in this area, funding institutions take a more active role and assist with the development of knowledge in the responsible conduct of research (Steneck & Bulger, 2007).

Plemmons *et al.* (2006, p. 581) state that "if research instruction is to be effective, then it is essential that the goals are clear, measurable outcomes are defined, and the relative merits of different approaches are assessed". In developing a consistent approach to research instruction, it is imperative that the "important values and principles that guided science for its entire history" should not be ignored or put aside (Heitman & Bulger, 2007, p. 224). Every effort should be made not to develop research instruction into a rule-following duty (Heitman & Bulger, 2007). Despite the lack of consistency and ill defined goals in the responsible

conduct of research instruction, it seems that instruction in this area is becoming wide spread (Plemmons et al., 2006). Plemmons *et al.* (2006) suggest that this change may be due to increased understanding that training in this area should be a core aspect of a researcher's education.

2.5 Students and Responsible Research

2.5.1 Research Misconduct and Universities

Universities conduct research for several reasons. Vasgrid (2007, p. 835) defines the overarching goal of tertiary institutions as "the generation and dissemination of new knowledge". Instances of research misconduct suggest that tertiary institutions do not seem to have done everything they can to promote the responsible conduct of research (Vasgrid, 2007).

When students conduct research irresponsibly, it not only reflects badly on the university's reputation, but harm could be caused to human subjects participating in the research (Israel & Hay, 2006). In South Africa alone, there have been numerous instances of research misconduct at various tertiary institutions (Cleaton-Jones, 2000). An example of this was at Wits University where breast cancer treatment results were falsely reported (Cleaton-Jones, 2000; Watts, n.d.). This incident may have potentially harmed participants (therefore violating ethical codes of conduct) and tarnished the university's reputation. This highlights that research misconduct is a problem in South Africa, despite preventative measures which have been put in place such as laws and research ethics committees.

Law in South Africa requires that research (particularly that conducted on humans) is ethical and does not cause harm to participants. The SA Health Act (2003), provides explicit regulations for conducting research on humans. This serves to highlight once again the

importance of teaching students at universities ethical conduct in order to ensure that laws are not broken. Israel and Hay (2006) note that South Africa was one of the first countries to disseminate guidelines for conducting research responsibly; although these guidelines were at first not compulsory, they are frequently revised. Furthermore, in 2004, South African policy stated that social science research should also be subject to ethical review (Israel & Hay, 2006). This highlights that South Africa does take seriously the need for implementing methods which deal with research misconduct.

2.5.2 South Africa and Responsible Research

There has been very little research on students' knowledge of responsible research in South Africa. One study by Moodley (2007) looked at the effects that apartheid has had on teaching ethics to undergraduate medical students. This study highlights the historical context of South Africa and the part that it may play in the knowledge that students possess (Moodley, 2007).

Despite the apartheid regime being formally over for fifteen years, a study conducted by Walker (2005, p. 53) at a university in South Africa suggested that although the "older apartheid ideology has been subdued…[it has not been] entirely defeated." Many tertiary institutions in South Africa have been built around the culture of those racial groups which were dominant and powerful during the apartheid era (Walker, 2005). The culture of these racial groups (i.e. the dominant cultures of the apartheid times) has as a result of apartheid become strongly entrenched in the institutions culture and traditions (Walker, 2005).

Although the context of the university is an important aspect of learning, there are other factors relating to apartheid that have impacted on certain racial groups more than others (Rushton & Skuy, 2000). These factors would be particularly related to black African

students as many come from disadvantaged backgrounds and have had some exposure to adverse circumstances such as overcrowded homes, no electricity of running water, poorer schools, libraries and study facilities, and poor nutrition (Rushton & Skuy, 2000). These circumstances may have had an impact not only on the cognitive development, but also on the sociomoral development of these students (Rushton & Skuy, 2000). Furthermore, many of these students are expected to learn at a tertiary level in their second language, which can pose more difficulties for those students who are already disadvantaged in some manner (Rushton & Skuy, 2000).

It is important that when conducting a study in a context such as South Africa that these factors are considered. As has been mentioned, the history of South Africa has had an impact on different race groups in different ways. It is therefore important to acknowledge these differences, as they may account for some of the differences in knowledge that students possess with regard to responsible research.

2.5.3 The University of KwaZulu-Natal and Responsible Research

For the University of KwaZulu-Natal, research is conducted primarily to "develop new knowledge; interpret and integrate knowledge; pass on knowledge and provide education at a high level; apply knowledge and use it for the benefit of society; and to contribute to the growth of broad based intellectual cultures" (University of KwaZulu-Natal[2] I, n.d., p. 1).

The University of KwaZulu-Natal has several policies in place that provide rules and guidelines for the conduct of research. The university takes responsibility for ensuring that any research conducted under the institution's name has been approved by a research ethics committee (University of KwaZulu-Natal[3] V, n. d.). The university also has a Research

[2] http://www.ukzn.ac.za
[3] http://www.ukzn.ac.za

Office which deals with ongoing issues that arise when research is taking place (University of KwaZulu-Natal[3] V, n.d.). Many of the policies developed by the university have been developed on the basis of ethical guidelines such as the CIOMS and the US Office of Research Integrity guidelines and principles (University of KwaZulu-Natal[3] I, n.d.).

The University of KwaZulu-Natal notes in its policies that "pressure to publish is a modern fact of academic life with a strong bearing on the career and standing of the researcher" (University of KwaZulu - Natal[3] V, n.d., p. 9). This is, however, followed by a number of guidelines enforcing responsible ways of publishing research (University of KwaZulu-Natal[3] V, n.d.). Although these guidelines are emphasised in the research policies, it seems that University of KwaZulu-Natal has developed an atmosphere which encourages publication and places pressure on researchers to do so. Over the last few years, the retirement policy of the university has stipulated that academic staff within the institution need to retire at 60 years old (University of KwaZulu-Natal[3] II, n.d.). Should academic staff wish to extend their retirement by a year, they should have a good publication record, which places immense pressure on those who only wish to retire when they are 65 years old (University of KwaZulu-Natal[3] II, n.d.).

2.5.4 Knowledge of Responsible Research

Very little is known about how much students at universities know about responsible research, despite a consensus across disciplines that "graduate training in the responsible conduct of research is vital to the continued growth of the field" (Fisher, Fried, Goodman & Germano, 2009, p. 227). Vasgrid (2007) notes that graduate students often complain about receiving little or no instruction in responsible research. This often means that, after three years of undergraduate training, little is known about conducting research responsibly

(Heitman & Bulger, 2007). According to Heitman *et al.* (2007), there are numerous reasons why it would be beneficial to conduct an assessment of students' knowledge of conducting research responsibly. Firstly, little may be known about a student's past research and education experience, which may have a significant effect on the amount of knowledge they enter their postgraduate studies with (Heitman et al., 2007). Many educators also make the assumption that students know enough. Little emphasis is therefore placed on the value of learning research skills and methods of conducting research (Heitman et al., 2007). Finally, there is the assumption that there is no need to teach responsible research as students' "morals and integrity" should be established and therefore no further instruction is required (Heitman et al., 2007, p. 838).

A study conducted by Heitman *et al.* (2007) on biomedical students at tertiary institutions in the USA suggested that they did not have sufficient knowledge of conducting research responsibly. Furthermore, variables (age, research experience and research training) were shown to be non significant which suggested the possibility of other variables that may affect students' knowledge of conducting research responsibly.

A study conducted by Fisher *et al.* (2009) aimed to explore various factors that contribute to the responsible conduct of research of graduate psychology students. The factors explored included "RCR (Responsible Conduct of Research) instruction and modelling by research mentors;…department policies, faculty and student practices;…and student's confidence in their ability to conduct research responsibly" (Fisher et al., 2009, p. 227). The findings of the study indicate that the environment of graduate students plays a significant role in their knowledge of responsible research principles and values (Fisher et al., 2009). Graduate

students' environments appear to be affected by the atmosphere fostered, policies and guidelines, and the quality of mentorship which is received (Fisher et al., 2009).

As the incidence of research misconduct is on the rise it is important that those areas which are said to prevent research misconduct are explored. In this case the area of exploration is the knowledge of conducting research responsibly. This study not only focuses on the gap in the literature with regard to students' knowledge of conducting research responsibly in the social sciences, but it also considers this gap in the South African context with regard to this topic.

2.6 Summary

In the sections above, the history and development of ethical codes and guidelines were discussed in relation to research misconduct. Many codes and guidelines have been developed in response to studies which violated human dignity and rights. It can also be seen from the discussion above that, although social science ethics were initially based on the medical sciences, it has now come to develop its own set of practices and ethical guidelines. Research conducted in the social sciences should be conducted in an ethical manner, particularly because much research conducted in this field involves human participants.

The concept and causes of research misconduct were also discussed. It was noted that the incidence of research misconduct is on the rise. Individual causes such as immorality and environmental causes such as the lack of education and poor training were discussed. Furthermore, this section looked at the two major ways that research misconduct could be dealt with – either through corrective measures or through preventative measures. It

concluded that although these two measures have been effective to some extent, it is also necessary to foster values and standards through the concept of responsible research. Responsible research was defined and discussed in terms of the principles developed by the Office of Research Integrity in the U.S. The discussion considered both individual and environmental factors which contribute to conducting research in a responsible manner.

It was evident that very little research has been conducted into this area, particularly with regard to the knowledge which students at tertiary institutions have obtained through both their studies and experience. On the whole, it appears that biomedical students have insufficient knowledge of conducting research responsibly. It was also evident that no such studies have been conducted within the social sciences and in South Africa in particular. It is notable that if research is not furthered in this area, then responsible research may not be developed into an effective preventative method for dealing with the rise of research misconduct.

3. RATIONALE

The incidence of research misconduct has been shown to be on the rise (Drenth, 2006; Weed, 1998). Despite the development of policies, codes, corrective measures and other interventions aimed at dealing with research misconduct, it is still occurring, which suggests that current ways of dealing with research misconduct are ineffective (Drenth, 2006). In order to develop more effective ways of managing research misconduct, it is imperative that research is furthered in this area so that intervention methods can be based on factual knowledge rather than just on the management of the extreme incidences of research misconduct.

Those researchers who conduct their research responsibly are thought to have applied "good citizenship... to professional life" (Steneck, 2004, p. 6). It is thought that responsible researchers are developed both through individual (DuBois, 2007) and environmental factors (Braunschweiger & Goodman, 2007; Drenth, 2006; Kalichman, 2007; Vasgrid, 2007), which contribute to the holistic development of the researcher. One of the main ways of enhancing the conduct or responsible research is through the use of educative and preventative methods (Macrina, 2007). However, there has been very little research conducted in this area, particularly with regard to the education methods of promoting responsible research.

Education about responsible research as well as about research ethics is often received by students studying at tertiary institutions (Vasgrid, 2007). It is thought to be within the university's best interests to ensure that students conduct research responsibly (Israel & Hay, 2006). As a result, many institutions have policies, guidelines and research ethics committees in place in an attempt to manage research misconduct. Very little is known, however, about the amount of knowledge students have about conducting research responsibly. A study conducted by Heitman *et al.* (2007) on biomedical students at tertiary institutions in the USA suggested that they did not have sufficient knowledge of conducting research responsibly.

Social science research engages with a broad range of ethical issues, particularly with regard to the use of human participants (Lutabingwa & Nethonzhe, 2006). In light of the need to conduct research in this area, as well as the gap in the literature regarding social science postgraduate students, it was decided to adapt Heitman *et al.*'s (2007) study to a South African context. Based on the results of the Heitman *et al.* (2007) study, it was hypothesised that social science postgraduate students would not have adequate knowledge of responsible

research. It was further hypothesised that a number of variables (age, gender, race, research experience, research training) could have an impact on postgraduate students' knowledge of conducting research responsibly.

4. METHODOLOGY

4.1 Aims and Hypotheses

4.1.1 Aims

The main aims of the present study are:

1. To determine whether postgraduate social science students have adequate knowledge of conducting research responsibly.
2. To determine whether those social science students with previous research experience and training have more knowledge about responsible research than those with less research experience and training.

4.1.2 Hypotheses

To meet these objectives, and in consideration of Heitman et al's. (2007) findings, the following hypotheses will be investigated:

1. Students who have previous research experience (published research, completed research project, hands on experience as a research assistant) are more likely to have higher scores on the questionnaire, than those students who are inexperienced.
2. Students who have received extensive training (as determined by the questionnaire – Appendix A) in research ethics and research methods are more likely to be associated with higher scores on the questionnaire than those students who have received little or no training.
3. A high score on the questionnaire (Appendix A) is more likely to be associated with older students than younger students.

4.2 Design

This study was an empirical study using primary survey data. A multiple choice questionnaire developed by Heitman *et al.* (2007) was adapted and administered to the postgraduate social science students of the University of KwaZulu-Natal. The questionnaire was administered using an email response method.

A quantitative design was chosen primarily because the study was developed using research conducted by Heitman *et al.* (2007). Heitman *et al.* (2007) used a survey method to collect data. As this study is an adaptation of the Heitman *et al.* (2007) study, it was decided that a similar methodology would be used. There are also numerous advantages associated with survey research designs. These include "low cost; no field staff required; easy access to

otherwise difficult to locate, busy populations" (Owens, 2002, p. 4;). A survey design was therefore relevant for the population chosen for this study because postgraduate students are not generally on campus as often as undergraduates, and they are considered to be generally busy and are therefore difficult to access.

Some of the disadvantages of a survey design study include "difficulty obtaining cooperation; no interviewer involved in the collection of data; more likely to need an incentive for respondents; slower data collection period" (Owens, 2002, p. 4). It must be noted that during the data collection process many of these difficulties were encountered.

4.3 Population

The humanities, development and social sciences faculties produce many postgraduates and researchers who conduct research in areas such as "public health, road safety, education, advertising, marketing, government policy formulation, political activism, personnel selection and development etc." (Terre Blanche & Durrheim, 2002, p. v.). Effective, useful, valid and ethical research in any of the above areas requires knowledge of research methodology and research ethics. As has been noted in the literature review, very little is known about the training of students in the social sciences. It was primarily for this reason that this population of students was chosen.

Although there are many humanities, development and social science faculties at different universities in South Africa, it was decided to focus on University of KwaZulu-Natal students. The primary reasons being because of the cost, convenience and time constraints of this study.

4.4 Sample Assignment

Initially it was decided that participants would be sampled using a simple random sampling method (Kerlinger, 1986; Durrheim, 1999). This method has been broadly defined as "probability sampling" (Durrheim, 1999, in Terre Blanche & Durrheim, 1999, p. 276). Basically, this sampling entails that the population is numbered from 1 to n and numbers are picked randomly by a computer programme. However, due to the poor response rate, it became necessary to sample the entire population of registered postgraduate social science students in order to achieve the sample size of 64 participants. It must be noted that non-probability sampling was inevitable in this instance as the main focus was to recruit enough participants to provide sufficient data for analysis.

The sample was therefore obtained through non-probability sampling. This method of sampling may yield some disadvantages for the statistical principle of randomness (which is associated with probability sampling) (Durrheim, 1999; Kerlinger, 1986;). Firstly, because the sample obtained is not associated with probability, it may not accurately represent properties of the overall population (Durrheim, 1999; Kerlinger, 1986). Secondly, non-random sampling may mean that the sample is biased in some way (Durrheim, 1999; Wilkinson, 1999).

4.5 Instrument

The instrument used was an adaptation of the multiple-choice questionnaire (APPENDIX B) developed by Heitman *et al.* (2007), which consists of 30 content questions and 12 demographic items. The questionnaire was developed over three phases. The first phase of the development of the questionnaire began with an analysis of "the content of 20 key

instructional resources in research integrity in the biomedical sciences, published in the United States between 1984 and 2004" (Heitman et al., 2007, p. 839).

Once the first phase was complete, "standard approaches to designing multiple-choice tests... [were used to] construct 50 objective multiple-choice test questions" representing the nine identified core instructional areas (Heitman et al., 2007, p. 839). Commonalities were identified amongst the wide range of principles, standards, regulations and issues of research integrity (Heitman et al., 2007). These commonalities were then categorised into nine core instructional areas of responsible research (Heitman et al., 2007). These questions were then reviewed by a five-member committee, who evaluated "the content, wording, and balance of test questions within each core instructional area and assisted with the clarification and revision of some items" (Heitman et al., 2007, p. 839).

Focus groups were conducted in the final phase of questionnaire development to identify "factors in undergraduate education and research experience that students believed related to their knowledge of RCR and the applicability of graduate RCR education" (Heitman et al., 2007, p. 839). The results of this phase were used to develop fourteen demographic questions (Heitman et al., 2007). There were no reliability statistics reported for the instrument.

The primary reason for the adaptation of Heitman *et al.*'s (2007) questionnaire in the current study was because the focus was on knowledge that biomedical students should have about conducting research adequately. It is however notable that there is much overlap between the knowledge that social science students require and the knowledge that biomedical students require. Despite this it was necessary to include questions that were especially relevant for social science students. Those items that could be adapted from Heitman *et al.*'s (2007)

questionnaire were adapted, and other items were constructed using university policies and the Office of Research Integrity's nine core principles of conducting research responsibly. Permission for adaptation was obtained from the authors. Items that were not applicable to the South African context and to the specific population of postgraduate social science students were omitted. For example, most social science students do not conduct their research in a laboratory, therefore they cannot be expected to know about this. The following items were taken from the Heitman *et al*. (2007) questionnaire: 5; 6; 7; 8; 9; 11; 12; 17. Questions 2; 3; 10; 14 and 16 were amended or adapted from the original questionnaire, while questions 1; 4; 13; 18 and 19 were new questions developed specifically for the purposes of the social sciences.

4.6 Sample

The Information Management Division at the University of KwaZulu-Natal was consulted with regard to the number of registered postgraduate students in the Faculty of Humanities, Development and Social Sciences. Permission was also obtained from this division and access was provided to registered students' student numbers. There were 582 postgraduate humanities, development and social science students registered at the University of KwaZulu-Natal at the time of this study (Registration Statistics, 2009). However, access to all 582 students was limited, as many of their email addresses had expired. As a result of this, the population accessed was approximately 482 students. A further reason for the limited population was that there was uncertainty around whether or not some of the students were using their university email addresses, as many of the emails remained unopened and undeleted.

4.6.1 Sample Size

Before the questionnaire was administered, an *a priori* power analysis was conducted using G*Power. Using Cohen's estimates of effect size (*d*) a= 0.2 and assuming that alpha (α) = 0.05, a sample size (*N*) of 150 participants was required in order to achieve a 0.8 level of power (1-β) (Buchner, Faul & Erdfelfer, 2007; Howell, 2007).

As the study progressed, however, it was evident that, with the small population and poor response rate to the survey, a sample size of 150 participants was likely to be unattainable. Erdfelder (1984, in Buchner et al., 2007, p. 4), developed a concept known as a "compromise power analysis", which was developed "for cases...in which pragmatic constraints prohibit that our investigations follow the recommendations derived from an a priori power analysis". Using G*Power to perform this analysis, it was determined that, with an effect size (*d*) of 0.3 and alpha (α) at 0.05, a sample size (*N*) of 64 participants would be required in order to achieve a 0.8 level of power (1-β). This was considered to be sufficient to warrant going ahead with this research.

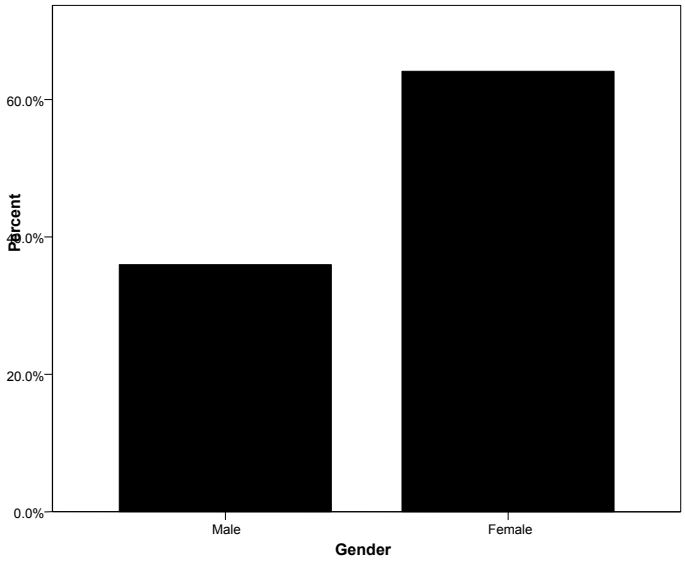
4.6.2 Demographic Data

In order to increase the number of participants who completed the questionnaire, it was necessary to send out the questionnaire on several occasions. Of the 2500 sets of questionnaires that were distributed, 67 (2.7%) questionnaires were returned, of which 3 (0.12%) were unusable. Data for the demographic groups can be found below, using 64 participants as the denominator. The data for faculty or discipline was not included in the demographic data (or analysed) because it appeared from the responses of the participants that many had misunderstood the question and indicated that they were studying in the Humanities Faculty.

4.6.2.1 Gender

Of the total sample group, 35.9% (*n*=23) were men and 64.1% (*n*=41) were women, as depicted in Figure 1.

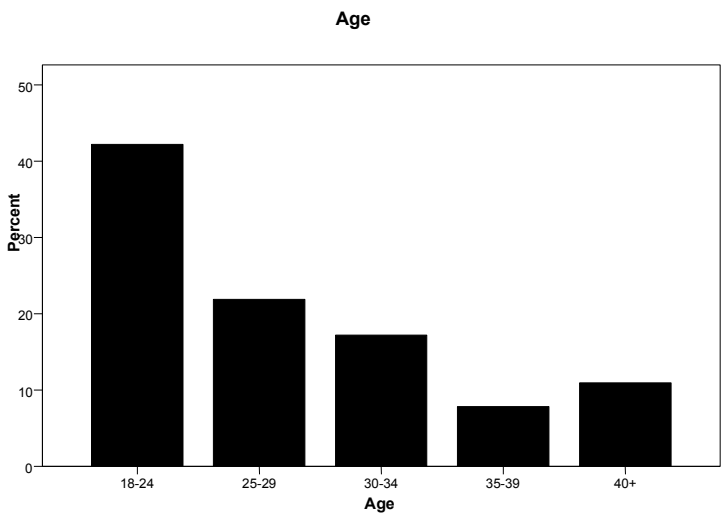
Figure 1: Gender



4.6.2.2 Age

Age of the sample participants was between 17 and 40 years of age. The majority (*n* = 27; 42.2%) of the sample fell into the 18 – 24 year age category. The 25 – 29 year age category was next (*n* = 14; 21.5%), followed by the 30 – 34 year age category (*n* = 11; 17.2%). The 40+ year age category (*n*=7; 10.9%) was followed by the 35 – 39 year age category (*n* = 5; 7.8%).

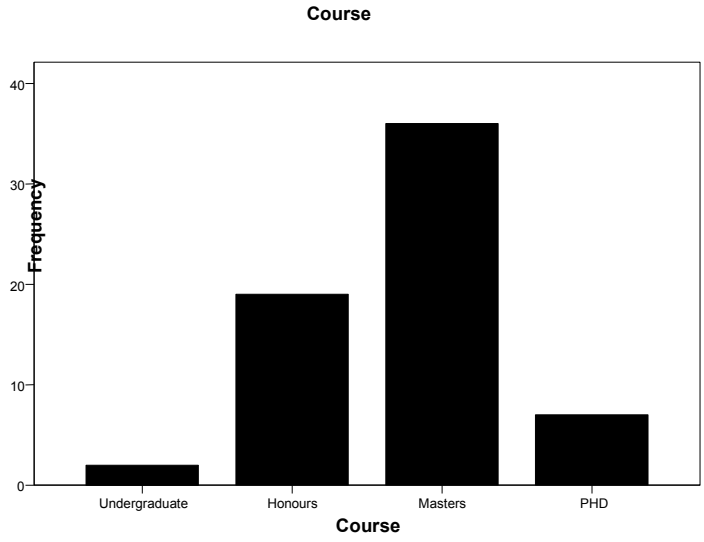
Figure 2: Age



4.6.2.3 Current Degree Course

The student sample was made up of 2 undergraduate students (3.1%), 19 honours students (29.7%), 36 masters students (56.3%) and 7 PhD students (10.9%). It must be noted that there were no undergraduate students present within the sampled population. Those students who ticked the undergraduate degree level were honours students currently completing their honours degree.

Figure 3: Current Course of Study



4.6.2.4 Other Demographics

Race: The student sample was made up of 35 Black students (54.7%); 20 White students (21.3%); 6 Indian students (9.4%); 2 Coloured students (3.1%) and 1 Other student (1.6%).

Research Experience: 16 (25%) of the sample participants had had no research experience and 48 (75%) of the participants indicated that they had prior research experience.

Publication: Of the sample, 9 (14.1%) students indicated that they had published some of their research, while 55 (85.9%) students indicated that they had not published their research.

Research Methods Courses: Of the sample, only 3 (4.7%) students indicated that they had not completed any research courses. 45 (70.3%) students had completed some courses, while 16 (25%) had completed extensive research courses.

Research Ethics Courses: 16 (25%) students had completed no research ethics courses, 40 (62.5%) students had completed some research ethics courses, and 8 (12.5%) students indicated that they had completed extensive research ethics courses.

Research Project: The sample showed that exactly half the student (n = 32; 50%) sample had completed a research project, and exactly half of the student (n = 32; 50%) sample had not completed a research project.

Research Assistant: The majority of the sample (n = 51; 79.7%) had never worked as a research assistant, while only 20.3% (n = 13) of the sample indicated that they had worked as a research assistant.

Research Courses at an Undergraduate Level: Of the sample, 60.9% (n = 39) students had not completed research courses at an undergraduate level, while 39.1% (n = 25) students had completed research courses at an undergraduate level.

4.7 Procedure

Data was collected using an email response method. There was initially some difficulty in obtaining student email addresses, which meant that the data collection was delayed. Students were emailed the multiple-choice questionnaire (with demographic questions attached) along with the informed consent sheet. The informed consent sheet included information about the study and also included an opt in or an opt out clause (See Appendix A). Once replies had been received, identifying details were immediately delinked from the email and were given a number in order to ensure confidentiality. Three databases were kept. The first was a list of email addresses from whom a reply had been received, to prevent duplicate sending. Secondly, a list of participants who had opted out was kept (so that no further emails were sent), and thirdly a list of addresses from whom no email had been received (so that a reminder email could be sent).

An email response method is relatively inexpensive and allows for direct communication with participants (Andrews, Nonecke & Preece, 2003). Email response methods also provide the ability to track questionnaires, and to ascertain whether or not the email was "...responded to...deleted...or undeliverable" (Andrews et al., 2003, p. 187).

There are several disadvantages associated with email surveys, which include alteration of the email by the respondent; confusion over questions; difficulty answering the questions in the email or attachment (Andrews et al., 2003). An attempt was made to manage the

alteration of the questionnaire by developing it into a form and then protecting it, which meant that participants could only select and change certain aspects of it. Despite this precaution, there was nonetheless a small number ($n = 2$) of responses in which the questionnaire was corrupted.

The response rate to this method was also extremely slow and questionnaires had to be sent out numerous times in order to get the responses required for the completion of the study.

4.8 Data Analysis

The data comprised multiple choice questionnaire responses and the results were generated by scoring these responses. The data was analysed quantitatively using the Statistics Package for Social Sciences (SPSS, 2006). Descriptive statistics were firstly used to analyse the information obtained from the demographic part of the questionnaire. Secondly, following some of the procedures used in the Heitman *et al.* (2007) study, either a *t*-test or a one way ANOVA was employed to compare the overall test score percentage between and within demographic groups. Following this, cross tabulations were run in order to determine whether or not there were any demographic variables associated with each other. Finally, the content areas of the questionnaire were analysed (by identifying those questions answered mostly correct and those questions answered mostly wrong). Independent *t*-tests were conducted to determine whether or not there was any significance between some of the content areas. Scores were determined significant at $p < 0.5$ level.

4.8.1 Reliability Testing

Reliability analyses were performed on the questionnaire to establish the internal consistency of the measure. The low alpha (Cronbach) value of 0.244 suggests that the scale was not a

sufficiently reliable measure. A factor analysis was also conducted in order to determine whether or not there were specific items affecting overall reliability. It was apparent that there are no questions which, if removed, affected the reliability. The results of the factor analysis can be seen in Appendix C .

Heitman *et al.* (2007) do not mention the reliability statistic of the original questionnaire in their paper. The low reliability of the questionnaire used in this study could therefore either suggest that the original questionnaire reliability was low, or it could suggest that the questionnaire used in the study was unreliable because of its use in a differing context. The original study conducted by Heitman *et al.* (2007) was conducted in the United States of America, on Biomedical Postgraduate Students, whereas this study was conducted in South Africa on Social Science postgraduate students.

4.8.2 Descriptive Statistics

The mean scores and standard deviations for each variable were calculated. The variables were categorised as demographic, research experience, and research training.

4.8.3 Inferential Statistics

Inferential statistics were performed on the results in order to determine whether any of the variables significantly affected knowledge of conducting research responsibly. SPSS (2006) was used to run the analyses. One way ANOVAs and *t*-tests were employed to test for significant differences between the means scores of the variables, while bivariate correlations were run to explore whether there were any associations between certain variables.

4.9 Ethical Considerations

A research proposal (together with the questionnaire) was approved by the Humanities Research Ethics Committee at the University of KwaZulu-Natal. The recruitment of participants for completion of the questionnaire was on a voluntary basis. The volunteers were informed of their freedom to choose not to participate and of their right to withdraw. Information was provided to the participants by means of an information form (included in the email – See **Appendix A**. An opt out clause was present in the information form, which allowed participants to choose whether or not they wanted to receive reminder emails. No risks or potentially harmful consequences of the questionnaire were anticipated, as the questionnaire had no effect on the courses being completed at the University of KwaZulu-Natal. Furthermore, participants were ensured confidentiality. Once their questionnaire was completed, the response was delinked from the email so that no identifying details could be associated with the questionnaire. No incentives were provided to the participants. They received no direct benefits from the study. However, it was hoped that results of the study would be of benefit to the broader population in future. Specifically in terms of understanding responsible research and exploring ways and methods that could be increased so as to decrease the incidence of research misconduct.

5. RESULTS

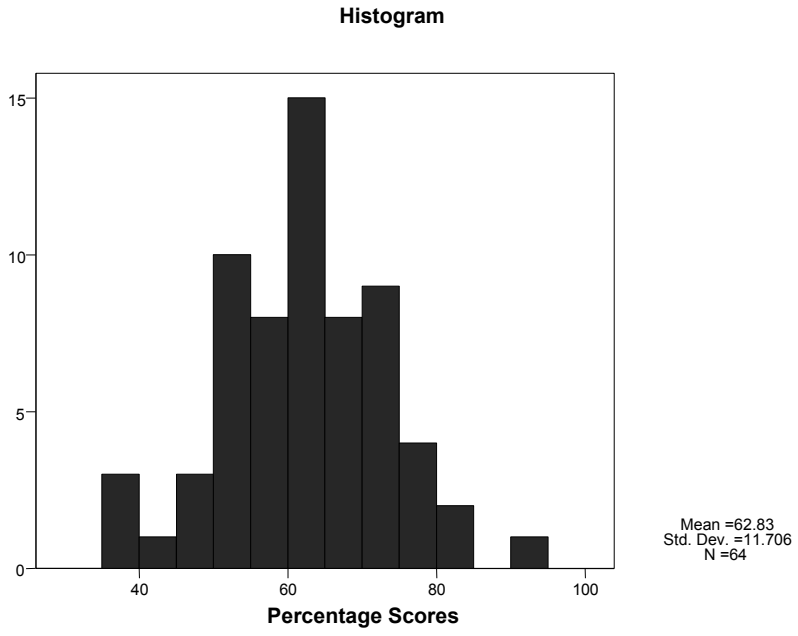
This chapter presents the results generated by an analysis of the data collected in the investigation. Firstly, descriptive statistics were used to analyse the scores obtained by the participants. A histogram was created to view the distribution of the scores. Descriptive statistics were then run on the variables (demographics included) so that means could be compared within each variable. One way ANOVAs and *t*-tests were then employed in order

to test the hypotheses set out in the methodology section. Finally, correlations were conducted on various variables to see whether there was a significant relationship between them.

5.1 Distribution of Scores

The histogram below indicates that the scores were normally distributed within the sample, with the mean (62.83; *SD* = 11.706; *N* = 64) and the median (63) being almost equivalent. The scores ranged from 37% to 95%, with fewer than 5 participants scoring above 80% and fewer than 5 participants scoring below 40%. The normal distribution of the data meant that parametric tests (such as one way ANOVAs or independent samples *t*-tests) could be used to test for significant differences within the data.

Figure 4 Hist



Frequency

5.2 Mean Scores

5.2.1 Age

The average percentage scored for the 27 participants in age 18 – 24 age category was 65.48 (*SD* = 12.618). This was marginally higher than the mean scores obtained in the other age categories. The lowest mean score was 53.80 (*SD* = 11.212), which was obtained by the 5 participants in the 35 – 39 age category. The mean score of the 25 – 29 age category was 60.93 (*SD* = 8.147; *n* = 14), while the 11 participants in the 30 – 34 age category obtained a marginally higher mean score of 63.18 (*SD* = 11.720). The 40+ age category obtained an average score of 62.29 (*SD* = 13.561; *n* = 7), which was similar on average to the 30 – 34 age category. The data show that, in general, the largest group and youngest of students obtained the best scores. The mean scores by age are presented in table 5.1 below.

Table 5.1

Means for Age Categories of Participants

	Mean Score	Standard Deviation	*n*

Age	18 – 24	65.48	12.617	27
	25 – 29	60.93	8.147	14
	30 – 34	63.18	11.720	11
	35 – 39	53.80	11.212	5
	40+	62.29	13.561	7

5.2.2 Race

The one participant in the 'other' race category obtained a mean score (*M* = 73.00; *SD* = 0.00) which was the highest. This score was followed by the Indian race group, which obtained a mean score of 68.50 (*SD* = 10.502; *n* = 6). The 20 White participants obtained a mean score of 65.60 (*SD* = 13.941), which was lower on average than the Indian race group and higher on average than both Black (*M* = 60.11; *SD* = 10.372; *n* = 35) and Coloured (*M* = 60.50; *SD* = 3.536) race groups. The mean scores by race are presented in table 5.2 below.

Table 5.2

Means for Race Categories of Participants

		Mean Score	**Standard Deviation**	***n***
Race	Black	60.11	10.372	35
	White	65.60	13.941	20
	Indian	68.50	10.502	6
	Coloured	60.50	3.536	2

	Other	73.00	0.00	1

5.2.3 Gender

The 23 male participants obtained a mean score of 57.87 (*SD* = 12.319), which was on average lower than the mean score of 65.61 (*SD* = 10.502) obtained by the 41 female participants. However, the female category was almost double the size of the male category, which could account for the difference in scores. The mean scores by gender are presented in table 5.3 below.

Table 5.3

Means for Gender of Participants

		Mean Score	Standard Deviation	*n*
Gender	Male	57.87	12.319	23
	Female	65.61	10.502	41

5.2.4 Research Experience

The research experience that postgraduate students had was compared to the percentage obtained on the questionnaire. The following categories were used to determine research experience: research experience; publication (of research conducted); research project (completion) and research assistant (job or work). The mean scores by research experience are presented in table 5.4 below.

Table 5.4

Mean Scores of Postgraduate Students with Research Experience

		Mean Score	Standard Deviation	*n*
Research Experience	Yes	62.96	11.649	48
	No	62.44	12.253	16
Publication	Yes	61.56	15.653	9
	No	63.04	11.102	55
Research Project	Yes	64.19	10.072	32
	No	61.47	13.161	32
Research Assistant	Yes	69.23	9.514	13
	No	61.20	11.729	51

Participants who indicated that they had research experience obtained a similar mean score (M = 62.96; SD = 11.649; n = 48) to the mean score (M = 62.44; SD = 12.253; n = 16) of the 16 participants who indicated that they had no research experience.

The 9 participants who had published research obtained a mean score of 61.56 (SD = 15.653), which was marginally lower than the mean score (M = 63.04; SD = 11.102; n = 55) obtained by those participants who indicated that they had not published their research.

The mean score (M = 64.19; SD = 10.072; n = 32) of participants who had completed a research project, was higher than the mean score (M = 61.47; SD = 13.616; n = 32) of those participants who had not completed a research project.

The 13 participants who had work experience as a research assistant obtained a mean score of 69.23 (SD = 9.514), which was higher than the mean score (M = 61.20; SD = 11.729) of the 51 participants who had not worked as a research assistant.

5.2.5 Amount of Research Experience

This category was developed in order to determine how much research experience each participant had. If the participant had no research experience, they received a score of 0, if they had one of the three categories (publication, research assistant or research project), they scored 1, if they had two of the categories (publication, research assistant or research project), they scored 2 and if they had all three of the categories (publication, research assistant or research project), they scored 3.

Table 5.5

Mean scores of Amount of Research Experience

Amount of Experience	Mean	Standard Deviation	*n*
0	63.50	12.396	14
1	60.46	11.582	37
2	65.00	11.730	6
3	72.14	6.694	7

It is evident from a comparison of the mean scores in table 5.5 that the 7 participants with the most research experience had a higher mean score (M = 72.14; SD = 6.694) than the mean score (M = 65.00; SD = 11.730, n = 6) of the participants with category 2 amount of research experience. However, participants with no research experience obtained a higher mean score (M = 63.50; SD = 12.396; n = 14) than the mean score (M = 60.46; SD = 11.582) of the 37 participants who fell into category 1 of research experience.

5.2.6 Training in Research Methods and Ethics

The level of training received by postgraduate students was grouped into research methods and research ethics categories. Level of research training received was determined by the categories: none (no educational experience), some (some courses completed at a postgraduate or undergraduate level), and extensive (many courses completed at a postgraduate or undergraduate level). Students were also asked to indicate whether or not they had received any of this training at an undergraduate level, which is why only a yes and no category are present in table 5.6.

Table 5.6

Mean Scores of Postgraduate Students with Training in Research Methods and Ethics

		Mean	Standard Deviation	*n*
Research Methods	None	57.67	13.614	3
	Some	62.80	11.984	45
	Extensive	63.88	11.093	16
Research Ethics	None	58.56	14.357	16
	Some	65.23	10.386	40
	Extensive	59.38	10.127	8
Undergraduate	Yes	63.12	13.343	25

No	62.64	10.708	39

The 16 participants who had received extensive training in research methods obtained a mean score of 63.88 (*SD* = 11.093), which was marginally higher than the mean score (*M* = 62.80; SD =11.984; *n* = 45) obtained by the participants who had received only some training, and higher on average than the mean score (*M* = 57.67; *SD* = 13.614; *n* = 3) obtained by the participants with no training.

Participants who had received extensive training in research ethics obtained a mean score of 59.38 (*SD* = 10.127; *n* = 8), which was marginally higher than the mean score (*M* = 58.56; *SD* = 14.357) of the 16 participants who had received no training in research ethics, but was lower on average than the mean score (*M* = 65.23; *SD* = 10.386; *n* =16) of participants who had received some training.

The 25 participants who had completed research courses at an undergraduate level obtained a mean score (*M* = 63.12; *SD* = 13.343) which was marginally higher than the mean score (*M* = 62.64; *SD* = 10.708) of those participants who had not completed research courses at an undergraduate level.

In general, these results show that those participants with training in research methods obtained higher mean scores than those participants with less training. Those participants with some training in research ethics obtained higher mean scores than those participants with extensive and no training in research ethics. Finally, those participants with training at an undergraduate level obtained marginally higher means scores than those participants with no training.

5.2.7 Current Course of Study

The current course of study of the students was categorized into the various levels of degrees. These levels included Honours, Masters and PhD, as shown in table 5.7.

Table 5.7

Mean Scores of Postgraduate Students at Different Levels of Degree

		Mean Score	Standard Deviation	*n*
Level of Degree	Honours	61.74	14.843	19
	Masters	63.44	10.275	36
	PhD	64.00	11.762	7

Participants currently completing a degree at a PhD level had a marginally higher mean score (M = 64.00; SD = 11.762; n = 7) than the mean score (M = 63.44; SD = 10.275; n = 36) of the participants completing a degree at a Masters level, while participants completing a degree at an Honours level had the lowest overall mean score (M = 61.74; SD = 14.843; n = 19).

Masters students' mean scores were higher on average than Undergraduate students' mean scores, while only slightly higher than Honours students' mean scores. The mean scores obtained by the Honours students were marginally higher than the mean scores obtained by undergraduate students. In general, the higher the degree course of study, the better the mean scores obtained by participants.

5.3 Comparisons

5.3.1 Comparison between Age and Percentage Scored on Questionnaire

A one-way ANOVA was run in order to explore whether or not there was a significant effect between age and percentage scored in the questionnaire. The standard deviations were roughly the same and therefore it can be said that homogeneity of variance was met. The box plot showed that the first three age groups were relatively normally distributed. However, the last two age groups were slightly skewed, which could either be due to the sample size, or the robustness of the ANOVA. This was further confirmed by the Levene's test. The *p* value ($p = .489$) was not significant, so the null hypothesis of equality of variance could not be rejected. Both the assumptions of the ANOVA were therefore met.

The 27 participants in the 18 – 24 age group had a mean score on the questionnaire of 65.48 ($SD = 12.617$); the 14 participants in the 25 – 29 age group had an average score of 60.93 ($SD = 8.147$); the 11 participants in the 30 – 34 age group had an average score of 53.80 ($SD = 11.212$) and the 7 participants in the 40+ age group had an average score of 62.29 ($SD = 13.561$). The result of the one-way ANOVA was not significant ($F = .217$; $p = .0319$; $df = 3$). This indicates that there was no significant difference between the age groups and the percentage scored on the questionnaire.

Table 5.8

Comparison of Age Means

			18 – 24	**25 – 29**	**30 – 34**	**35 – 39**	**40+**
	Means		65.48	60.93	63.18	53.80	62.29
Age	**18 – 24**	Significance	-	.758	.981	.250	.966
	25 – 29	Significance	.758	-	.989	.765	.999
	30 – 34	Significance	.981	.989	-	.569	1.00
	35 – 39	Significance	.250	.765	.569	-	.725

40+	Significance	.966	.999	1.00	0.725	-

* The mean difference was significant at the .05 level.

Even though the *F* value of the ANOVA was nonsignificant, *post hoc* analyses were carried out and are presented in table 5.8 above. The results of the *post hoc* analyses show that there were no significant differences between age groups. It can therefore be concluded that older postgraduate students did not have significantly more knowledge than younger postgraduate students.

5.3.2 Comparison between Gender and Percentage Scored

An independent samples *t*-test was run on the gender variable to explore whether this demographic variable had an effect on knowledge of responsible research. The results show that there was no significant (t = -2.657; p = .10) difference between the male (M = 57.87; SD = 12.319; n = 23) and female (M = 65.61; SD = 10.502; n = 41) gender groups.
Therefore gender did not have an effect on knowledge of conducting research responsibly.

5.3.3 Comparison between Race and Percentage Scored

A one-way ANOVA was run in order to explore the effect of the variable Race on percentage scored on the questionnaire. The standard deviations were not the same and therefore suggest that homogeneity of variance was not met. The box plot showed that the groups were not normally distributed and some of the groups were skewed. However, this could be accounted for by the sample size or the robustness of the ANOVA. It seems that the assumptions of the

ANOVA have not been met. The Levene's test does suggest, however, that the null hypothesis of equality of variance cannot be rejected (p = 1.222).

The one participant in the race group 'Other' had a mean score on the questionnaire of 73.00 (SD = 0.00); the 6 participants in the Indian race group had a mean score of the questionnaire of 68.50 (SD = 10.502); the 20 participants in the White race group had a mean score of 65.60 (SD = 13.941); the 35 participants in the Black race group had a mean score of 60.11 (SD = 10.372); and the 2 participants in the Coloured race group had a mean score of 60.50 (SD = 3.536). The effect of race on the percentage scored on the questionnaire was not significant (F = 1.340; df = 3; p = .266).

An attempt was made to run *post hoc* analysis on the race variable results. However, it was not possible to run a *post hoc* analysis because there were less than 2 participants in the 'Other' race group. It can therefore be concluded that the variable race had no significant effect on percentage scored on the questionnaire.

5.3.4 Comparisons between Students with Research Experience and Students without Research Experience

Independent samples *t*–tests were run on the research experience variables. The results of the *t*-tests are presented in table 5.9 below. Because each of the categories had to be scored separately (and analyses were run separately), an overall significance level for research experience and percentage scored on the questionnaire could not be obtained. Analyses were therefore run in order to determine the significance between each category and percentage scored on the questionnaire. The results are presented in table 5.9 below.

Table 5.9

Mean Scores of Postgraduate Students with Research Experience

			Yes	No
Research Experience		**Means**	62.96	62.44
	Yes	Significance	-	.879
	No	Significance	.879	-
Publication		**Means**	61.56	63.04
	Yes	Significance	-	.728
	No	Significance	.728	-
Research Project		**Means**	64.19	61.47
	Yes	Significance	-	.357
	No	Significance	.357	-
Research Assistant		**Means**	69.23	61.20
	Yes	Significance	-	.260
	No	Significance	.260	-

***** The means are significant at the .05 level

The 48 participants who indicated that they had research experience (M = 62.96; SD = 11.649) and the 16 participants who indicated that they had no research experience (M = 62.44; SD = 12.253) demonstrated a nonsignificant difference in performance on the questionnaire (t = -.521; p = .879). These results were not expected as those with research experience did not consistently perform better on the questionnaire than those without research experience.

The 9 participants who had published their research (M = 61.56; SD = 15.653) and the 55 participants who had not published their research (M = 63.04; SD = 11.102) demonstrated a nonsignificant difference in performance on the questionnaire (t = -.349, p = .728).

The 32 participants who had completed a research project (M = 64.19; SD = 10.072) and the 32 participants who had not completed a research project (M = 61.47; SD = 13.161), demonstrated a nonsignificant difference in performance on the questionnaire (t = .928; p = . 357). These results were unexpected, as those who had completed a research project did not perform significantly better than those who had not completed a project.

The 13 participants with experience as a research assistant (M = 69.23; SD = 9.514) and the 51 participants without experience as a research assistant (M = 61.20; SD = 11.729), demonstrated a nonsignificant difference in performance on the questionnaire (t = 2.282; p = .260). Those who worked as a research assistant did not perform significantly better on the questionnaire than those who had no experience as a research assistant.

In summary of the results presented above, there were no significant differences found between type and extent of research experience, and percentage scored on the questionnaire.

5.3.5 Comparison between Amount of Research Experience and Percentage Scored

A one-way ANOVA was conducted in order to determine the significance that the amount of research experience had on the percentage scored on the questionnaire. The standard deviations were all similar, except for the category 3 group, which had a standard deviation that was about half the size of the other groups. This suggests that homogeneity of variance may not have been met. Furthermore, the box plot indicates that the scores were not relatively normally distributed, and were slightly skewed. This could however be accounted for by the sample size or the robustness of the ANOVA. Levene's test for equality of variances shows that the null hypothesis of equality of variance cannot be rejected (p = .544).

The 7 participants in the category 3 experience group had a mean score of 72.14 (SD = 6.694); the 6 participants in the category 2 experience group had a mean score of 65.00 (SD = 11.730); the 14 participants in the category 0 experience group had a mean score of 63.50 (SD = 12.396) and the 37 participants in the category 1 experience group had a mean score of 60.46 (SD = 11.582). The effect of amount of experience on percentage scored was however not significant (F = 2.183; df = 3; p = .099).

Table 5.10

Comparison between Amount of Research Experience and Percentage Scored

Amount of experience		**0**	**1**	**2**	**3**
	Means	63.50	60.46	65.00	72.14
0	Significance	-	.830	.993	.365
1	Significance	.830	-	.802	.072
2	Significance	.993	.802	-	.674
3	Significance	.365	.072	.674	-

* The means are significant at .05 level

Even though the *F* value of the ANOVA was not significant, a *post hoc* analysis was run on the results and is presented in table 5.10 above. The results of the *post hoc* analysis suggest that there were no significant differences between the groups. It can therefore be concluded that that those participants with more research experience did not have significantly more knowledge of responsible research than those participants with less research experience.

5.3.6 Comparison between Research Methods Training and Percentage Scored

A one-way ANOVA was run in order to explore whether there was a significant effect between research methods training and percentage scored on the questionnaire. The standard deviations were roughly the same and therefore it can be said that homogeneity of variance was met. The box plot showed that the scores were relatively normally distributed, although slightly skewed. This could, however, be accounted for by the small sample size or the robustness of the ANOVA. This was further confirmed by the Levene's test. The *p* value ($p = .874$) was not significant, so the null hypothesis of equality of variance cannot be rejected. Both assumptions of the ANOVA were met.

The 16 participants in the extensive training group had a mean score on the questionnaire of 63.88 ($SD = 11.093$); the 45 participants in the some training group had a mean score of 62.80 ($SD = 11.984$); the 3 participants in the none training group had a mean score of 57.67 ($SD = 13.614$). The result of the one way ANOVA showed that these differences were not significant ($F = .348$; $p = .707$; $df = 2$).

Table 5.11

Comparison between Research Methods Instruction and Percentage Scored

Level of Training		**None**	**Some**	**Extensive**
Research Methods	Means	57.67	62.80	63.88
None	Significance	-	.748	.683
Some	Significance	.748	-	.948
Extensive	Significance	.683	.948	-

* The means are significant at the .05 level

Even though the *F* value of the ANOVA was not significant, a *post hoc* analysis was carried out and is presented in table 5.11 above. The results of the *post hoc* analysis show that there were no significant differences between the research methods groups. It can therefore be concluded that those participants with more research methods training did not perform significantly better on the questionnaire than those participants with less training in research methods.

5.3.7 Comparison between Research Ethics Training and Percentage Scored

A one-way ANOVA was run in order to explore whether or not there was a significant effect between the amount of training received in research ethics and performance on the

questionnaire. The standard deviations were roughly similar and therefore it can be said that homogeneity of variance was met. The box plot showed that the scores were not normally distributed and are slightly skewed. However, this could be accounted for by the sample size, or the robustness of the ANOVA. Levene's test was not significant (p = .874), which means that the null hypothesis of equality of variance cannot be rejected. This means that only one of the ANOVA assumptions was met.

The 40 participants in the 'some' category had a mean score of 65.23 (SD = 10.386); the 8 participants in the extensive category had a mean score of 59.38 (SD = 10.127); the 16 participants in the none category had a mean score of 58.56 (SD = 14.357). The result of the one way ANOVA was not significant (F = 2.345; p = .104; df = 2). This indicates that there was no significant difference between the ethics training received and the percentage scored on the questionnaire.

Table 5.12

Comparison between Research Methods and Ethics Training and Percentage Scored

Level of Training		None	Some	Extensive
Ethics	Means	58.56	65.22	59.38
None	Significance	-	.130	.985
Some	Significance	.130	-	.391
Extensive	Significance	.985	.391	-

* The mean difference was significant at the .05 level.

Despite the non significant F value of the ANOVA, a *post hoc* analysis was carried out and is presented in table 5.12 above. The results of the *post hoc* analysis show that there were no significant differences between the research ethics groups. It can therefore be concluded that participants with more training in research ethics did not have significantly more knowledge

of conducting research responsibly than those participants with less knowledge of research ethics.

5.3.8 Comparison Between Percentage Scored and Course Level

A one way ANOVA was run in order to explore whether or not there was a significant effect between course level and the percentage scored on the questionnaire. The standard deviations were roughly the same and therefore it can be said that homogeneity of variance has been met. The box plot showed that the groups were relatively normally distributed. Levene's test was not significant (p = .186), which means that the null hypothesis of equality of variance cannot be rejected. Both assumptions of the ANOVA were met.

The 7 participants in the PhD group had a mean score of 64.00 (SD = 11.762); the 36 participants in the Masters group had a mean score of 63.44 (SD = 10.275); and the 21 participants in the Honours group had a mean score of 61.38 (SD = 14.214). The result of the one way ANOVA was not significant (F = .217; df = 3; p = .884). This indicates that there was no significant difference between level of course and the percentage scored on the questionnaire.

Table 5.13

Comparison between Percentage Scored and Course Level

Course Level		Undergraduate	Honours	Masters	PhD
	Means	58.00	61.74	63.44	64.00
Undergraduate	Significance	-	.975	.923	.923
Honours	Significance	.975	-	.958	.973
Masters	Significance	.923	.958	-	.999
PhD	Significance	.923	.973	.999	-

* The mean differences were significant at the 0.5 level

Even though the *F* value of the ANOVA was nonsignificant, a *post hoc* analysis was carried out and is presented in table 5.13 above. The results of the *post hoc* analysis show that there was no significant differences between the course level groups. It can therefore be concluded that level of course had no significant effect on participants' knowledge of responsible research.

5.5 Correlations

5.5.1 Correlation between Age and Research Experience

Correlations were run on age and research experience variables in order to explore whether there was a significant relationship between age and research experience. The results of the correlations are presented in table 5.14 below.

Table 5.14

Correlation between Age and Research Experience

		Published	Project	Assistant	Research Experience
Age	Pearsons (*r)*	-.394**	-.150	.288*	-.087
	Sig. (2-tailed)	.001	.231	.021	.496

** Correlation was significant at the .01 level
* Correlation was significant at the .05 level

A significant negative correlation was found between age of postgraduate students and publication. This suggests that older postgraduate students are less likely to have published research than younger postgraduate students. There was no significant correlation found between age of postgraduate students and the completion of a research project.

A significant positive correlation was found between age of postgraduate students and experience as a research assistant. It must be noted that the relationship between these variables is however relatively small. In this case, it seems that older students had more experience working as a research assistant than younger students. There was no significant correlation found between age and the overall category of research experience.

5.5.2 Correlation between Course Level and Training

Correlations were run to explore the relationship between current course of study and training received in both research ethics and research methods. The results are presented in table 5.15 below.

Table 5.15

Correlations between Course Level and Training

		Research Methods	Research Ethics
Course Level	Pearsons	.011	.152
	Sig. (2-tailed)	.929	.230

** Correlation was significant at the .01 level
* Correlation was significant at the .05 level

There were no significant correlations between research methods and course level or between research ethics and course level. This is contrary to the expectation that research training is likely to increase as course level increases.

5.5.3 Correlation between Course Level and Amount of Research Experience

Correlations were run to explore the relationship between course level and amount of research experience. The results shown in table 5.16 suggest that there were no significant correlations between the two variables. This means that there is no relationship between the amount of experience participants had and course level.

Table 5.16

Correlations between Course Level and Amount of Research Experience

		Amount of Research Experience
Course Level	Pearsons	.199
	Sig. (2-tailed)	.115

* * Correlation was significant at the .01 level
* Correlation was significant at the .05 level

5.6 Summary of Results

The reliability scores on the questionnaire suggested that the instrument used was not sufficiently reliable. This could be attributed to a number of factors, such as low reliability of the original questionnaire or the use of the questionnaire in a different context.

The mean scores obtained by the participants on the questionnaire were distributed normally. No significant differences were found for the main variables: age, research experience, research ethics and methods training. There were significant correlations for the predicted associations between some of the secondary variables. These secondary variables include: age and research experience. There were non significant correlations present for predicted associations between: course level and training (research methods and ethics); and course level and research experience.

It was also evident from the results section that the three hypotheses set out in the methodology section were not confirmed. This means that participants with previous research experience did not obtain higher scores on the questionnaire (appendix A), than those participants with less experience. The scores of those participants with extensive training in research ethics and research methods were not higher than those participants who had

received little or no training. Finally, older participants did not obtain higher scores on the questionnaire than younger participants.

6. DISCUSSION

This study was an adaptation of Heitman et. al.'s (2007) study, which explored postgraduate biomedical students' knowledge of conducting research responsibly. The aims of this study were: to determine whether or not postgraduate social science students had adequate knowledge of conducting research responsibly and to determine whether those students with previous research experience had more knowledge about conducting research responsibly

than those without research experience. Several variables were hypothesised to have an effect on the amount of knowledge of responsible research. These included: age, gender, race, research experience, research training, and course level.

6.1 Overall Knowledge of Responsible Research

A histogram (figure 4) of the distribution of mean scores indicates that the data was distributed normally. The discussion below compares the results obtained by the Heitman *et al.* (2007) study with the results obtained in this study. It must however be noted that the populations may not be comparable and therefore conclusions drawn with regard to this discussion should be done so cautiously. The majority of participants had a mean score of 62.83 (SD = 11.706, N = 64). This mean score is higher than the mean score of 59.95 (SD = 10.5, N = 251) obtained by the participants in the Heitman *et al.* (2007) study. It therefore seems that, in comparison to the mean score of Heitman *et al.*'s (2007) study, it can be concluded that on average, postgraduate social science students at the University of KwaZulu-Natal have sufficient knowledge of conducting research responsibly. However, Heitman *et al.* (2007) did not provide the cut off mean scores used to indicate sufficient knowledge of conducting research responsibly. For this study, a mean score above 60 percent was used to indicate sufficient knowledge of responsible research, whereas a mean score below 60 percent would indicate insufficient knowledge of responsible research. This distinction is somewhat arbitrary in the absence of empirical cut-off scores.

The conclusions drawn by the Heitman *et al.* (2007, p. 839) study suggested that postgraduate biomedical students "…had inadequate and inconsistent knowledge of RCR [responsible conduct of research] irrespective of their prior education or experience". However, there were a number of differences between the two studies, which could account for the difference in results. Firstly, the Heitman *et al.* (2007) study was conducted on a much larger scale,

which involved a number of different tertiary institutions, as well as a sample size of 250 participants. The current study was conducted at a single tertiary institution, with only 64 participants. Furthermore, the contexts of the two studies differed significantly. The Heitman *et al.* (2007) study was conducted in the USA on postgraduate biomedical students, while this study was conducted on postgraduate social science students in South Africa.

Little was also known about the content of the responsible research or research ethics courses (if any were taken) taken by either the participants in the USA or the participants in South Africa (Heitman & Bulger, 2007). This may suggest that the South African participants had knowledge of how to conduct research responsibly, which differed to the USA participants. This seems unlikely, however, as policies at the University of KwaZulu-Natal are based on codes and guidelines developed in the USA (University of KwaZulu-Natal[4] I, n.d.). This was not evaluated in the present study, so is probably speculation. It is also noteworthy that the reliability of the questionnaire was low, which implies that the validity of the study was also low. Thus, the questionnaire may not have accurately measured participants' knowledge of responsible research.

In the South African context, the results of this study are mildly encouraging. Conducting research responsibly has been defined in the literature as "good citizenship applied to professional life" (Steneck 2004, p. 6). The development of this value, alternatively known as research integrity, has been attributed to individual and environmental factors. A study conducted by Fisher *et al.* (2009) showed that the environment of the institution has a significant effect on the internalisation of the values and principles of conducting research responsibly. The findings of the current study could be accounted for by a combination of both environmental and individual factors arising from the South African context.

[4] http://www.ukzn.ac.za

South Africa is a country which, in the past 15 years, has overcome a violent and troubled apartheid era (Walker, 2005). In a context where many crimes against humanity have been committed, it seems that South Africans may have developed a sense of 'virtue' or justice (DuBois, 2004). This could mean that because of the context in which the participants of this study are immersed, they may have learnt "…how to reason morally and identify the ethical dimensions that are in conflict" (Thompson & Thompson, 1989, in Aita & Richer, 2005, p. 122). South Africans have been forced to deal with issues of morality in a way in which Americans have not. It could however, also be argued that due to South Africa's historical context South Africans have more reason to abandon morality.

The sense of virtue or justice inherent in South Africans, could have implications for the manner in which research is conducted at various research institutions in the country. This is not to suggest that South African research institutions are more effective at increasing knowledge of responsible research than USA research institutions, particularly as the University of KwaZulu-Natal has based their polices, codes and interventions on those developed in the USA (University of KwaZulu-Natal, I, n.d.). It rather suggests that both research institutions and individuals in South Africa are likely to be more sensitive to ethical issues and therefore have an awareness of what it means to conduct research responsibly, which differs to the USA. It seems that South African research institutions have perhaps developed a climate which fosters an internalisation of responsible research values (Fisher et al., 2009). This is, however, an assumption and further research would need to be conducted in order to determine whether or not the above statement has any validity.

Therefore, based on the results of this study, and with acknowledgement of the methodological limitations, it can be tentatively concluded that social science postgraduate students at the University of KwaZulu-Natal have sufficient knowledge of responsible conduct of research. In comparison to the Heitman *et al.* (2007) study, the higher mean score on this study could be attributed to contextual factors, as it was evident from this study that those variables hypothesised to have an effect on the knowledge of conducting research responsibly were not significant.

6.2 Demographics

Some of the demographic variables were hypothesised at the outset of this study to have an impact on participants' knowledge of conducting research responsibly. The results indicate that there were no significant relationships between students' knowledge of responsible research and any of the variables, which may mean that there are other variables (unaccounted for here), which may have impacted on the findings. These findings may also highlight the difference between having knowledge and of responsible research and actually conducting research responsibly.

6.2.1 Age

It was hypothesised at the outset of the study that older participants were likely to perform significantly better on the questionnaire than younger participants. There were no significant differences between age and the percentage scored on the questionnaire. This finding differs from the significant finding in the Heitman *et al.* (2007) study, which suggested that older participants performed significantly better than younger participants on the questionnaire. The direction of the mean scores showed that the 18 – 24 age group (the youngest group) achieved the highest overall mean score, possibly because this group is closer to the period of

research training. This means that as research training has come about in recent years, younger participants are more likely to have been exposed to it than older participants.

The findings of this study may indicate that in a South African context the age of students has no effect on their knowledge of the responsible conduct of research. According to Heitman *et al.* (2007), there is literature which suggests that experience and knowledge increases with age and maturity. It could therefore be assumed that older students should have more knowledge and experience of conducting research responsibly than younger students, who might have less experience and less knowledge. This does not seem to apply to the current study, which showed no significant difference and therefore suggests that other variables may have impacted upon the participants' knowledge of responsible research.

6.2.2 Gender

It is notable that gender did not have a significant effect on knowledge of responsible research. There were no significant findings between gender and the percentage score by participants on the questionnaire. This supports the findings of the Heitman *et al.* (2007) study, which also found no significant difference between gender and knowledge of responsible research.

6.2.3 Race

In light of the South African history of apartheid, it was decided that race would be included as a secondary variable in this study. Apartheid has been the cause of much disadvantage for many racial groups in South Africa to date (Rushton & Skuy, 2000). Even though the era of apartheid has formally come to an end, it has left racial groups in South Africa on an unequal footing (Moodley, 2007). It can therefore be reasoned that those racial groups, where the

majority of students are coming from a disadvantaged background (particularly educational), as well as having to learn in a language which is their second language, may have less knowledge of responsible research than other racial groups.

The results showed no significant differences between the different racial groups and their scores on the questionnaire. Although this could probably be accounted for by the small size of the sample, it does suggest that racial differences may not have as big an impact as it is often thought. It is notable, however, that those participants who have made it through an undergraduate degree to a postgraduate degree are likely to be at the top of their respective 'racial' groups, which suggests that they may not be amongst the most disadvantaged students currently registered at the University of KwaZulu-Natal. Those students who were severely affected by apartheid and have major difficulties with funds and language may not have made it through to postgraduate level education. Research would have to be conducted to determine this, as there is no literature currently which supports the above mentioned point.

6.2.4 Research Experience

Research experience was originally thought by Heitman *et al.* (2007) to have a major impact on postgraduate students' knowledge of conducting research responsibly. However, their findings showed no significant difference between research experience and knowledge of conducting research responsibly (Heitman et al., 2007). In the current study, it was nonetheless hypothesised that there would be a significant difference between research experience and knowledge of responsible research. Research experience was divided up into the following areas: publication of research; completion of a research project; experience as a

research assistant; and amount of research experience. Although no significant findings were found, each of the areas of research experience will be discussed sequentially below.

6.2.4.1 Publication

It appears that there was no significant difference in knowledge of responsible research and participants' publication of research. This does not support the hypothesis that students who have had the experience of publishing their research would have more knowledge of conducting research responsibly. In fact, those participants who had not published their research performed slightly better on the questionnaire than those participants who had published research. One way of interpreting this is that those students who publish may not have conducted the published research as responsibly as they should have. However, this small difference could have been accounted for by the small sample size of the group of participants who had published their research.

Pressure to publish has been cited in the literature as one of the causes of research misconduct (Braunschweiger & Goodman, 2007; Breen, 2008). The primary reason for this is the value which is placed on publications by researchers and the institutions from where they come (Barrett et al., 2004). Despite the value of publishing research, it is evident that many researchers have inadequate knowledge and awareness of responsible publication guidelines (Barrett et al., 2004). Publication guidelines have also been established as the one of the areas which should be included in responsible research instruction (Heitman et al., 2007; Steneck, 2004). It was therefore hypothesised that those participants who had published their research would have more knowledge of conducting research responsibly than those students who had had not published their research.

What is also interesting to note is that even though much of the literature states that there is much pressure from within an institution to publish research, it is evident that only 9 out of the 64 (14%) participants had published research. This suggests that perhaps the pressure for postgraduate students to publish research within an institution is not as great as is often thought. This may mean that pressure is more on academic staff within institutions than on postgraduate students. More research would have to be conducted within the area in order to determine whether or not pressure to publish can be ruled out as a contributing factor to research misconduct. There are variables such as the context of research in the social sciences which may have accounted for the small number of participants that published research.

As has been noted in the literature review, publication pressure at various tertiary institutions is often intense because the more research published, the more likely the institution is to receive funding (Barrett et al., 2004). As the reputation of an institution grows, so too does the institution's publication record. However, as has been noted, pressure to publish research is often a cause of research misconduct, which often means that research has been conducted irresponsibly and potential harm has been caused to research participants (Barrett et al., 2004).

In conclusion, this study suggests that the publication of research does not increase postgraduate social science students' knowledge of responsible research, despite pressure within institutions for publication.

6.2.4.2 Research Project

Completion of a research project was chosen as a variable for research experience because the majority of postgraduate degrees at tertiary institutions require students to complete a

project for part or all of a degree. It is one of the ways postgraduate students are able to obtain research experience under the guidance of a mentor or supervisor (Howard Stone, 2001). This variable was not included in the Heitman *et al.* (2007) study, but it was nonetheless hypothesised that participants who had completed a research project would have significantly more knowledge than those who had not completed a research project. The lack of significant findings here suggests that completion of a research project did not increase knowledge of responsible research.

A research project is considered to be 'hands on' research experience because the postgraduate student completing the project not only conducts the research themselves, but has a supervisor or a mentor providing them with guidance and knowledge (Howard Stone, 2001). Poor guidance and pressure from within a research institution may contribute to the incidence of research misconduct (Barrett et al., 2004; Howard Stone, 2001). The findings of this study could suggest that the mentorship or supervision received by participants when completing a research project does not improve the knowledge that students have of responsible research compared with those who have not done a research project. Mentorship or supervision of a research project could be identified as an area which could be developed to more effectively promote the responsible conduct of research. Further research would be required to explore this further and to develop ways that this could be achieved.

6.2.4.3 Research Assistants

Experience working as a research assistant was also considered to be a variable within the broader category of research experience. It was hypothesised that postgraduate students who had previous experience as a research assistant would have more knowledge of conducting research responsibly than those participants who had no experience working as a research

assistant. Once again, these findings were significant in supporting Heitman *et al.* (2007) who found that experience as a research assistant had no significant effect on students' knowledge of responsible research.

Although there is not much literature which explores the benefit of work as a research assistant, it seems that this type of work may be a valuable as a means of gathering experience and as a possibility of once again being a cause of research misconduct if it occurs without proper training and guidance (Steneck & Bulger, 2007). The non significant findings of this study show that those participants with research experience performed slightly better than those participants without research experience. This may mean that experience as a research assistant may be worthwhile as a way of developing more knowledge of conducting research in a responsible manner. Bulger and Heitman (2007) note that responsible research education is ill defined. In defining responsible research education, it may be worthwhile to consider practical components of research instruction courses, which are known to increase knowledge of conducting research responsibly. More research would have to be conducted in order to determine which practical experiences contribute significantly to knowledge of conducting research responsibly.

6.2.4.4 Amount of Research Experience

In order to try and explore the overall effect of research experience on knowledge of conducting research responsibly, it was decided that a variable known as amount of research experience would be developed. All of the above variables were 'lumped' together and it was hypothesised that the more experience that postgraduate students had, the more knowledge they would have of conducting research responsibly. There were no significant findings for

this variable. They could not be compared to the findings of Heitman *et al.* (2007) as their study did not include amount of research experience as a variable.

It can be concluded that neither research experience type nor amount had an effect on postgraduate social science students' knowledge of responsible research. Although the lack of significant findings could be attributed to the low reliability and validity of the study, they could also suggest that research experience is not a contributing factor to knowledge of responsible research.

6.2.5 Research Training

Training in research ethics and research methodology has been considered an important aspect of the responsible conduct of research (Steneck & Bulger, 2007). Although there are other factors which are thought to contribute to the responsible conduct of research (individual and environmental), education is considered to be one of the most important means of training students in knowledge of conducting research responsibly (Heitman & Bulger, 2007). It was for this reason that it was hypothesised in this study that education in either research methods or research ethics would increase postgraduate students' knowledge of responsible research.

The results showed no significant differences in knowledge of responsible research between those students with training in either research methods or research ethics, and those students without training in research methods or research ethics. Furthermore, there was no significant difference between those students who had received training in the above mentioned fields during their undergraduate training and between those who had received no training. These results support those found by Heitman *et al.* (2007). What these results suggest is that

education in research ethics or methodology has less impact on the knowledge of responsible research than has been suggested in the literature (Steneck & Bulger, 2007).

There are many faculties within the social sciences, which suggests that the content of the courses varies considerably between each of the faculties. This has been noted by Heitman and Bulger (2007), who suggest that education in research ethics or research methodology is often ill defined between and within institutions. In the light of the developments of social science methodology in recent years (Lutabingwa & Nethonzhe, 2006), it is interesting to note that in this study there were some participants who had not received training in research ethics (1 %) or research methodology (25%). The majority of participants (61%) had received no training in either research methods or research ethics at an undergraduate level.

This is an alarming finding about undergraduate students' education and suggests that many of the faculties and disciplines within the social sciences do not see the importance of training in these areas at an undergraduate level. It is notable, however, that despite receiving no training at an undergraduate level, most of these students appear to have had sufficient knowledge on the questionnaire to be able to 'pass'. This may also be an indication that knowledge of conducting research responsibly is less reliant on environmental factors and more reliant on individual factors such as integrity and compliance (Plemmons et al., 2006). The reasoning behind this is that, despite receiving little or no training in research methods or ethics, those students have almost performed as well as those who received training, which suggests that there are other factors which may affect knowledge of conducting research responsibly.

The findings of this study show that research instruction had no significant effect on knowledge of responsible research. This may have been accounted for by the fact that the findings in this study are based solely on self-report by students There was not enough information obtained about the University of KwaZulu-Natal research instruction to conclude whether or not instruction of responsible research was adequate. Although the non significant findings could be accounted for by the lack of reliability and validity of the study, it seems that there may be other variables affecting knowledge of responsible research. Furthermore, it seems that the variable 'training' may have been very vaguely defined within the questionnaire. There is therefore the possibility that these results could be accounted for by this methodological limitation and research training as a variable should not be ruled out until it has been more clearly defined.

6.2.6 Course Level

In terms of training received, there were no significant findings, which suggests that a higher level of degree is not necessarily an indicator of more knowledge of responsible research. These findings support those of Heitman *et al.* (2007), which suggest that education has less of an effect on the knowledge of responsible research than may have been previously thought. This said, those participants studying at a PhD level performed slightly better on the questionnaire than those students at a Masters and an Honours level, but not significantly so. Further research is needed to explore this further.

6.3 Correlations

6.3.1 Age and Research Experience

Correlations were run on the variables age and research experience in order to determine whether there was a significant relationship between the age of the participants and the publication, research assistance, research project and research experience variables. There were no significant correlations between age and the research project variable or age and the research experience variable. There were significant correlations between age and the publication variable and age and the research assistance variable.

The age / publication correlation suggests that there is a relationship between those participants who had published their research and younger participants. This does not imply that age is associated with more research experience as was suggested by Heitman *et al*. (2007). What this highlights is that it may be worthwhile to explore publication and its link to age (as well as other factors, which have been discussed above). The reason for this being that publication pressure is one of the more common causes of research misconduct (Barrett et al., 2004).

The age/assistant correlation suggests that there is a significant relationship between those participants with experience as a research assistant and older participants. This suggests that older participants may have more opportunity and time to gain experience as a research assistant than younger participants. As experience as a research assistant has been discussed as an important variable, which could make a contribution to research education, it may be useful to explore the above assumption further.

There were no significant correlations found for completion of a research project and age and whether or not participants had research experience and age. The reason for this could be that at every level of a postgraduate degree completed at the University of KwaZulu-Natal,

there is a requirement of a research project (of varying lengths) (University of KwaZulu-Natal, V, n.d.). Age does not appear to be a factor in this instance.

6.3.2 Course Level and Research Experience

Correlations were run in order to establish whether or not there was significant relationship between course level and research experience variables (publications, work as a research assistant, completion of a project). It was hypothesised that as course level increases, so too should the amount of experience that postgraduate students have.

There was a significant correlation between course level and publication. The relationship suggests that the higher the level of course, the more likely it was that a student had published their research. This could be due to Masters or PHD students attaching themselves to pre-existing staff projects, which have publication as an outcome. Or, simply that no one really considers publishing work at levels below Masters or PHD. However, it may also indicate that as course level increases so too does pressure from within the institution to publish research (as seen in the discussion about publication).

There was also a significant correlation between course level and completion of a research project. The relationship suggests that the higher the level of course, the more likely a student had completed a research project. This does however seem to have more to do with the requirements at various course levels (honours, masters and PHD) than with students' abilities to conduct research responsibly. This is a more likely relationship than age and research project because it is evident that the honours postgraduate participants will only complete their first research project at the end of their honours year, as this is considered to be their first year of postgraduate study.

There was no significant correlation between experience as a research assistant and level of course. What this suggests is that participants with this experience are at different levels in their degrees, which means that this type of experience can be obtained at any time during postgraduate study.

6.3.3 Course Level and Amount of Experience

The correlation between course level and amount of research experience was also explored to determine whether or not amount of experience increased as course level did. No significant correlations were found, which suggests that course level has no relationship to amount of research experience obtained. It therefore seems that research experience can be obtained at any level of degree. It also seems that the amount of research experience that each individual possesses seems related to characteristics within the individual and not specifically to general course requirements. This is, however, an assumption and research would have to be conducted to determine whether this statement has any significance.

6.4 Summary, Limitations and Implications

6.4.1 Summary

This study attempted to determine whether or not social science postgraduate students at the University of KwaZulu-Natal in South Africa had adequate knowledge of conducting research responsibly. A study conducted by Heitman *et al.* (2007) in the USA was adapted for this study. Although the low response rate and poor reliability of the questionnaire were the main difficulties encountered in this study, the findings were interpreted cautiously.

The overall mean score obtained by the participants suggested that the participants had adequate knowledge of conducting research responsibly. Analysis of variables thought to have an effect on knowledge of responsible research produced no significant findings. This suggests that there may be other variables (such as integrity and compliance), which affect knowledge of responsible research. There were some significant correlations between the variables, which, although these associations did not provide insight into knowledge of responsible research, they did highlight other areas of focus for further research to be conducted in the area.

It was evident that there is a lack of research regarding areas of responsible research and research ethics training, related particularly to students studying at tertiary institutions. Due to ongoing research misconduct, it is imperative that more research is conducted in this area so that a more thorough understanding is achieved so that more effective intervention and prevention methods are established (Dyer, 2005).

6.4.2 Limitations of this Study

There were a number of limitations in this study. Firstly, gathering the data through an email response method posed many difficulties. Some of the participants' email addresses had expired, which made it difficult to access the entire population of postgraduate social science students. This meant that, along with the slow response rate of the participants, the sample size of the population was compromised. Furthermore, non probability bias due to non probability sampling may have also affected the data as a self-selection error may have existed due to the sampling technique used. The slow response rate may have been caused by

the email response method or alternatively it could be accounted for by the nature of the student population from which the sample was drawn.

The low reliability of the questionnaire also appears to have limited the generalisability and validity of the study. Furthermore, the validity and generalisability of the study may have been affected by difficulties with self report methods on the questionnaire, particularly with regard to the questions concerning research instruction and training. As has been mentioned, the low reliability of the study may be due to the differing context between the USA and South Africa, as well as between biomedical students and social science students. Although the questionnaire was adapted as far as possible, it would probably have been beneficial to conduct a pilot study, where the questionnaire could be standardised for the population of social science postgraduate students. However, this may have further compromised the overall sample size, as participants of the pilot study could not have been included in the overall sample.

The non-significance of the variables thought to have an effect on the knowledge of responsible research, suggests that there may be other variables (such as integrity and compliance), which were not explored in this study. These variables may have an effect on the knowledge of responsible research and it may be useful to consider exploring these at a later stage.

While assessing what knowledge social science postgraduate students possess is beneficial, it seems that there is little use for the results of the current study, as it is unclear from the study exactly what kind of training each participant had received. Furthermore, the questionnaire

did not include the amount of training that each participant received, which would have been useful in assessing research training.

6.4.3 Implications of this Study

There are various inferences which can be made from this study. As has been mentioned, it seems that the participants had sufficient knowledge of responsible research. This may be accounted for by the context from which the participants came, or it could suggest that postgraduate social science students have a sense of virtue or justice, which contributes to the way in which they consider research responsibly.

Secondly, as none of the variables were significant, there is the possibility that there are other factors which affect the knowledge of conducting research responsibly which have not been explored in this study. It is therefore imperative that further research is conducted regarding the knowledge of conducting research responsibly in order to determine whether there are any other factors (such as integrity and compliance) that contribute.

Finally, there are very few studies of this nature which have been conducted in South Africa specifically. This is especially relevant for the social sciences discipline, which is often neglected as a topic of study. It is also important that studies conducted in a differing context are not merely assumed to be applicable to South Africa.

7. CONCLUSION & RECOMMENDATIONS

7.1 Key Conclusions

This study showed that social science postgraduate students at the University of KwaZulu-Natal had sufficient knowledge of conducting research responsibly. The overall mean score

obtained by participants in this study was higher than the mean score obtained by the participants in the Heitman *et al.* (2007) study. This may suggest that the context from where the participants came had an impact on their knowledge of responsible research. Variables such as age, race, gender, research experience, training and course level, which were thought to have an impact of knowledge of responsible research, produced no significant findings. This may suggest that the variables explored are unrelated to social science postgraduate students' knowledge of responsible research. It may however have been related to the lower than expected sample size, or to the low reliability of the questionnaire. There were however some significant relationships found between some of the demographic variables.

7.2 Recommendations for Future Research

From the results of this study, it is evident that more research needs to be conducted in this area before any sound conclusions can be drawn. Research focusing specifically on the content of research instruction received needs be conducted, as well as looking at the relevance of education on the prevention of research misconduct.

There were indications in this study that individual factors (such as integrity and compliance) may play a role in the participants' knowledge of responsible research. It may be beneficial for this to be researched in order to determine whether or not individual factors have an impact on knowledge of conducting research responsibly.

Knowledge of conducting research responsibly appears to be a small fragment of what contributes to an individual's decision to conduct research either responsibly or irresponsibly. Furthermore, there appears to be a gap which exists between the knowledge of responsible research and behaviour related to conducting research responsibly. It may be useful to expand this study and compare results across different tertiary institutions in South Africa. With a

larger population, it may be easier to identify those variables which contribute to or have an effect on the knowledge of responsible research. However, this is likely to be a large and complex study, which has various logistical and cost implications.

Finally, future studies in this area should pilot reliable instruments and procedures before commencing formal data collection. Formal cut-offs for measuring low, adequate and high ranges of knowledge of responsible research also need to be established and validated.

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APPENDICES

APPENDIX A: INSTRUMENT

KNOWLEDGE OF THE RESPONSIBLE CONDUCT OF RESEARCH

This questionnaire is adapted from Heitman *et al.* (2007).

Thank you for agreeing to assist with this study. Please save this form on your drive disk before completing it and emailing it back to **Casalis@ukzn.ac.za**. *For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.*

1. **According to some ethical guidelines "the pursuit of knowledge is the pursuit of truth". Therefore research should be carried out with:**
    A. Honesty and integrity.
    B. Safe and responsible methods.
    C. Fairness and equity for the participants.
    D. All of the above.
    E. None of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only□□□□□

2. **How long should research data be stored for before it can be destroyed?**
    A. 5 years
    B. 2 years
    C. 10 years
    D. 3 years
    E. 7 years

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

3. **Under which circumstances can the confidentiality and anonymity of individual participants be disregarded?**
    A. When the research is published.
    B. If permission is granted by the University where the research took place.
    C. When some of the participants agree for their information to be released.
    D. Under any circumstances.

E. The confidentiality of individual participants can never be disregarded.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

4. Pressure to publish can often lead to ethical problems. These are:

A. Failure to allocate credit to the work of others.

B. Taking more personal credit for collaborative work than is justified by one's contribution.

C. Overuse of a limited body of work to provide more publication credit than is justified.

D. All of the above

E. C and A

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

5. Which of the following must a researcher always do before submitting a manuscript to a journal for publication?

A. Get approval of the manuscript from all the paper's co-authors.

B. Get approval of the manuscript from both the Department Chair and Dean of Research

C. Get approval of the manuscript's description of the research protocol from the Research Ethics Committee.

D. Get approval of the manuscript by two or more external reviewers.

E. All of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

6. By being listed as authors on a journal article, researchers imply all of the following claims EXCEPT which of the following?

A. Each named author has made an identifiable contribution to the manuscript.

B. The work has not been published previously.

C. Each author takes responsibility for others' previous work on the subject.

D. Each author is responsible for the conduct of the entire research project unless that person's roles are specifically described in the manuscript.

E. Each author has reviewed the manuscript and has approved the final version.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

7. Which of the following statements about plagiarism is TRUE?

A. Plagiarism occurs most often when collaborators use their common data independently.

B. Plagiarism includes misappropriation of others' ideas and copying of another's words or data without giving credit to the source.

C. Plagiarism includes the use of nearly identical phrases describing commonly used methods and common scientific knowledge.

D. Using ideas from another researcher's government grant application is not plagiarism because the contents of the application are the property of the government.

E. All of the above statements are true.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

8. Which of the following statements on authorship is TRUE?

A. Giving honorary authorship to well-respected scientists who have not been involved with the research is acceptable since it increases the likelihood that the paper will be accepted for publication.

B. It is never appropriate to include a technician as a co-author on a manuscript.

C. An individual who has left the institution where funded research is being done does not need to be included as an author on any manuscripts that later result from his or her work there.

D. Being identified as an author requires participation in key aspects of the reported research, taking responsibility for its results, and reading the final manuscript.

E. A single large research project should be reported in several different papers, each with a different first author, in order to maximise the number of resulting publications.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

9. International collaborations may raise particularly difficult practical and ethical challenges for researchers because:

A. Basic scientific concepts vary widely between countries.

B. There are no universal ethical principles in research.

C. Researchers from different countries typically do not trust each other's politics or motives.

D. Language barriers and cultural differences among collaborators may complicate their professional and personal communication and subsequent interaction.

E. International collaboration does not pose any challenges not evident in other collaboration.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

10. Which of the following is NOT an important principle of research ethics?

A. Government funded trials must analyse whether the variables being studied affect women or racial/ethnic minority groups differently than others in the trial.

B. Respect for persons includes the concept that autonomous individuals are able to deliberate about their personal goals and can act according to such deliberation.

C. The recruitment of research participants must ensure that classes of subjects are not selected simply because of their easy availability, their compromised position, or their ability to be manipulated.

D. Persons with diminished autonomy are entitled to special protection.

E. The demands of beneficence/nonmaleficience include maximizing possible benefits and minimising possible harms.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

11. Which of the following are NOT generally considered to be vulnerable participants in need of special protections?

A. Prisoners

B. Women of child-bearing potential

C. Children

D. Mentally ill persons

E. Pregnant women, human foetuses, and neonates

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

12. Which of the following situations would generally NOT be considered to be a form of coercion for potential research participants?

A. Payment that the research participant would consider to be very large monetary incentive to volunteer for the study.

B. A false claim that the research will provide the best care available to patients with the disease under study.

C. A patient's belief that refusing to participate in the study will decrease quality of care that his or her doctor would provide.

D. A participant's incorrect belief that the researcher will give him or her only the best treatment available, not placebo or control intervention

E. All of the above are forms of coercion.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

13. Informed consent generally gives research participants the right to:

A. Refuse to take part in the diagnostic portion of the protocol but insist on receiving the study treatment.

B. Leave the study at any time.

C. Receive financial compensation for harms that occur during the study.

D. Continue to receive benefits from the study even though the study has been completed.

E. All of the above are aspects of the right of informed consent.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

14. A conflict of interest occurs when?

A. Two parties both have the same research idea and can not come to an agreement as to who will get funding.

B. A member of the University has an opportunity, whether real, potential, or perceived, to place his personal interests, or the interests of external organisations, ahead of interests of the University.

C. When a member of the University conducts research in order to benefit the University and not for personal gain.

D. All of the above.

E. None of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

15. **Research misconduct can be classified into three categories that are known collectively as "FFP". FFP stands for:**

A. Fraud, fabrication, and piracy.

B. Fraud, forgery, and plagiarism.

C. Fraud, forgery, and piracy.

D. Fabrication, falsification, and plagiarism.

E. Falsification, forgery, and plagiarism.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

16. A conflict of commitment would occur:

A. When a member of the university is unable to meet his or her commitments due to external activities.

B. A member of the University is committed to many projects at the same time.

C. If a gift was accepted from a company that funded his/her research.

D. If a member received a large sum of money from a business that directly relates to the research.

E. None of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

17. The collaborative partnership principle requires:

A. Researchers within an institution to work together.

B. Researchers to ensure that the research they are conducting is developed in collaboration with the target community or population.

C. Researchers to make sure that any benefits of the research are given to all researchers who made contributions to the study.

D. Researchers to provide participants with gifts to get them to participate in the research.

E. All of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

18. The standard components of informed consent are:

A. Provision of appropriate information.

B. Participants' competence and understanding.

C. Voluntariness in participating and freedom to decline or withdraw.

D. Researchers must provide participants with clear, detailed and factual information about the study.

E. All of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

Please continue to the next page.

For each of the following questions, select the single answer that best answers the question, by clicking on the drop down arrow.

19. Research should address questions that are of value to society or particular communities in society because:

A. The problems being studied should lead to knowledge or interventions that will be of value to society.

B. Research does not necessarily have to be of value to society.

C. Research should not be conducted if it is going to waste people's time and money.

D. What the government at the current time values as important is the most beneficial to society.

E. None of the above.

Select one answer for the question above by clicking on the drop down arrow, here:

Choose one answer only

DEMOGRAPHIC QUESTIONS (These are for statistical purposes only)

Please place an x in the appropriate box, by clicking on the blank square.

1. What is your age?

A. 18 – 24☐ B. 25 – 29☐ C. 30 – 34☐ D. 35 – 39 ☐ E. 40 +☐

2. Are you male or female?

A. Male ☐ B. Female ☐

3. What is your race or ethnicity?

A. Black ☐ B. White ☐ C. Indian ☐ D. Coloured ☐ E. Asian☐ D. Other☐

Please continue to the next page.

Please place an x in the appropriate box, by clicking on the blank square.

4. What research experience have you had prior to this degree?

A. No previous research experience ☐

B. I have completed a postgraduate research project/ dissertation/ thesis ☐

C. I have worked as a research assistant ☐

D. I have completed research exercises at an undergraduate level ☐

5. Has your research work ever been published (other than completion of a thesis)?

A. Yes ☐ B. No ☐

6. What training have you received in research methods?

A. I have no educational experience in research methods ☐

B. I have completed some research methodology courses at postgraduate/ undergraduate level. ☐

C. I have completed extensive research methodology courses at a postgraduate or an undergraduate level. ☐

7. What training have you received in research ethics?

A. I have no educational experience in research ethics ☐

B. I have completed some research ethics courses at postgraduate/ undergraduate level. ☐

C. I have completed extensive research ethics courses at a postgraduate or an undergraduate level. ☐

Please continue to the next page.

Please place an x in the appropriate box, by clicking on the blank square.

8. Current course of study?

A. Undergraduate degree ☐ B. Honours Degree ☐ C. Masters Degree☐ D. PhD☐

9. What Faculty or Discipline is your current course of study in? (Click on the grey line below and start typing)

□□□□□

Please save your response and email it back to the following email address by 20 June 2009.

Casalis@ukzn.ac.za

Thank you for taking the time to complete this questionnaire.

INFORMATION FORM

Title: An evaluation of postgraduate social science students' knowledge of conducting research responsibly in a South African University.

Dear Student,

Thank you for considering participation in this study. The aim of this study is to explore postgraduate social science students' views concerning ethical issues in research. One of the main functions of a university is research. Universities obtain much of their income and prestige through research. They contribute to the development of knowledge through publication of articles in peer reviewed journals. It is therefore important that Universities uphold a reputation of research integrity. In order for this to be done it is

vital that any research conducted at a university is done responsibly and in accordance with ethical guidelines.

Postgraduate students contribute significantly to a university's research outputs. It is therefore important that they and their supervisors are familiar with and apply research ethics. This study aims to assess this background so that, if necessary, methods of providing students with relevant training and information can be evaluated. Furthermore there has been little research carried out on this topic in South Africa.

2. How you came to be chosen for this study

This study's focus is on postgraduate Social Science students. Very little research has been done on Social Science students in particular, as most research on this topic to date has involved medical students.

3. Requirements of participants

If you decide to participate in this study you will be required to complete the Multiple Choice Questionnaire attached to this email. This will take you approximately 30 minutes. Once you have completed it you are asked to email it back to the researcher at Casalis@ukzn.ac.za. The questions are by no means intended to be personal or discriminatory and there is no risk to you as a person answering these questions.

4. Benefits

There are no direct benefits of participating in this study. The benefits of being part of this study are to help in the exploration of the knowledge that postgraduate social science students have with regard to conducting research responsibly. By doing this, research in this area can be furthered. You will not be paid for your time.

5. Confidentiality

When you reply by email, **your response will be immediately delinked from your name and email address.** After this has been done the responses will be stored separately to the email data bases so that no links can be made. The only people who will have access to the actual emails will be myself (Wendy Maitin-Casalis) and my supervisor (Prof D. Wassenaar). When the data is analysed you will not be identified in

any way. All information gathered from the email response will be stored so as not to allow anyone access to it and will be destroyed after a specified period of time.

6. Voluntariness

Your decision to participate in this research will not harm you in anyway or disadvantage you while studying at the University of KwaZulu-Natal. By filling out and replying to the email you understand that you are participating of your own free will and therefore give your informed consent to do so. You are free not to participate, and refusal will have no adverse consequences. If you do not wish to receive any reminders or further correspondence please send an opt out reply to the following email address Casalis@ukzn.ac.za. Furthermore, if you would like to know the results of this study they will be present in the form of a thesis and placed in the library of the University of KwaZulu-Natal at the end of 2009 for public access.

7. Contact Details

Please feel free to contact me with regard to problems or information that you may require.

Wendy Maitin-Casalis
083 306 2548
Casalis@ukzn.ac.za

Supervised by: Prof D.R. Wassenaar
wassenaar@ukzn.ac.za

APPENDIX B : Heitman et al. (2007) INSTRUMENT

For each of the following 30 questions, select the single response that best answers the question and click on the oval beside the corresponding letter.

1. Which of the following constitutes good practice for recording laboratory data?

A. Data may be recorded on individual sheets of paper as the work is done, but all notes must be transcribed into a data book when the experiment is completed.
B. Entries from all experiments done in a given week must be edited and entered into the researcher's data book by the end of the week.
C. Data should be recorded directly into a data book using permanent ink on numbered and dated pages as the experiment is done.

D. Members of a research team may keep experimental data in their own preferred format as long they can reconstruct or remember essential details when the manuscript is being prepared.
E. Saving research data as computer files is preferable to keeping paper notebooks because it is safer and more efficient.

2. Which of the following statements is TRUE about fabrication and falsification of research data?

A. Fabrication and falsification of data are only harmful in situations in which the researcher is not sure what the experiment's results should be.
B. Most scientists falsify data from time to time as they interpret their results, so it is not reasonable to be concerned about the effects of falsification on the literature.
C. Small omissions of data have little effect on the overall results of large experiments and should not be considered a form of falsification.
D. Fabrication and falsification of data undermine the objectivity of experimental results and introduce investigators' biases into the research record.
E. Fabrication of data is always wrong but falsification is acceptable in circumstances where the researcher is confident in his or her methods.

3. When an academic investigator believes that his/her research may lead to a patent, all of the following record-keeping practices are important EXCEPT which of the following?

A. The investigator should record the data directly in the data book in ink as the experiment is carried out.
B. The investigator should date the pages of the data book to record when the experiment is being done.
C. Both the investigator and another knowledgeable person not directly involved in the research should read and sign the data book at key points in the experiment.
D. The investigator should document his or her thinking about the goals of the research in order to establish the time the idea for a patentable discovery or invention was developed.
E. The investigator should store a regularly updated copy of the data notebook with the university's Office of Legal Affairs.

4. **Under National Institutes of Health (NIH) policy, who owns the research data that result from work funded by an NIH grant?**

    A. The principal investigator (PI) responsible for getting the grant owns all of the resulting data.
    B. Each scientist collecting data under an NIH grant owns any data that he or she personally collects.
    C. All named investigators, but not graduate students or technicians, own any data that they personally collect under an NIH grant.
    D. The federal Department of Health and Human Services owns any data that result from research funded by an NIH grant.
    E. The institution that receives the NIH grant owns all of the resulting research data.

5. **Which of the following statements is TRUE about the length of time that research data must be maintained?**

    A. All primary data from NIH-funded research grants must be retained for three years after the grant's final financial statement is submitted to NIH.
    B. Data books from NIH-funded research must be retained for three years but all other data may be discarded one year after the project is completed.
    C. Data used to support a patent application must be kept for five years after the date that the patent is filed.
    D. Patients' medical records may be stored with research data as long as they are available to the physician or institution providing medical care for at least seven years after the research is completed.
    E. Clinical research data used to support a FDA drug-approval application must be retained for three years after the submission of the application.

6. **Which of the following constitutes good practice for research advisors with respect to their trainees' research data books?**

    A. The research advisor should review trainees' data books at the end of a project to be sure that their notes are complete and their findings are valid.
    B. The research advisor should review, sign, and date trainees' data books regularly to ensure that the data are up-to-date and well documented.
    C. A research advisor should not need to review trainees' data books unless the project is very complex or the trainee is trying to learn new methods.
    D. Whenever trainees leave the laboratory for more than a day, they should turn in their data books to their advisors for security purposes.
    E. None of the above.

A conflict of interest occurs when a university scientist

    F. is not sufficiently interested in research to perform his/her job adequately.

G. takes six months leave of absence from the lab for personal reasons.
H. requires graduate students to provide services unrelated to research.
I. falsifies research data for an industrially funded project.
J. holds personal investments in a company that funds his or her research.

7. Many universities' sexual harassment policies discourage or even forbid sexual relationships between faculty and students because

A. faculty members' institutional authority may make students unable to refuse romantic or sexual relationships initiated by faculty members.
B. a faculty member engaged in an intimate relationship with a student may, consciously or unconsciously, give that student unfair advantages over others in the classroom or laboratory.
C. romantic or sexual intimacy interferes with the crucial objectivity and critical judgment that faculty need to train junior researchers.
D. All of the above.
E. None of the above.

8. Which of the following must a researcher always do before submitting a manuscript to a scientific journal for publication?

A. Get approval of the manuscript from all of the paper's coauthors.
B. Get approval of the manuscript from both the Department Chair and Dean of Research.
C. Get approval of the manuscript's description of the research protocol from the Institutional Review Board.
D. Get approval of the manuscript by two or more external reviewers.
E. All of the above.

9. By being listed as authors on a scientific journal article, researchers imply all of the following claims EXCEPT which one of the following?

A. Each named author made an identifiable contribution to the manuscript.
B. The work has not been published previously.
C. Each author takes responsibility for the others' previous work on the subject.
D. Each author is responsible for the conduct of the entire research project unless that person's roles are specifically described in the manuscript.
E. Each author has reviewed the manuscript and has approved the final version.

10. Which of the following statements about plagiarism is TRUE according to the Office of Research Integrity?

A. Plagiarism occurs most often when collaborators use their common data independently.

B. Plagiarism includes misappropriation of others' ideas and copying of another's words or data without giving credit to the source.
C. Plagiarism includes the use of nearly identical phrases describing commonly used methods and common scientific knowledge.
D. Using ideas from another researcher's NIH grant application is not plagiarism because the contents of the application are the property of the federal government.
E. All of the above statements are true.

11. Which of the following activities are acceptable activities for a reviewer of a manuscript for a journal?

A. Contacting the manuscript's authors to clarify parts of the research that you do not understand
B. Keeping a photocopy of the manuscript in your files until the article is published
C. Assigning your graduate students to read the manuscript and repeat any reported experiments that seem questionable
D. Verifying the manuscript's references and background literature
E. Reviewing a manuscript in an area outside your area field of expertise, if you have experience with the process of manuscript review.

12. All of the following are good reasons to have an institutional or laboratory policy on authorship EXCEPT which of the following?

A. A formal policy helps prevent misunderstandings among collaborators about their roles and responsibilities in publication.
B. New graduate students and postdoctoral fellows can refer to the policy to know what publication practices to expect before they start work on specific projects.
C. Formal policies on authorship prevent plagiarism.
D. Junior researchers can use a formal policy to gain institutional protection of their interests in publication.
E. Having a formal policy on authorship lets faculty, students, and staff know that the institution values good ethical conduct.

13. Which of the following statements on authorship is TRUE?

A. Giving honorary authorship to well-respected scientists who have not been involved with the research is acceptable since it increases the likelihood that the paper will be accepted for publication.
B. It is never appropriate to include a technician as a coauthor on a manuscript.
C. An individual who has left the institution where funded research is being done does not need to be included as an author on any manuscripts that later result from his or her work there.
D. Being identified as an author requires participation in key aspects of the reported research, taking responsibility for its results, and reading the final manuscript.
E. A single large research project should be reported in several different papers, each with a different first author, in order to maximize the number of resulting publications.

14. International collaborations may raise particularly difficult practical and ethical challenges for researchers because

A. basic scientific concepts vary widely between countries.
B. there are no universal ethical principles in research.
C. researchers from different countries typically do not trust each other's politics or motives.
D. language barriers and cultural differences among collaborators may complicate their professional and personal communication and subsequent interaction.
E. International collaboration does not pose any challenges not evident in other collaboration.

15. Which of the following is NOT an important principle of research ethics identified in the Belmont Report of 1978?

A. Federally funded trials must analyze whether the variables being studied affect women or racial/ethnic minority groups differently than others in the trial.
B. Respect for persons includes the concept that autonomous individuals are able to deliberate about personal goals and can act according to such deliberation.
C. The recruitment of research subjects must ensure that classes of subjects are not selected simply because of their easy availability, their compromised position, or their ability to be manipulated.
D. Persons with diminished autonomy are entitled to special protection.
E. The demands of beneficence/nonmaleficence include maximizing possible benefits and minimizing possible harms.

16. In a federally funded institution, which of the following research protocols or research-related procedures must be approved by an Institutional Review Board (IRB) before it may be carried out?

A. The simple removal of 50 cc of blood by an experienced person
B. A prospective psychological survey that identifies the respondent
C. Taking biological specimens (such as hair or nail clippings) for research purposes by non-invasive means
D. A randomized clinical trial requiring administration of either an experimental drug or a placebo for the proposed treatment of a disease
E. All of the above protocols and procedures must be reviewed and approved by an Institutional Review Board before the research can begin.

17. Which of the following are NOT generally considered to be vulnerable subjects in need of special protections?

A. Prisoners
B. Women of child-bearing potential
C. Children
D. The mentally ill
E. Pregnant women, human fetuses, and neonates

18. Which of the following situations would generally NOT be considered to be a form of coercion for potential research participants?

A. Payment that the research participant would consider to be a very large monetary incentive to volunteer for the study
B. A false claim that the research will provide the best care available to patients with the disease under study
C. A patient's belief that refusing to participate in the study will decrease the quality of care that his or her doctor would provide
D. A patient's incorrect belief that the study physician will give him or her only the best treatment available, not a placebo or control intervention
E. All of the above are forms of coercion.

19. Which of the following aspects of research is NOT required in the Institutional Review Board's review of a protocol?

A. Whether the risks to the study's human subject are reasonable in relation to the anticipated benefits (if any) from the research

B. How the informed consent process will be carried out and documented
C. Whether the budget for the proposed study is adequate to fund the work planned
D. The qualifications of the investigators involved in the study
E. Whether the study examines an important scientific question unanswerable by other methods of research

20. According to the Nuremberg Code and U.S. regulations, informed consent gives research participants the right to

A. refuse to take part in the diagnostic portion of the protocol but insist on receiving the study treatment.
B. leave the study at any time.
C. receive financial compensation for harms that occur during the study.
D. continue to obtain study medications after the end of a clinical trial if the medications are not otherwise available.
E. All of the above are aspects of the right of informed consent.

21. Federal policy on conflicts of interest requires that a university that receives NIH grants regulate and disclose whether any of its industrially funded researchers

A. receives gifts over $5,000 from their industrial funders.
B. owns stock worth over $5,000 in a company related to their research.
C. owns 4% or more of the stock of any company funding their research.
D. has a spouse who owns over $10,000 in stock in any company funding the scientist's research.
E. None of the above.

22. Both the Nuremberg Code and the World Medical Association's Declaration of Helsinki call for animal research to

A. serve as the basis of experimentation with human beings.
B. avoid all unnecessary physical and mental suffering of animal subjects.
C. use the fewest number of animal subjects possible to answer the scientific question posed by the experiment.
D. conduct animal experiments on several different species before using human beings in a trial.
E. None of the above.

23. **In 1959, English scientists Russell and Burch published *Principles of Humane Experimental Technique,* in which they identified *3 R's* for humane animal research. Russell's and Burch's 3 R's are**

A. review, reduction, and restoration.
B. refinement, reduction, and replacement.
C. reuse, reduce, and recycle.

D. replace, review, and replicate.
E. None of the above.

24. **Historical and contemporary philosophical debates about humans' use of animals, including experimentation with animals, has often focused on the question of animals' *sentience.* Sentience is best defined as the ability to**

A. reason.
B. communicate.
C. experience emotion.
D. experience pain and pleasure.
E. be self-conscious.

25. **The Animal Welfare Act requires institutions that conduct federally funded research with animals to have an Institutional Animal Care and Use Committee (IACUC) to oversee several aspects of animal research. Which of the following activities is NOT the responsibility of the IACUC?**

A. Reviewing animal research protocols for scientific merit, including choice of animal model and species-specific methods
B. Reviewing animal research protocols for humane research practices, including pain control and method of disposition
C. Inspecting areas where research animals are housed to ensure compliance with federal standards
D. Providing species-appropriate training in handling and research technique for animal researchers
E. All of the above activities are the responsibility of the IACUC.

26. **At the end of an experiment in which specially bred genetic knock-out mice have undergone and recovered from major surgery, the *Guide for the Care and Use of Laboratory Animals* recommends that researchers**

A. humanely kill the mice using a standard euthanasia protocol.
B. transfer the mice to other laboratories for further research requiring animals with the same genetic marker.
C. offer the mice as pets to good homes.
D. release the mice in a rural environment.
E. None of the above.

27. **The federal Department of Health and Human Services (DHHS) and the National Science Foundation (NSF) both classify research misconduct into three categories that are known collectively as "FFP". FFP stands for**

A. fraud, fabrication, and piracy.
B. fraud, forgery, and plagiarism.
C. fraud, forgery, and piracy.

D. fabrication, falsification, and plagiarism.
E. falsification, forgery, and plagiarism.

28. Which of the following policies or programs on scientific integrity does the U.S. Public Health Service (PHS) require universities to have in order to receive research funding from NIH?

A. An institutional policy and process for investigating charges of research misconduct and protecting whistle blowers
B. A formal educational program in the principles of scientific integrity for all faculty, employees, and trainees whose work is supported by federal grant funds
C. An honor code governing academic work by undergraduate and graduate students
D. An anti-discrimination policy and cultural competency program
E. Both A and B.

29. **A conflict of commitment would occur if a university scientist**

A. agreed to give an industrial partner the first option to develop the scientist's intellectual property for commercial application.
B. received more than $10,000 from an industrial partner or supporter whose business relates directly to the scientist's research.
C. spent excessive time on industrially funded research that interfered with his/her professional role as a teacher.
D. accepted a gift of $5,000 from a company that funded his/her research.
E. None of the above.

Demographic Questions

In order for us to understand more fully your experience in science and your previous education in the responsible conduct of research, please answer the following demographic questions. Except where noted, please mark the single best answer.

201. **Prior to enrolling in my current graduate program, I had completed the following graduate-level work in science or the health professions**

A. Doctoral-level degree (PhD, DrPH, MD, DSN, DDS, DPharm, etc)
B. Masters-level degree (MS, MPH, MSN, etc.)
C. Some graduate coursework
D. I have had prior no graduate level work in science or the health professions.

202. **During my previous graduate-level work in science or the health professions I took part in formal training in the responsible conduct of research, research integrity, or research ethics (not including theoretical bioethics).**

A. Yes
B. No
C. I have had no prior graduate-level work in science or the health professions.

203. **I received my *undergraduate* degree**

A. before 1991.
B. between January 1991 and December 2000.
C. after January 2001.

My *undergraduate* major* was in the *if you had a double/interdisciplinary major or a joint degree, check all that apply

D. Natural Sciences
(ex: Biology, Biochemistry, Ecology)
E. Physical Sciences
(ex: Chemistry, Physics, Mathematics)
F. Engineering
G. Health Professions.
(ex: Nursing, Physical Therapy, Public Health)
H. Social Sciences
(ex: Anthropology, Sociology, Psychology, Economics)
I. Humanities
(ex: English, History, Language, Linguistics, Literature)

I received my* undergraduate *degree from a college or university in

*the United States.**

***graduates of Puerto Rican institutions, mark A if your education was primarily in English; mark C if your undergraduate education was primarily in Spanish**

J. Canada/United Kingdom/Australia/New Zealand.
K. Latin America/Caribbean.
L. Europe.
M. Africa.
N. China/Japan/Southeast Asia.
O. India/Pakistan/Bangladesh.
P. Middle East/North Africa.

***As an* undergraduate*, I took one or more formal courses in* scientific research methods.**

Q. Yes
R. No

204. As an *undergraduate*, I took one or more formal courses in the *responsible conduct of research, research integrity, or research ethics* (**not** including theoretical bioethics**).**

A. Yes
B. No

205. Before entering graduate school, I spent time in a laboratory doing work that gave me practical experience in *hands-on research.*

A. Yes, on someone else's research project
B. Yes, on my own, independent research project
C. No

206. **Before entering graduate school, I had a *research mentor*.**

A. Yes
B. No

207. **My *undergraduate* institution had an *honor code*.**

A. Yes
B. No

My age is:

18-24
25-29
30-34
35-39
40 or over

My ethnic/racial background is best described by the following NIH category:

(mark all that apply)

American Indian or Alaskan Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
Hispanic/Latino
White
Other

My gender is

Female
Male

APPENDIX C: FACTOR ANALYSIS RESULTS

Table

Factor Analysis Results

Question	Cronbach's Alpha if Item Deleted
1	.292
2	.183
3	.261
4	.192
5	.214
6	.190
7	.241
8	.259
9	.274
10	.152
11	.152
12	.279
13	.267
14	.211
15	.269
16	.253
17	.227
18	.232
19	.268