

**Mobile Bullying: Investigating the Non-Technical Factors that  
Influence Forensic Readiness in Township Schools in South Africa.**

**A Dissertation Presented To The**

**Department of Information Systems**

**University of Cape Town**



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**28 August 2015**

In partial fulfilment of the requirements for the degree of Master of Commerce  
in Information Systems

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## **ii. Acknowledgements**

To the Almighty God, thanks for granting me wisdom and strength to complete this course, and thank You for sparing and blessing me abundantly. A special gratitude goes to the light of my life Hildah Mamabolo, my parents, brothers, and sisters who have been very supportive throughout my studies. Prof Kyobe, I appreciate the support, guidance, patience, mentorship you provided from the honours research project through to the masters research project. Without your encouragement, enthusiasm, and pushing me hard, I wouldn't have made it this far; no words can express my gratitude. NDAA!

## **iii. Dedications**

In loving memory of my great grandma Mathibela Nkwana and my Uncle Thanyani Samuel Nempandoni the-Vhafuwi of the Mpandoni land in Venda.

#### **iv. Abstract**

The increasing use of mobile devices by high school learners has resulted in increased networking activities for learners who take advantage of opportunities presented by mobile technologies. Mobile technology continues to play a key role in facilitating online interactions amongst South African youth, and some learners use mobile technology to enhance their learning capabilities. However, such electronic operations have also presented new risks particularly in the developing countries where online bullying is on the rise and investigations of such incidents or threats are expensive. Mobile bullying and lack of discipline of bullies, for instance, are major concerns in the society at large. To control these incidents, learners and teachers need to know what to do when incidents arise.

The process of digital forensic investigation is typically left for those specialising in the field of digital forensics. Those responsible for learner's safety in schools are often faced with situations where they have to perform basic investigations or preserve evidence for incident escalation to the specialists. However, schools often do not prepare themselves well enough for the challenges relating to mobile bullying. They find themselves not knowing where to start or how to preserve evidence. Digital forensic investigations are even more challenging in school settings because of the dynamic nature of these environments. While studies have been conducted in the developed countries, little is still known about how schools in the developing world, for instance South Africa, may handle mobile bullying. Very little is known about how schools in the developing countries may maximise their potential to use digital evidence while minimising the impact resulting from the incident. There is limited guidance on how to be digital forensic ready in schools where teachers, learners, principals, and other role players are not trained well enough to deal with mobile bullying.

The objective of this study was to provide insight into factors that enhance the non-technical forensic readiness program in township schools and the ability of teachers to investigate mobile bullying incidents. The study aimed at employing concepts of forensic readiness to ignite schools' ability to prepare for response to mobile bullying incidents and create a digital forensic ready learning environment. The study was conducted in South Africa, Limpopo and North West provinces. Five schools agreed to participate in this study; eighty-two valid responses were obtained from teachers. The study followed mixed methods approach to the theory.

Some key findings indicated that the majority of the participants, about 51%, had handled at least six mobile bullying incidents in their teaching career. It was noted that teachers do not

necessarily know how to conduct basic investigations nor how to preserve evidence for incident escalation to the relevant parties. However, teachers appear to know how to classify incidents according to where incidents must be escalated for further investigation. Other role players were found to be generally ready and willing to assist teachers in dealing with mobile bullying in schools. Regarding the proposed non-technical forensic readiness model, this research found that the ability to identify and classify incidents had a positive effect on school readiness and ability to handle mobile bullying. The availability of people and post-incident reporting also shows a positive effect on school readiness and ability to handle mobile. Well documented processes, procedures, and policies as well as periodic improvements also showed a significant positive effect on school readiness and ability to investigate mobile bullying.

The recommendation ensuing from this research is that the Department of Education in South Africa needs to take a driving seat to assist high schools in implementations of forensic readiness and knowledge to investigate incidents. Establishment of well-defined policies, processes and procedures that will provide guidelines for mobile bullying investigations is recommended. Schools should ensure that more efforts are invested in mobile bullying awareness programs and general readiness program improvements. Another recommendation is that the incident respondents need to ensure that the evidence is treated with integrity. Incident responders must ensure that evidence meets the legal requirements and that additional support is acquired from relevant external people if help is required.

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## **1. CHAPTER ONE – Introduction**

This chapter presents an introduction. The first chapter outlines the background of this research, and it presents the research problem statement and research question. The third section of this chapter presents the scope of this research, and then a section on research objectives and value follows after that section. The last section of this chapter outlines the structured of this dissertation.

### **1.1 Background**

Sub-Saharan Africa's mobile industry grows faster than any other region in the entire world according to a longitudinal study conducted between 2007 and 2012 by GSMA (2013). Furthermore, in Sub-Saharan Africa, South Africa had the highest penetration rate of unique SIM-based subscribers at 65.7% in 2012, which shows that the mobile communications industry was growing at exponential rates (GSMA, 2013). Burton & Mutongwizo (2009) reported that while mobile technology penetration and adoption rates increase, a high number of high school learners continue to gain access to mobile phones rapidly than ever before. UNICEF (2012) reported that 81.1% of South African high school learners had access to mobile phones. The number of South African high school learners with access to mobile phone will continue to increase as James (2015) predicted that penetration rates would quadruple from the 2012 figures by the year 2016.

Although learners who use mobile phones to improve their learning proficiencies realize better results (Burton & Mutongwizo, 2009), there exists potential online risks for those learners (Kowalski & Limber, 2007). Online risks such as exposure to interactions that may compromise learners' safety and emotional well-being, exposure to inappropriate content, and a possibility of being bullied through their mobile phones (Li, 2010; Burton & Mutongwizo, 2009). Badenhorst (2011) highlighted that with limited research in mobile bullying and sexting done in South Africa, it remained unclear how many learners are exposed to such risks.

In order to bring mobile bullies to book, it is imperative that a basic credible digital forensic investigation is conducted as soon as the incident is identified and reported. Digital forensically, readiness requires that schools must prepare for such incidents. The state of

forensic readiness facilitates smooth incident response while reducing the disruptions that may result from the incident. Digital forensic readiness is defined by Rowlingson (2004) as the ability of an organisation to maximise the potential to use digital evidence while minimising the cost of an investigation.

## **1.2 Problem Statement and Research Question**

School principals, teachers, and parents are often caught in situations whereby they are inept to help learners who fall victim of mobile bullying. Teachers who want to assist victims often do not know where to start, how to preserve evidence, and where to escalate incidents (Sonhera, Kritzinger, & Loock, 2012). According to Patchin & Hinduja (2010) schools are often caught in situations where they do not have mobile bullying policies. Some schools that have policies do not review policies regularly, and some learners are not even aware of the existence nor contents of these policies (Li, 2010). The majority of the schools do not have processes that they can refer to when investigating mobile bullying, and that makes incident response a chaotic event.

While developed nations have been at the forefront of extensive research in mobile bullying, developing nations, South Africa for instance, lags far behind in mobile bullying research (Prinsloo, 2005; De Lange & Von Solms, 2011). Even fewer studies in developing nations focus on how schools can prepare their environment to investigate mobile bullying incidents efficiently (Sonhera et al., 2012; Serra & Venter, 2011). To study the factors that influence a non-technical forensic readiness program in Township schools will assist officials to prioritise the important factors when implementing school forensic readiness. Therefore the research question is:

*What are the non-technical factors influencing forensic readiness and the ability to investigate mobile bullying incidents in township high schools in South Africa?*

## **1.3 Scope of the Research**

The scope of this research was to determine the non-technical factors that influence readiness and ability to investigate mobile bullying incidents in South African township high schools. A

random clustered sampling was used in this research. The research aimed at as many schools as possible but due to time constraints five schools participated in this research. About eighty-two valid responses were obtained from teachers; the responses were found to be adequate for this exploratory research.

#### **1.4 Research Objective and Value**

The main objective of this research was to provide insight into the non-technical factors that influence forensic readiness in township schools and their ability to handle mobile bullying incidents. Subsequent to that objective, the other objective seeks to explore opportunities for employing non-technical forensic readiness for role players who are not necessarily forensic specialist in township school.

The value added by this research was thought to be contributing in theory and in practice. Theoretically the value-add is in the field of Information Systems, mobile bullying and Digital Forensics. The study provides insight into how developing countries may tackle mobile bullying in schools, which is a gap in the current literature (Patchin & Hinduja, 2010; Badenhorst, 2011). Regarding contribution on the practical level, the study provides a start for ways in which South African township schools can prepare for challenges that come with mobile bullying. The contributions ignite questions about developing non-technical forensic readiness culture in South African schools, develop policies, processes and procedures that can be referenced when responding to mobile bullying incidents in schools in general.

#### **1.5 Overview of the Dissertation**

This dissertation is structured in such a way that it consists of a total of eight chapters. The chapters in this dissertation are presented as follows:

CHAPTER ONE, the current chapter, presents introduction. The introduction included background, problem statement, research objectives, scope, and the value added by this research.

CHAPTER TWO presents a literature review. The chapter explores mobile phone technology and then the discussion moves into mobile bullying. The third section of the literature review explores digital forensic readiness. The chapter then produces a proposed research framework

to guide the remainder of the research. The final section of the literature review concludes by identifying gaps in the literature and showing the need for this research.

CHAPTER THREE presents the proposed research framework and hypotheses development. The chapter also highlights research questions and objectives. The chapter concludes by providing a summary of research hypotheses that would be tested statistically in a chapter on data analysis.

CHAPTER FOUR presents research design. The chapter covers the underlying philosophy, research sample, research methodology, and data analysis.

CHAPTER FIVE presents the descriptive analysis of the sample data. The results of the tests conducted to determine the instrument's validity and reliability are presented in this chapter. The chapter then presents results obtained from hypotheses testing with the corresponding analysis and discussion of findings per item. Implications as a result of the findings are presented in this section. The chapter finally presents a summary of findings, and a refined research framework is presented before the final discussion of the findings.

CHAPTER SIX concludes this dissertation. The chapter includes implications for both academia and practice, and the recommendations for future research are given.

CHAPTER SEVEN and EIGHT presents the references used throughout the dissertation in APA format, and the appendixes included in the dissertation, respectively.

## **2. CHAPTER TWO – Literature review**

Saunders, Lewis & Thornhill (2009) published a book in which a chapter on literature review posited that literature review helps the researcher to understand the research problem by ensuring that all concepts are identified, defined, and discussed. Literature review highlights the study's theory base and explains how the proposed study fits into existing literature (Saunders et al., 2009). Therefore, this section presents a literature review for this research. The review begins by presenting a summary of the history of mobile technology.

### **2.1 Mobile Phone Technology**

This section presents a background of mobile phone technology to bring emphasis to communication data which, in essence, is the messages sent by perpetrators to bully victims using mobile phones. A background to mobile phone telephony is presented, followed by brief mobile phone architecture and location-based services, and then finally a brief discussion of locating mobile phones is presented.

#### **2.1.1 History of Mobile Technology and Networks**

Mobile phones are important contributors to mobile technology connecting people worldwide. The history of mobile devices can be traced back to the 1930s with the use of “walkie-talkies” during the Second World War (Millington, 1997). “Walkie-talkies” were used by the on-ground United States (US) soldiers for keeping in touch with their headquarters.

According to Dunnewijk & Hultén (2007) the US government agencies and military were the first to use the First Generation wireless technology, 1G, which was later open for public usage in the 1980s. The First Generation wireless technology, 1G, used the analogous signal system. In the late 1980s and early 1990s the Second Generation wireless network, 2G, was rolled out with digital technology as opposed to the analogous system of 1G (Dunnewijk & Hultén, 2007). Mobile communications technology then improved to Third Generation wireless technology known as 3G that brought faster and more resilient connections compared to its predecessors. Today, the wireless network technology is on 4G with even better connection speeds (GSMA, 2013).

According to Sissing & Prinsloo (2013), the first South African connection to the Internet was to the Council for Scientific and Industrial Research (CSIR). The University of Cape Town followed shortly afterwards, and then later in April 1995 the Internet was available to all South Africans (Sissing & Prinsloo; 2013). GSMA (2013) reported that network improvements coupled with affordable Internet-ready mobile devices contributes to increasing usage of the Internet by mobile devices, especially in Sub-Saharan Africa. UNICEF (2012) also reported that today mobile phone penetration among youth has reached levels higher than ever before.

### **2.1.2 Mobile Phone Handset and Communication data,**

At its basic form a mobile phone handset consists of a radio transceiver, digital signal processors and a removable smart card, known as a Subscriber Identity Module (SIM) card (Dunnewijk & Hultén, 2007). The SIM card is transferable between handsets and contains the international mobile subscriber identity (IMSI) number, which is used to identify the subscriber to the system (Dunnewijk & Hultén, 2007). The South African law requires that the SIM card be registered along with the subscriber's basic information in the national mobile subscribers database (RICA, 2002). The mobile phone handset is uniquely identified by its International Mobile Equipment Identity (IMEI) number.

Communication trails regarding subscribers are left behind after every communication session (Yar, 2006). A log of all communication data trails such as SMS, location information and phone call records are by law required to be retained and archived by mobile network service providers (RICA, 2002). It is possible to retrieve communication data of all the devices involved in a communication session and indirectly locate device owners by examining the mobile cellular network communication trails (Yar, 2006). Such communication data can be useful in locating and identifying culprits in investigations of mobile bullying incidents even in instances where the perpetrator is not known to the victim. The next section highlights the legislature governing access and use of communication data trails in the South African context.

### **2.1.3 South African Law on Communication Data**

The South African law that regulates the interception of communications is the Regulation of Interception of Communications and Provision of Communication-related Information Act 70 of 2002 (RICA, 2002). RICA also regulates the relating processes such as the applications for

authorisation to intercept communications. RICA requires that subscribers register their subscriptions and residential details on a national database to reduce anonymous communications and to assist law enforcement to track criminals who use mobile phones for criminal activities. Furthermore, RICA prohibits unlawful access and usage of subscriber details. However, subscribers' geographical locations and movements are recorded, and data is archived by network service providers as stipulated by the law. Digital forensic investigators seeking access to communication data must obtain relevant authorisations and then the network service providers are bound to release data for investigations (RICA, 2002).

The ability to access communication data can be a double-edged sword providing both positive opportunities and threats. The opportunities for accessing or retrieving communication data are great in landscapes of mobile forensics, businesses, governments, and personal safety for individuals. However on the other side, threats such as implications on personal privacy and social injustices have many subscribers worried. South Africa has laws such as the Protection of Personal Information (POPI) Act 4 of 2013 for governing the protection of personal information. The Electronic Communications and Transactions (ECT) Act 25 of 2002 provides guidance for using communication data as forensic evidence and how such evidence may be admitted in the court of law. However, there seems to be a misalignment in the laws governing electronic or digital communications in South Africa since these laws make very little to none reference to each other. The next section deals with the chief subject area of this research which is mobile bullying.

## **2.2 Mobile Bullying**

Bullying has been known to be associated with the abuse of power by perpetrators through repeatedly and deliberately harming victims (Li, 2008). Literature shows that there are various types of bullying such as physical, relational and verbal bullying which are typically referred to as traditional bullying (Vandebosch & Van Cleemput, 2009; Smith, Mahdavi, Carvalho, Fisher, Russell & Tippett, 2008). Mobile bullying, which is another type of bullying, can be described as bullying done with the aid of mobile digital devices (Sonhera et al., 2012; Smith et al, 2008). A relationship between traditional bullying and mobile bullying has been reported by some researchers (Beale & Hall, 2010). Li (2008) further warned that mobile bullying may

grow to become a severe problem as traditional bullying was at its peak and called for regular research into mobile bullying.

Firstly, for one to understand mobile bullying, it is important to understand its founding phenomenon that is cyberbullying. Some scholars remarked that no standard definition of cyberbullying has been agreed upon (Völlink, Bolman, Dehue, & Jacobs, 2013; Vandebosch & Van Cleemput, 2009; Li, 2008). However, there is evidence of unison in literature when defining cyberbullying. Emphasis is placed on the characteristics of cyberbullying and the description of devices or platforms used by perpetrators to cyberbully victims (Kowalski & Limber, 2007; Beale & Hall, 2010).

Cyberbullying is defined by Li (2008, p. 224) as “bullying via electronic communication tools such as email, cell phone, Personal Digital Assistant (PDA), instant messaging or the World Wide Web”. This definition rather focuses on platforms and devices used in cyberbullying. Beale & Hall (2010, p. 8) added more online platforms by defining cyberbullying as “new method of bullying which involves the use of e-mail, instant messaging, Web sites, voting booths, and chat or bash rooms to deliberately antagonize and intimidate others”. Digital devices used in cyberbullying were not of focus in Beale and Hall (2010) definition.

Patchin and Hinduja (2010, p. 615) defined cyberbullying as “wilful and repeated harm inflicted through the use of computers, cell phones, and other electronic devices”. It can be noted from this definition that cyber bullies carry out their actions intentionally, causing psychological and emotional scars for victims (Patchin & Hinduja, 2010). A definition by Willard (2007, p. 1) said, “sending or posting harmful material or engaging in other forms of social aggression using the Internet or digital technologies”, defines cyberbullying. Therefore, mobile bullying can be defined as a form of cyberbullying committed using mobile phones (Li, 2008; Kowalski et al., 2008).

Considering the continuous advancements of technology, defining mobile bullying using specific online platforms is problematic because the categorisation may soon be outdated as technology evolves. It is proposed that a more desirable definition must be less-dependent on platforms. For instance the direct vs. indirect description of mobile bullying as discussed by some scholars (Kowalski et al., 2008; Patchin & Hinduja, 2010). Direct mobile bullying also

known as ‘to my face bullying’ includes bullying on the cyberspace in which the victim experience mobile bullying first-hand. While indirect mobile bullying, ‘behind my back bullying’, involves online spreading of gossip or potentially embarrassing material of victim without them knowing (Kowalski et al., 2008; Vandebosch et al., 2006).

Willard (2007) further unpacked mobile bullying by describing its various forms that include cyber-stalking, flaming, impersonation, harassment, outing, trickery, and exclusion. Thus, the next section briefly describes forms of mobile bullying.

### **2.2.1 Forms of Mobile Bullying**

Mobile bullying can be classified by noting the differences in impact and how mobile bullying is perpetrated. Firstly, *flaming* can be described as a form of mobile bullying which occurs when a perpetrator sends angry, vulgar, or rude messages about the victim to a group of bystanders or directly to the victim using a mobile phone (Li, 2010; Willard, 2007). Flaming is typically heated and short-lived, but it often proceeds for longer periods of time in which case it is referred to as a flame war (Willard, 2007). Sometimes flaming leads to an exchange of threat messages between perpetrator(s) and victim(s) with bystanders trying to encourage or defuse the flame (Willard, 2007).

*Cyber-stalking* is the act of the perpetrator repeatedly sending harmful messages with the threat of harming the victim, and messages are of extreme intimidation in nature (Li, 2010). Contrary to flaming, perpetrators of cyber-stalking usually hide their identity from victims making it hard to identify the perpetrators (Willard, 2007). Furthermore, if the perpetrator is not stopped at the beginning of the confrontations they tend to feel powerful, and sometimes they make worse encounters such as sexual denigration or exploitation (Sissing & Prinsloo, 2013).

*Harassment* is described by Willard (2007) as a longer-lived flame war but its one-sidedness distinguishes it from the usual flame wars. The perpetrator sends a harassing message to the victim even though the victim does not respond to the messages. Typically, perpetrators use their online contacts to inflict further harassment to the victims, thus making the perpetrators or harassing circle bigger and often hard to trace (Willard, 2007). Harassment differs from flaming by its notable power imbalance between the perpetrator and the victim.

The most common form of mobile bullying among school learners is *denigration* (Willard, 2007). Denigration occurs when the perpetrator sends harmful, false, or cruel messages to a group of bystanders about the victim (Li, 2007). Perpetrators usually denigrate victims mainly to damage the victim's friendships and reputations in the school or beyond school grounds (Willard, 2007).

Another form of mobile bullying is *outing*. Willard (2007, p. 9) described outing as “publicly posting, sending, or forwarding personal communications or images, especially communications or images that contain intimate personal information or are potentially embarrassing”. Outing usually happens when perpetrators forward communications containing personal, sensitive, or embarrassing images or information on victims to bystanders who were not meant to receive or view such content (Li, 2010; Willard, 2007).

*Impersonation* or *Masquerade* is a form of mobile bullying that occurs when the perpetrator imposes online stealing online profile of the victim and sending messages as if they were the victim (Willard, 2007). Impersonation is characterized by the bully ruining victim's online profile, sabotaging online friendships between the victim and his/her friends. Similar to outing, *trickery* occurs when the victim makes private communication with the perpetrator and then later the perpetrator forwards those communications to recipients that were not intended to see the communications (Willard, 2007). The main difference between trickery and outing is that the perpetrator tricks the victim into believing that they do not forward their private communications to bystanders in trickery.

*Exclusion* is another form of mobile bullying that is related to the exclusion of the victim from an online group (Li, 2008; Willard, 2007). Willard (2007) further warned of the severe emotional impact that may be felt by victims of online exclusion; teens may even feel rejected. The discussion above described various forms of mobile bullying, the discussion therefore leads into the next section to explore motivations for perpetrating mobile bullying.

### **2.2.2 Motivations for Mobile Bullying**

Much of the literature agrees that traditional bullying and mobile bullying share some similar characteristics and some significant differences (Hinduja & Patchin, 2008; Burton & Mutongwizo, 2009; Tokunaga, 2010). The differences are mainly due to the technological

nature of mobile bullying as opposed to the physical confrontation of traditional bullying (Li, 2010). Some scholars further argued that the motivations and appealing nature of mobile bullying over traditional bullying goes far beyond the technological nature versus the physical nature between the two (Kowalski & Limber, 2007; Li, 2008; Tokunaga, 2010). The following concepts describe motivations of mobile bullying as described by Tokunaga (2010).

### ***I. Anonymity***

In traditional bullying the identity of the perpetrator, physical appearance, is immediately known to the victim but not in mobile bullying. Ghost online accounts and falsified accounts allow bullies to have some sense of anonymity motivating them to mobile bully others thinking that they are untraceable (Keith & Martin, 2005; Li, 2008). The perceived online anonymity usually explains why mobile bullies are likely to say and do things that they would not normally do in face-to-face confrontations (Badenhorst, 2011; Hinduja & Patchin, 2008). Kowalski & Limber (2007) warned that the perceived online anonymity is not necessarily certain anonymity, meaning that mobile bullies are not as untraceable as they may think. About forty to fifty percent of incidents found that the victim knew the perpetrators, in a study conducted by Kowalski & Limber (2007).

### ***II. Accessibility***

Another appealing aspect of mobile bullying is related to the accessibility of the mobile phones and its features through which bullying can be instigated (Willard, 2007). Some perpetrators are encouraged by the capability of mobile phones enabling the perpetrator to harm the victim without even crossing the physical boundaries (Willard, 2007; Li, 2008). The increased accessibility allows the perpetrator to bully victims from anywhere and at any time (Li, 2008; Hinduja & Patchin, 2008). The high accessibility for perpetrators to bully victims may lead to deeper harm because bullying messages can spread quickly between perpetrator, the victim, and bystanders (Tokunaga, 2010; Smith et al., 2013).

### ***III. Lack of feedback***

The fact that parties involved in mobile bullying do not see each other, the perpetrator cannot see how much harm they are causing to the victim (Smith et al., 2013). Without the immediate

feedback revealing victim's reaction to mobile bullying, the perpetrator may continue bullying the victim without feeling any guilt whatsoever (Slonje & Smith, 2008).

#### ***IV. Punitive fear***

Tokunaga (2010) argued that many of the mobile bullying incidents remain unreported because victims fear that their mobile phones may be taken away from them by their parents or guardians. Smith et al. (2013) reported that they found similar results in their research. Keith & Martin (2005) further found that victims feel that bullying is less harmful than losing access to their mobile phones.

The next section therefore discusses impact and prevalence of mobile bullying.

### **2.2.3 Nature, Impact and Prevalence of Mobile Bullying**

UNICEF (2012) reported a sharp increase in mobile phone usage among South African youth. Badenhorst (2011) related the increasing mobile phone penetration to a rise in mobile bullying among South African high school learners. The trend emphasises the importance of exploring proactive measures to assist South African high schools to deal with mobile bullying incidents efficiently. Thus, it is imperative that the nature, impact and prevalence of mobile bullying be understood in the context of the South African schools. Only then appropriate countermeasures can be developed and implemented to curb this issue in South Africa. Therefore, this section focuses on nature, impact and prevalence of mobile bullying.

#### **I. Nature and Prevalence of Mobile-bullying**

In an attempt to understand the nature of mobile bullying, Huang and Chou (2010) investigated the types of mobile bullying in relation to the role players involved. It was reported that the role players can be classified as a victim, perpetrator or bystander. The study further reported that harassment and threats were the most common forms of mobile bullying among victims and bullies, and humour was found to be the most frequent among bystanders. Another study published in the same year, 2010, published a more comprehensive list of forms of mobile bullying compiled by Rivers and Noret (2010). The list includes the threat of physical violence, abusive, name-calling, death threats, ending of relationships, sexual acts, demands, threats to

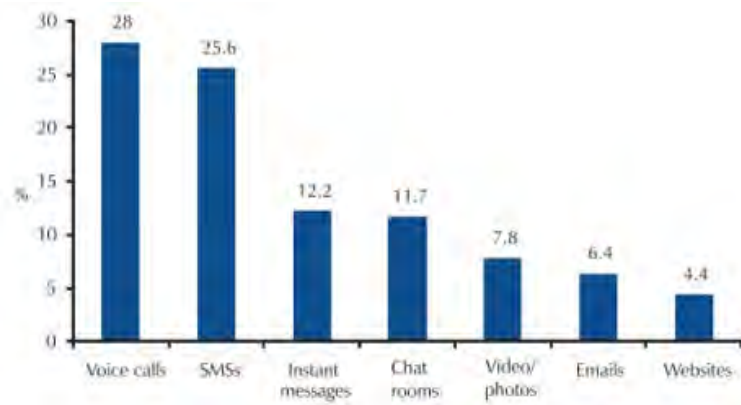
family, and menacing chain messages (Rivers & Noret, 2010). Other researchers firmly argued that the nature of mobile bullying has long-term psychological implications on perpetrators and victims:

*“The negative effects inherent in cyberbullying are not slight or trivial and have the potential to inflict serious psychological, emotional, or social harm. When experienced among members of this highly impressionable and often volatile adolescent population, this harm can result in violence, injury, and even death and later criminality for both the initiator and recipient of bullying.”* (Patchin & Hinduja, 2006, p.149).

Popovac and Leoschut (2012) performed a comparison of results obtained from two South African studies on the prevalence of cyberbullying and found that about 46.8% of surveyed youth admitted to having experienced online aggression at school or home. Another report by Burton and Leoschut (2013), said that 20.9% of learners who participated in their study reported having experienced some form of online violence. Furthermore, online violence was higher in the metropolitan areas compared to rural; about 12.1% of learners admitted having met someone offline whom they met online (Burton & Leoschut, 2013). Since the youth carries their mobile phones almost everywhere they go, it becomes difficult to escape mobile bullying (Mark & Ratliffe, 2011; Popovac & Leoschut, 2012).

Burton and Mutongwizo (2009) reported that voice call and SMS's constituted the majority of media used to perpetrate mobile bullying. A later study by De Lange and von Solms (2011) found that MXit and Facebook (social networks) was the most used for mobile bullying. A report by Burton and Leoschut (2013) also showed that bullying was mostly perpetrated through video clips and pictures (35.3%), followed by instant messaging platforms at 27.2%, and SMS at 14.7%.

These shows how dynamic the platforms used to perpetrate mobile bullying have been over time, and keeping up with these trends would mean regular studies must be carried out which comes at a cost. Below is a figure that was sourced from Burton and Mutongwizo (2009) showing different media used in perpetrating mobile bullying:



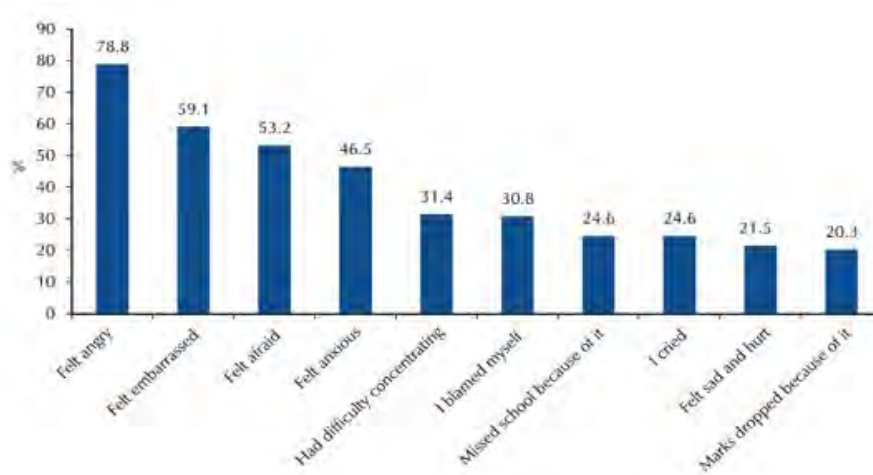
**Figure 2-1: Young South Africans’ experiences of cyberbullying (Burton & Mutongwizo, 2009)**

All the media shown in Figure 2-1 are platforms supported by any Internet-enabled mobile phone. Some of the media such as SMS and voice calls do not require the internet, which shows the level of ease of access to media that can be used to inflict mobile bullying.

## **II. Impact of Mobile bullying**

Literature indicates that the hidden nature of mobile bullying that is worsened by the victim’s fear to report incidents brings about the great impact of mobile bullying on youth (Hinduja & Patchin, 2008). Tokunaga (2010) found that the impact is dependent on frequency, length and severity of the bullying. The impacts of mobile bullying on learners includes poor academic performance at school, increased absenteeism from school, decline in quality of family relationships, low self-esteem, and depression (Hinduja & Patchin, 2008; Mark & Ratliffe, 2011; Li, 2010; Badenhorst, 2011).

Although this may seem trivial, some studies published worse findings such as the established link between mobile bullying and an increased risk of suicidal thoughts, attempts and successful suicides (Hinduja & Patchin, 2008).



**Figure 2-2: Impact of online experiences by % (Burton & Leoschut, 2013)**

Burton and Leoschut (2013) further elaborated that their findings mirrored those from the “Growing Up With Media” Survey conducted in United States. This shows that the problem is not only local but rather international. Thus, this problem needs to be tackled at its infancy in South Africa, rather than later when it is manifested into an epidemic. The next section then discusses possible preventative measures that can be implemented to prevent mobile bullying.

#### **2.2.4 Preventing Mobile Bullying**

Serra and Venter (2011) argued that mobile bullying can be prevented at two main levels known as the technological level and educational level. At a technological level, there are many software applications in the market which can be used to put strict controls on mobile phones (Sissing & Prinsloo, 2013). Parents and teachers can filter and limit content that children can access on their phones thus reducing risk and exposure to mobile bullying and inappropriate content. On the other hand, some social networking site such as Facebook and Twitter allows users to configure strict security settings to block unwanted content and block pestering users (Badenhorst, 2011; Mark & Ratliffe, 2011). YouTube also released a version of their website dedicated to the youth. This version of YouTube filters out and blocks explicit and inappropriate content from views by the youth. Instant messaging and email also has features that allows for configuration such that filtering and blocking offensive messages and bullying (Tokunaga, 2010). In extreme cases it is recommended that email addresses, cell phone numbers, and user name and passwords be changed to avert persistent mobile bullying

(Tokunaga, 2010). Parents can exploit such features to reduce mobile bullying; however it is possible for such measures to be bypassed by perpetrators (Sissing & Prinsloo, 2013).

At an educational level, many studies recommended extensive educational and awareness programs in schools (Badenhorst, 2011; Hinduja & Patchin, 2008; Rivers & Noret, 2010). Awareness gets learners to know what mobile bullying is, and it equips learners with knowledge relating to what to do when facing mobile bullying. Other researchers reported that educational and awareness programs do not necessarily stop mobile bullying (Li, 2008). Badenhorst (2011) recommended that school policies should be developed, and a review of the acceptable use of mobile phones or technology at large should be done alongside policy reviews. Furthermore, schools should develop anonymous reporting channels, and learners must know of such interventions to improve on mobile bullying incident reporting (Li, 2008).

Additional to the two levels, other researchers argued that relevant legislature should be enforced at a national level to protect learners from mobile bullying (Badenhorst, 2011). However, this could take a while to implement adequately as Section 2.1.3 raises some concerns about misalignment in the current laws governing the electronic use and abuse in South Africa. All the role players must be involved in all intervention programs. The role players include government, learners, teachers, school principals, parents, school governing body, and school management team (Sonhera et al., 2012; Li, 2008). Other novel solutions are needed in cases where the preventative mechanisms are bypassed by perpetrators (Serra & Venter, 2011), and that is where this research comes in.

### ***Section Summary***

The section first discussed what is mobile bullying. Various definitions of cyberbullying were presented to lead the discussion into forms of mobile bullying and the differentiating factors between them. The motivations of mobile bullying on school learners were discussed as well as the nature and prevalence of mobile bullying. The last section explored measures that can be used to prevent mobile bullying. These were found to be mainly technological and school levels of preventative measures. It is worth noting that the ‘always on’ and mobility features

of mobile phones puts victims in positions of being bullied anytime with little or no hiding place (Kowalski et al., 2007; Smith et al., 2008).

To prevent mobile bullying in schools perpetrators must be identified, reported and digital evidence need to be available to discipline the bullies. However evidence that is digital in nature and the procedures followed in compiling it must be credible and admissible in disciplinary proceeding or in court. It is then required that an understanding of what digital forensic investigators look for and how schools can be ready to provide such digital evidence be established. Furthermore, an understanding of how to perform basic investigations in-school to reduce investigation turnaround times is required. Therefore, this leads into the next section that presents digital evidence and mobile forensics, what these concepts mean, how one can be digital forensic ready, and how schools can employ similar solutions to curb mobile bullying.

## **2.3 Digital Evidence**

Digital evidence serves as the main guideline for disciplinary bodies' ruling on incidents of wrongdoing with the aid of digital devices. Therefore, the credibility and competency of digital evidence must be observed when dealing with an investigation that rely on the use of digital evidence (Yadav, 2011). Carrier & Spafford (2005, p2), defined digital evidence as any digital data containing reliable information that proves or disprove allegations being investigated. According to Bassett et al. (2006) digital evidence is made up of any digital device's hardware, software, or data that can be useful in the investigation of an incident. Due to the delicacy of digital evidence, improper handling thereof has the potential to alter, damage or even destroy digital evidence (Casey, Bann & Doyle, 2010). The change in state of the digital evidence may render that evidence as inadmissible to be used for prosecution (Ryan & Shpantzer, 2002). The next section describes the details of the admissibility of digital evidence in courts and disciplinary proceedings.

### **2.3.1 Admissibility of Digital Evidence**

According to Kenneally (2001), the admissibility of any evidence is guided by the principles of relevance, competency, and the value of that evidence in the investigation. Digital evidence thus observes similar requirement before it can be used to prosecute perpetrators. The rules and laws that govern the use of evidence thus applies to digital evidence (Kenneally, 2001).

The fundamental case, *Daubert vs. Merrel Dow Pharmaceuticals*, laid a platform for admissibility of scientific evidence in courts in the United States of America in 1993 (Stephenson, 2003). From that case followed the ‘Daubert test’ that laid the foundation for scrutinizing scientific evidence for admissibility in court. The Daubert test contains vigorous checks which include checking whether the theory or technique used is refutable, and/or testable. Secondly, check whether the theory or technique used has been subjected to peer review and if it has been published. Thirdly, checks what the known or potential error rate is. The fourth check determines if there are maintenance of standards and controls concerning the technique or theory’s operation. Lastly, the test determines to what degree the theory or technique is accepted by the relevant scientific community (Stephenson, 2003).

The criterion serves as a standard for evaluating scientific evidence admissibility in the court of law (Kenneally, 2001). Digital evidence undergoes similar critique to ensure evidence credibility and admissibility in court.

The South African context of digital evidence admissibility is governed primarily by the ECT Act 25 of 2002 South Africa. Section 15(3) of the Act defined guidelines for courts to assess credibility and admissibility of evidence (ECT Act, 2002). The Protection of Personal Information (POPI) Act 4 of 2013 South Africa generally gives constitutional rights to privacy by regulating any processing of personal information, however chapter 4 of the POPI Act caters for exemption to interfere with privacy of information provided that the matter is in the interest of national security. RICA Act 70 of 2002 South Africa regulates the interception and monitoring of communication. Furthermore, the South African Gazette provides exemptions for officials to interfere with the privacy of information subject to interests of national security relating to the prevention, detection and prosecution of any perpetrators. The discussions of legislation are detailed in Section 2.1.3.

## **2.4 Mobile Forensics**

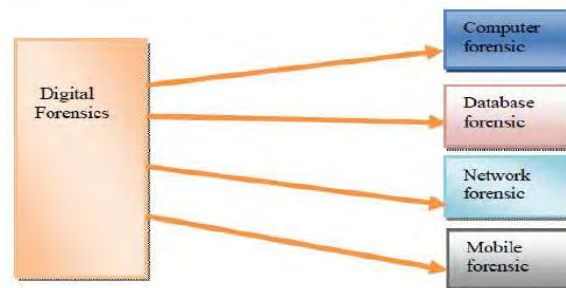
The use of mobile devices such as smartphones and tablets has become prevalent in the society. Some mischievous people abuse the communications capabilities that come with these devices by committing crimes with the aid of technology (Barske et al., 2010). It is then imperative that those trusted with enforcing the law and safe-keeping of the communities and youths in schools, be able to perform basic investigations of mobile bullying incidents. The forensic

investigations of incidents involving mobile devices are referred to as mobile forensics (Yadav, 2011).

### 2.4.1 History and Development

Digital forensics is typically used by organisations for their own internal investigation in events where security breaches, crime, fraudulent transactions, harassment, or mischief occurs with the aid of digital devices (Pooe and Labuschagne, 2012). Digital forensics as a discipline is a relatively new science derived as a synonym for computer forensics, with the aim of extending the definition of computer forensics to cater for all digital devices (Reith, Carr, & Gunsch, 2002). There is no agreement in the literature regarding a standard definition for digital forensics. This research adopts a definition of digital forensics which posits that “digital forensics is the application of computer science and investigative procedures for a legal purpose involving the analysis of digital evidence after proper search authority, chain of custody, validation with mathematics, use of validated tools, repeatability, reporting, and possible expert presentation” by Duranti & Endicott-Popovsky (2010, p. 1).

According to Yadav (2011), digital forensics consists of four main forensic branches that as a collective make up the digital forensic discipline as depicted in Figure 2-3.



**Figure 2-3: Classification of Digital Forensics (Yadav, 2011)**

Computer forensics deals with forensics of computer systems. The main source of evidence comes from system logs, data saved or deleted from the system, application data, browser history and many other sources of evidence from a computer system used in a suspected e-crime (Carrier, 2003). Database forensics mainly deals with forensics of databases and its associated data and metadata; network forensics deals with monitoring and analysis of network

traffic to investigate incidents involving network communications (Yadav, 2011). Mobile forensics is concerned about the forensics of mobile devices such smartphones (Casey, Mislán, & Kessler, 2010b). This study focuses on the mobile forensics paradigm. The mobile phone as a tool for perpetrating mobile bullying calls for mobile forensic skills to investigate incidents and bring perpetrators to book.

The typical process of mobile forensics draws from that of digital forensics. The process consists of three fundamental steps which can be described as evidence acquisition while preserving evidential integrity, authenticating evidence validity and analysing collected evidence while maintaining its integrity (Cisar & Maravic Cisar, 2011).

Evidence acquisition typically includes shutting down the target device to image or perform acquisition of the data stored on the device using forensic tools (Singh, Yadav & Rastogi, 2015). The acquired image is then hashed to confirm that it is an exact binary copy of the source evidence (Endicott-Popovsky et al., 2007). Mobile device acquisition process can be conducted as a logical acquisition or physical acquisition. Logical acquisition allows for a bit-by-bit copy of the logical storage of the mobile device such as SMS and call log (Singh, Yadav & Rastogi, 2015). Physical acquisition caters for a bit-by-bit copy of the entire physical storage thereby allowing the recovery of deleted items (Singh, Yadav & Rastogi, 2015). Analysis of the acquired image then follows after the acquired image file has been authenticated and validated (Cohen, Bilby, & Caronni, 2011). The next section discusses digital forensic readiness.

#### **2.4.2 Digital Forensic Readiness**

The notion of forensic readiness embraces a proactive approach to digital forensics while complimenting traditional reactive forensic methods. Institutions can, therefore, anticipate that at some point an incident will arise requiring digital forensics for resolution. The institution then prepare their environment to handle such incidents efficiently while reducing the operational impact on the business (Pooe & Labuschagne, 2012). Digital forensic readiness can be defined as “the ability of an organisation where certain controls are implemented to facilitate digital forensic processes and to anticipate malicious actions that may be disruptive to the business operations” (Pangalos & Katos, 2010, p. 14).

Tan (2001) was the first to posit that digital forensic readiness holds two key objectives for any institution. The objectives of forensic readiness are to minimise the costs of investigations, and to maximise the institution's ability to gather credible digital evidence. Digital forensic readiness program consists of technical and non-technical factors which contribute to the adequacy of forensic readiness in an institution (Barske et al., 2010; Rowlingson, 2004). This research focuses on the non-technical factors of digital forensic readiness. The expectation is that high school teachers, principals, school administrators, and school governing bodies may not necessarily possess the technical skills similar to those of digital forensic specialists. However, it not suggested that schools role players have non-technical forensic skills. The next section discusses intervention on mobile bullying based on concepts of digital forensic readiness.

#### **2.4.3 Mobile Bullying Interventions Based on DFR**

Serra & Venter (2011) identified a gap in literature and practice with regards to solutions in response to the mobile bullying epidemic in schools. Once the gap was identified, Serra & Venter (2011) proposed proactive measures to determine the risk of exposure for children who have access to mobile phones. The process is based on the risk profile to predetermine risk exposure for individual child mobile phone user (Serra & Venter, 2011). The results of the risk evaluation are then used as a policy governing what that child user is exposed to while online irrespective of whether the child is on school grounds or at home. Serra & Venter (2011) further proposes that once a neural network application is developed, it can then be installed on a mobile phone to monitor all interactions including texting, social media, and instant messaging. The input into the system has three fundamental categorisations which includes a *categorisation of the state of security of an individual based on age* categorisation, a *categorization of online usage as a function of time spent online*, and a *categorisation of the types of online access and associated risks* Serra & Venter (2011). The whole approach is grounded on theories of digital forensic readiness specifically for cyberbullying perpetrated through mobile phones Serra & Venter (2011).

Sonhera et al. (2012) noted how the lack of national policies and procedures regarding the handling of cyber threats in schools contributes to teachers not knowing how to handle these incidents. According to Willard (2007) cyber threats incidents are one example of mobile

bullying incidents. Thus, the lack of national cyber threats procedures for schools implies a lack of national mobile bullying policies and investigatory procedures. Sonhera et al. (2012) proposed a readiness procedure which explicitly calls for collaboration amongst various role players. The role players include the police, social workers, teachers, parents, guardians, and learners themselves (Sonhera et al., 2012). The readiness procedure outlines how incidents should be dealt with, defines where the escalation points should be, and how relevant role players should conduct reporting. The incident handling procedure is aimed at assisting learners to report mobile bullying, and to empower other role players to handle mobile bullying incidents in a systematic manner in South African schools.

The next section provides a discussion of published digital forensic readiness frameworks, compares and contrasts common key components, and then proposes a non-technical conceptual framework to guide the remainder of this research.

#### **2.4.4 Digital Forensic Readiness Frameworks**

This section presents a review of four published digital forensic readiness frameworks. These four frameworks are chosen on the basis that they were developed for diverse industry specialisation. The focus of the discussion is mainly on key components that contributed to each framework, and then a discussion of the common components of digital forensic readiness program will follow after this section.

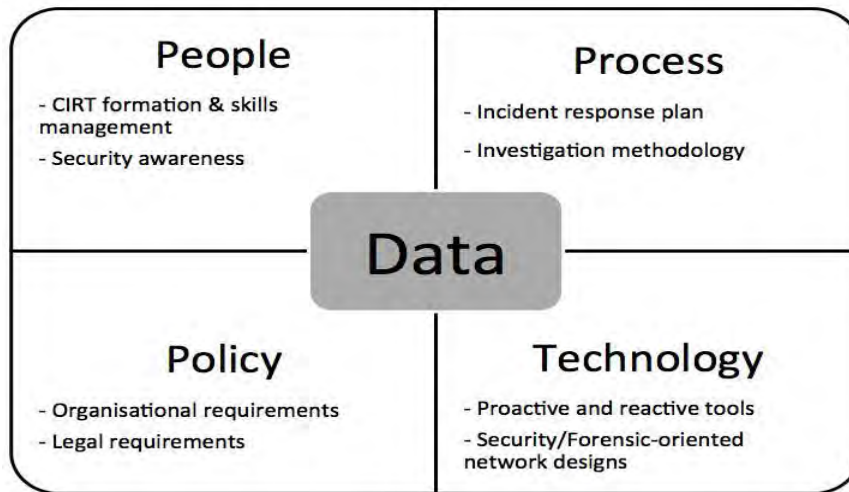
According to Barske et al. (2010), the essential components of forensic readiness can be grouped into thematic categories which include *Technology, Policy and Procedure, Strategy, Digital forensic response, and Compliance and monitoring*. The main purpose of this framework was to provide scalable digital forensic readiness model for small, medium enterprises (SMEs) operating in South Africa. This framework further outlined how interdepartmental collaboration within an organisation enhances the adequacy of forensic readiness (Barske et al., 2010). The framework is summarised by Barske et al. (2010) as portrayed in figure 2-4:



**Figure 2-4: Components of Digital Forensic Readiness (Barske et al., 2010)**

Grobler et al. (2010) proposed a framework for proactive forensics with high-level components that include *Governance, Legal and Judiciary, Policy, Process, Technology, and People* dimensions. The legal and judiciary dimension is the core of the framework, and it influences all activities within the structure of forensic readiness (Grobler et al., 2010). While governance is the subset of legal and judiciary, the remaining components are subsets of governance that handles overall adequacy of forensic readiness program. The main purpose of this framework was to give management a holistic view of forensic readiness program ensuring the availability of sound evidence during investigations (Grobler et al., 2010).

Pooe & Labuschagne (2012) argue that at a macro level, it is possible to group core digital forensic readiness activities into four categories which include *Process, People, Policy, and Technology*. Each component consists of activities classified as proactive and reactive classes (Pooe & Labuschagne, 2012). The proactive classes includes those activities that can be implemented and actioned proactively such as continuous logging. While reactive classes includes those activities that can only be actioned reactively even though they form part of the readiness program, for instance imaging a system (Pooe & Labuschagne, 2012). While Pooe & Labuschagne (2012) model emphasise on departmental collaboration when setting up forensic readiness program, the model further proposes a centralised classification of roles and responsibilities to reduce duplicate activities. Figure 2-5 summarises the framework.



**Figure 2-5: Digital Forensic Readiness Conceptual Model (Pooe & Labuschagne, 2012)**

Trček, Abie, Skomedal, & Starc (2010) proposed a conceptual framework for forensic readiness procedures which aims at adapting service organisations to setup proactive approach to digital forensics. The framework focuses on the technological aspect and configuring systems for collecting potential digital evidence before an incident occurs. Once the evidence is collected, it is then secured and stored systematically maintaining sound forensic practices (Trček et al., 2010). The framework proposes high-level components which include *Policies, Processes and procedures, Legislation, and People*.

The discussion of frameworks about components of digital forensic readiness program shows notable differences in naming of components amongst researchers. However, the discussion still presents similar ideas in terms of the contents of digital forensic readiness components. For instance Barske et al. (2010) discusses digital forensic “response team” while Pooe & Labuschagne (2012) and Grobler et al. (2010) refers to the same component as “people”. Table 2-1 highlights the common components of digital forensic readiness from the frameworks discussed above.

**Table 2-1: Similarities in DFR frameworks (own compilation)**

Framework	Digital Forensic Readiness Components					
	<i>Strategy</i>	<i>Process/ Procedure</i>	<i>People</i>	<i>Policies</i>	<i>Techno logy</i>	<i>Compliance /monitoring</i>
Barske et al. (2010)	✓	✓	✓	✓	✓	✓
(Grobler et al. (2010)		✓	✓	✓	✓	✓
Pooe & Labuschagne (2012)		✓	✓	✓	✓	
Trček et al. (2010)		✓	✓	✓	✓	

According to Table 2-1, it can, therefore, be deduced that the common components of digital forensic readiness, based on the reviewed frameworks, are *technology, processes and procedures, people, and policies*. The common components of digital forensic readiness can be summarised as follows.

### **I. Policies**

Policies are typically used to enhance digital forensic readiness by outlining key forensic readiness activities. The activities include incident response plans, training, preventing anonymous activities, retaining potential evidence, and finding secure evidence storage for collected evidence (Yasinsac & Manzano, 2001). Barske et al. (2010) proposed that a minimum set of policies that an institution should have in order to support their digital forensic readiness includes:

A policy to administer the acceptable use of information systems resources by employees. This policy defines information systems resource allocations and rights assigned thereto. Another policy must administer ownership of firm's information systems resources including data stored therein. Employees should not assume ownership nor privacy rights of information transmitted using the firm's information systems resources. A third policy must oversee monitoring of firm's information systems resources; this policy includes details of potential evidence, instances of how and when evidence will be preserved. Another policy must administer internal investigations and subsequent consequences; this policy stipulates instances that evidence may be released to external parties including escalating incidents to law

enforcement. Finally, a policy that define roles and responsibilities of parties involved in the organisation's forensic readiness program. Taylor et al. (2007) warns that failure to adhere to forensic policies may have a negative impact on organisation's revenues, worse in the event of legal liability.

## **II. Legal**

The legal factor of digital forensic readiness program in an organisation plays a major role in ensuring that the whole forensic program is conducted legally (Pooe & Labuschagne, 2012). It is the responsibility of the legal representative to ensure that any collected potential evidence maintains high levels of data integrity, authenticity and admissibility in disciplinary proceedings or court of law (Ryan & Shpantzer, 2002). The people responsible for automating evidence collection should make certain that their methodologies adhere to best practices. Observing best practice ensures legality and admissibility of evidence during an investigation because mistakes can alter evidence and render it inadmissible in court (Carrier, 2002; Ryan & Shpantzer, 2002; Barske et al., 2010). According to Pooe and Labuschagne (2012), ultimately it is the responsibility of the management to see to it that forensic readiness has adequate compliance measures in place. Furthermore, periodic reviews of the legal compliance and awareness must be conducted to ensure the legality of the organisation's readiness programs (Taylor et al., 2007; Orebaugh, 2006).

## **III. Technology**

It is important that organisations implementing digital forensic readiness program acquire software and hardware to collect and preserve potential evidence (Barske et al., 2010). The software used must be able to collect evidence in a forensically sound manner (Cohen, Bilby, & Caronni, 2011). Digital evidence will come from various sources such logs on workstation and servers, information systems network, and from other security sources such as surveillance camera system (Pangalos & Katos, 2010). While proactive acquisition of potential evidence is automated and data stored safely in secure storage, it is important that the organisation ensures that user privacy is respected (Grobler & Louwrens, 2006; Endicott-Popovsky et al, 2007). The South African laws that relate to information privacy includes POPI Act, which is discussed in greater detail in Section 2.1.3.

#### **IV. People**

Digital forensic readiness team must include both technical and non-technical members of the team to ensure that the correct balance is maintained in the team (Rowlingson, 2004). For instance, the team should have a digital forensic specialist to take care of the technical matters (Casey, 2005). Legal counsel is non-technical. However, they ensure that the correct legal principles are applied to the entire forensic readiness program (Kenneally, 2001). According to Grobler et al. (2010) organisations should consider integrating digital forensic readiness team into existing enterprise information security response plans and people responding to incidents. More often than not it happens that the required forensic skills are not found in the organisation. Such instance requires the external or outsource people and consultants to assist the internal people with the investigation (Trček et al., 2010). Clearly collaboration between various people within an organisation and externally enhances the adequacy of forensic readiness program (Trček et al., 2010). However, to lessen duplicate activities, it is important for every member of the digital forensic readiness team to know their unique roles and responsibilities (Orebaugh, 2006). Training and development of the forensic people to keep their skills updated as technology advances should be at the core of the forensic readiness program (Carrier, 2003; Orebaugh, 2006).

#### **V. Processes and Procedures**

The processes and procedure class is concerned with documented actions that incident responders follow when responding to incidents (Pooe & Labuschagne, 2012). The guidelines are crafted in such a way that evidence integrity is the helm of the whole readiness program. The key activities of the digital forensic process includes *securing the evidence maintaining its integrity, acquiring the evidence without altering the source evidence, ensuring that the acquired evidence is the exact copy of the original evidence, and then analyse the acquired evidence without altering it*. The complexities of conducting investigations require that processes, procedures and policies be defined well ahead of time to enhance the forensic readiness program (Barske et al., 2010; Pooe & Labuschagne, 2012).

This leads the discussion into the next section that presents the proposed forensic readiness model that is proposed for schools where role players are typically unskilled in digital forensics.

### 2.4.5 The Proposed Conceptual Framework

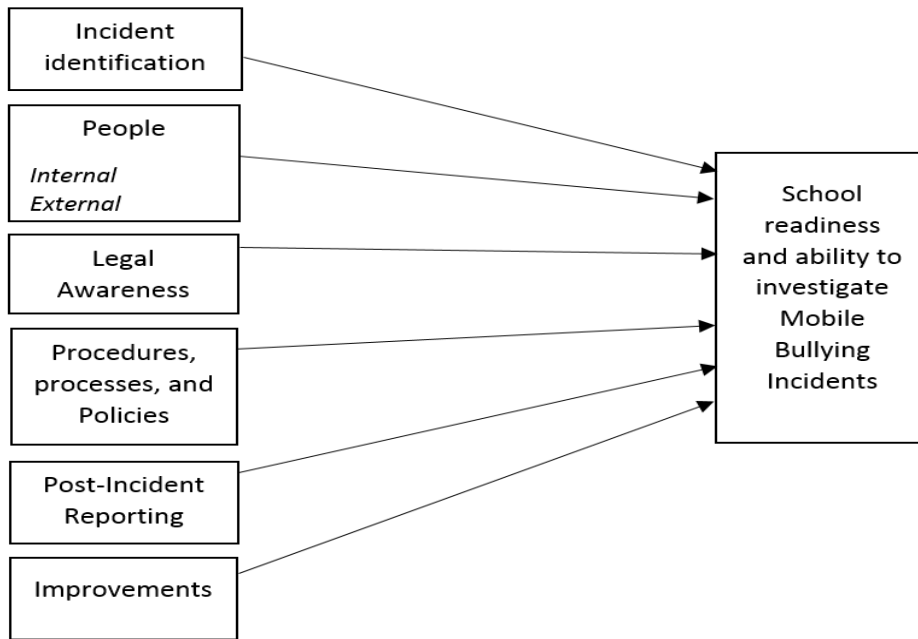
The proposed framework is tailored such that it captures key requirements that any school need to prioritise if they want to be digital forensic ready. The requirements are grouped into components, and Figure 2-6 summarises the proposed framework. The arrows from each component show the component's relationship and influence on readiness and ability to investigate incidents. Though the framework draws from technical forensic readiness frameworks discussed in the previous section, the framework is adapted such that it provides guidelines for schools to prepare for incidents when they are required to perform basic investigations. Therefore, the framework is tailored to be non-technical in nature, as mentioned, school role players are not expected to be technically sound when coming to digital forensics.

Table 2-2 below summarises a list of key references cited in support of the key concepts used in the conceptual framework.

**Table 2-2: Similarities in DFR frameworks (own compilation)**

Concept	Reference
Incident identification	Rowlingson (2004)
People (internal and external)	Trček et al. (2010)
Legal awareness	Pooe & Labuschagne (2012)
Post-incident reporting	Endicott-Popovsky et al. (2007)
Procedures, processes and policies	Barske et al. (2010)
Improvements	Taylor et al. (2007)

Figure 2-6 below presents the proposed conceptual framework.



**Figure 2-6: Proposed Conceptual Framework**

The constructs of the proposed framework are discussed as follows.

- ***Incident identification***

Incident identification marks the start of the entire incident lifecycle. If the mobile bullying incident is not identified and brought to light, the investigation cannot commence. Rowlingson (2004) describes incident identification as the ability to identify offences and preserve evidence required to support the investigation. The people responsible for the initial incident response in a school setting should then establish whether the incident can be handled internally within the school or help is required from external parties (Sonhera et al., 2012). If the incident can be dealt with internally, the incident investigation phase commences. If internal people can not handle the incident, it is then escalated to external support, for instance the police (Vandebosch et al., 2012).

- ***People***

The people construct refers to the people involved in the digital forensic readiness program. While people includes internal role players such as learners, teachers, principal, school IT

personnel, school management team, and school governing body (Sonhera et al., 2012). External role players include parents or guardians, the police, social services, and other private industry groups such as internet service providers (Sonhera et al., 2012). The external role players are typically called upon when internal role players are not able to resolve the incident internally (Adelstein, 2006).

- ***Legal awareness***

This concept caters for the necessity that the incident respondents are always mindful of legal requirements such as privacy issues (Reddy & Venter, 2009). Consultation with the legal counsel ensures the legality of the entire forensic readiness program (Barske et al., 2010). It is important that incident responders understand the legal requirements so that evidence can be treated with integrity to ensure admissibility in disciplinary proceedings (Ryan & Shpantzer, 2002; Kenneally, 2001).

- ***Processes, procedures and policies***

The incident response team must refer to the documented processes, procedures and policies (Barske et al., 2010). This construct deals with the provision of guidelines for incident respondents to handle the incident in a sound forensic manner (Yasinsac & Manzano, 2002; Poole & Labuschagne, 2012). Processes, procedures and policies are the documented school guidelines and policies specifically to address mobile bullying (Sonhera et al., 2012). The processes and procedure relate directly to what steps need to be taken when responding to incidents, and these include the investigatory processes, escalations, reporting, and follow-ups. Sonhera et al. (2012) recommends that policies should address the prevention of online bullying in schools. Policies should be used to grant monitoring rights for mobile phone usage while learners are on school premises; and state the outcomes of breaching policies (Sonhera et al., 2012). Incident investigation is a sub-concept under processes, procedures and policies. Incident investigation includes the entire incident probe from evidence preservation, analysis, interpretation, presentation of findings, and reporting (Cisar & Maravic Cisar, 2011). Carrier and Spafford (2003) added the readiness phase to ensure that the entire investigation can be fully supported by readily available resources (Carrier & Spafford, 2003).

- ***Post-incident reporting***

Reporting typically follows after the entire incident investigation has been completed (Yasinsac & Manzano, 2002). Post-incident reporting includes the consolidation of all the steps taken during investigation until the action taken upon findings such as disciplinary hearing (Carrier & Spafford, 2003). This step caters encourages storing each incident report in a systematic filing system, be it paper-based or electronic filing system, there must be acceptable levels of security to incident reports (Carrier, 2003).

- ***Improvements***

Many researchers emphasised the importance of reviewing processes, procedures, policies, incident investigation, and reporting channels in order to improve the readiness program (Rowlingson, 2004; Kortjan & Von Solms, 2014; Walaza et al., 2014). Training and awareness programs are amongst some of the improvement measures schools can implement to increase their levels of readiness to handle mobile bullying incidents (Sonhera et al., 2012). It is worth noting that the proposed research framework is limited to one directional testing of the relationship for each component versus ‘readiness and ability to investigate’ as presented in the conceptual framework.

#### **2.4.6 Summary, Conclusion and Gaps**

The chapter on literature review highlighted that with the increasing adoption of mobile technology by high school learners, mobile bullying has since been on the rise. Role players in schools are often caught in situations where they do not know what to do when mobile bullying incidents arise. Mobile forensics is typically used to conduct digital investigations that involve the use of mobile devices. The investigation seeks to gather credible digital evidence that can be used to prosecute perpetrators. For schools to successfully prosecute mobile bullies, it is imperative that some measures are put in place to know how to preserve, collect, and handle digital evidence. Literature revealed key factors that have an impact on institution’s digital forensic readiness. However, none of the existing frameworks looks at the non-technical factors influencing forensic readiness from the school’s perspective. Secondly, there is a gap in literature for research that focuses on the ability and competency of teachers in investigations of mobile bullying incidents. Furthermore, it is unknown whether other role players such as

parents, community services, police, and social services, know what to do when mobile bullying incidents are reported to them.

The proposed model then seeks to bridge this gap in literature by studying the non-technical factors that influence forensic readiness in schools. The application of the proposed model would lead to proper policies that address mobile bullying in South African township schools. Furthermore, the awareness with legal issues regarding investigations of mobile bullying incidents would be improved. Lastly, the model will encourage incident responders to develop proper incident response plans. The next chapter presents research hypotheses development.

### **3. CHAPTER THREE – Research Hypotheses Development**

This chapter presents the development of research hypotheses. The chapter starts by recapping on the research question and the objectives to lead the discussion into hypotheses development. The final section of this chapter presents the proposed research framework with hypotheses incorporated in the framework.

#### **3.1 Research Question and Objectives**

The main research question for this study is ‘*what are the non-technical factors influencing forensic readiness and the ability to investigate mobile bullying incidents in township high schools in South Africa?*’ To answer the main research question efficiently, sub-questions were developed and were as follows:

- How does mobile bullying incident identification proficiency of teachers affect the readiness and ability of teachers to handle mobile bullying incidents in schools?
- How does the availability of people affect readiness and the ability of teachers to handle mobile bullying incidents in schools?
- How does well-documented processes, procedures, and policies affect readiness and the ability of teachers to handle mobile bullying incidents in schools?
- How does teachers’ legal awareness affect teachers’ readiness and ability to handle mobile bullying incidents in schools?
- How does general readiness program improvements in schools affect the readiness and ability of teachers to handle mobile bullying incidents in schools?

This leads to research objectives and what the researcher hoped to archive at the end the end of the research project. The research objectives are a result of literature review, especially the gaps identified following the literature review. The objectives of this study are:

- To provide insight into the non-technical factors that influence forensic readiness and the ability to handle mobile bullying incidents in township schools.
- To explore opportunities for employing non-technical forensic readiness for role players in South African township schools who are not necessarily forensic specialist.

### 3.2 Research Hypothesis Development

Drawing from the literature review, research question, and research objectives, this section presents the development of research hypotheses. The hypotheses will be subjected to statistical tests to determine their significance in the data analysis section. Hypotheses development follow in the next paragraphs.

According to Mumba and Venter (2014), potential digital evidence identification process starts when the incident is identified and brought to light. The incident identification stage is important because evidence is identified and preserved for use in the investigation. The incident responder must ensure that the evidence is collected in a sound forensic manner preserving evidence integrity to ensure admissibility (Punja & Mislán, 2008). During evidence identification, the responders must start with the documentation that will form part of the overall report. The documentation typically includes phone make and model, and what type of evidence is of relevance to the incident, for instance, offensive SMS (Mumba & Venter, 2014). Sonhera et al. (2012) emphasised the importance of school incident responders in knowing how to classify incidents according to where to escalate matters if required to do so. For instance, teachers should not engage in investigations of incidents relating to child protection issues, such incidents must be escalated to social services immediately (Sonhera et al., 2012). It is therefore proposed that

*H<sub>1</sub>: The ability to identify and classify incidents has a positive effect on the school readiness and ability to investigate mobile bullying incidents.*

Barske et al. (2010) reported that the people who form part of the readiness program should always be available to respond to incidents. Furthermore, if the incident requires help from external people, the external people must be available to assist in the investigation. Sonhera et al. (2012) identified the key external people for incident escalation for schools. These external people include the police, social workers, network service providers, and forensic specialists. The police typically handle incidents of criminality in nature, while social workers handle child protection incidents, and the forensic specialists handle cases where extensive incident investigation is need to resolve an incident (Sonhera et al., 2012). Thus, the following hypothesis is put forward:

*H<sub>2</sub> – The readily available people have a positive effect on the school readiness and ability to investigate mobile bullying incidents.*

Legal awareness is described by Valjarevic & Venter (2012) as a very crucial matter to observe legal regulation especially when conducting the investigation. It is crucial that privacy issues are observed and that proper legal advice is obtained prior to schools conducting investigations internally (Reddy & Venter, 2009). Barske et al. (2010) highlighted that proper legal awareness and advice from those qualified in the law enhances the overall forensic readiness program and ensures the legality of all the investigations. Therefore, the following hypothesis is put forward:

*H<sub>3</sub>: Ensuring legal awareness amongst role players in schools has a positive effect on the school readiness and ability to handle mobile bullying incidents.*

Researchers in mobile forensics agree that a chain of custody must be maintained throughout the investigation (Carrier, 2003; Jansen & Ayers, 2007; Yadav, 2011). Those that handle the incidents are required to document every action they perform and compile a post-incident report detailing their action from the start of the investigation to the conclusion (Carrier, 2003). Therefore, the following hypothesis is put forward:

*H<sub>4</sub>: The ability to document proper post-incident report has a positive effect on the school readiness and ability to investigate mobile bullying incidents.*

Sonhera et al. (2012) argued that the correct implementation of anti-mobile bullying policies can assist schools in reducing mobile bullying. Burton and Mutongwizo (2009) suggested that policies should provide guidelines to teachers and learners regarding what to do when mobile bullying incident arises. Furthermore, any investigation of mobile forensics has to follow some form of acceptable procedures. Documented processes and procedure ensures that the actions of incident responders can be repeated by other investigators if it is required (Mumba & Venter, 2014). Thus, the following hypothesis is put forward:

*H<sub>5</sub>: The existence of policies, investigatory processes and procedures has a positive effect on the school readiness and ability to investigate mobile bullying incidents.*

According to Barske et al. (2010), the overall forensic readiness program must undergo periodic reviews to ensure that relevant improvement actions are implemented to enhance program. Training and awareness programs have been found to be very effective in improving the overall program (Valjarevic & Venter, 2012). De Lange and von Solms (2011) also recommended that regular cyber awareness must be conducted in schools. Thus, the following hypothesis is put forward:

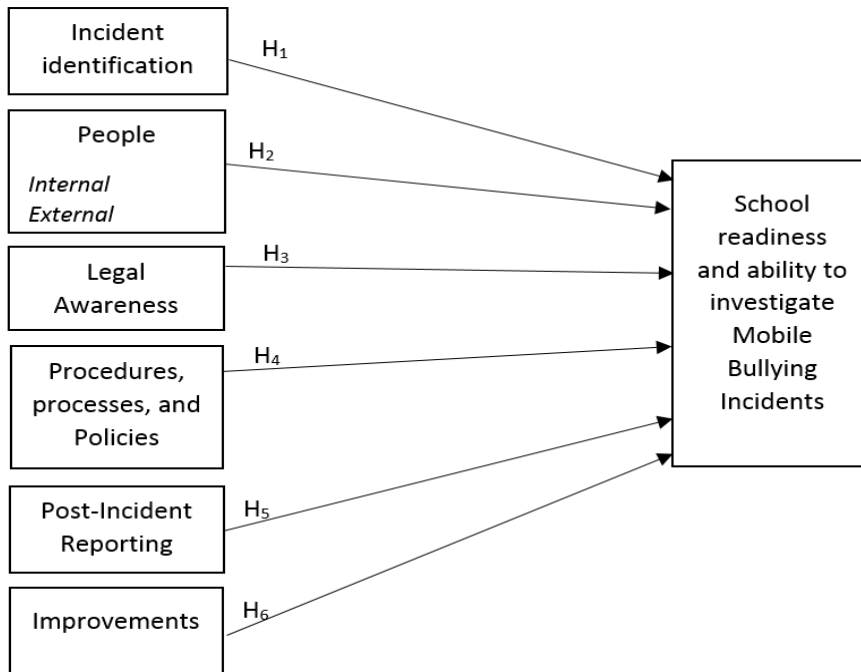
*H<sub>6</sub>: Periodic improvements to readiness program has a positive effect on the overall school readiness and ability to investigate mobile bullying incidents.*

Table 3-1 below presents a summary of all the hypotheses proposed in this research.

**Table 3-1: Research Hypotheses**

<b>Hypothesis</b>	<b>Description</b>
<i>H<sub>1</sub></i>	<i>The ability to identify and classify incidents has a positive effect on the school readiness and ability to investigate mobile bullying incidents.</i>
<i>H<sub>2</sub></i>	<i>The readily available people have a positive effect on the school readiness and ability to investigate mobile bullying incidents.</i>
<i>H<sub>3</sub></i>	<i>Ensuring legal awareness amongst role players in schools has a positive effect on the school readiness and ability to handle mobile bullying incidents.</i>
<i>H<sub>4</sub></i>	<i>The ability to document proper post-incident report has a positive effect on the school readiness and ability to investigate mobile bullying incidents.</i>
<i>H<sub>5</sub></i>	<i>The existence of policies, investigatory processes and procedures has a positive effect on the school readiness and ability to investigate mobile bullying incidents.</i>
<i>H<sub>6</sub></i>	<i>Periodic improvements to readiness program has a positive effect on the overall school readiness and ability to investigate mobile bullying incidents.</i>

The research framework that was discussed in Section 2.4.6 can, therefore, be summarised as per Figure 3-1 below. The summary in the figure incorporates all the research hypotheses that were discussed in this section.



**Figure 3-1: Proposed Framework with Hypotheses**

### 3.3 Summary

This chapter presented the development of research hypotheses. The discussion recapped on the research question and objectives to lead the argument into hypotheses development. The final section of this chapter presented the proposed research framework with hypotheses incorporated in the framework. The next chapter presents research methodology.

## **4. CHAPTER FOUR: Research Methodology**

This chapter discusses the research methodology employed in this research. The research design is an essential aspect of every research project since it outlines how the study would be conducted within the chosen research paradigm (Saunders et al., 2009). To determine the most suitable research design for this study, the objectives of the study were allowed to be the main driver towards the construction of the research design. A summary of the philosophy, approach, purpose, sampling, timelines, and methodology is conferred in this chapter.

### **4.1 Research Philosophy**

According to Hevner (2007), all studies are undertaken with some form of fundamental assumptions that guide the researcher throughout the research. Considering the nature of this research and the literature in research philosophical stances, a positivistic approach was found to be the most suitable approach for this research. Saunders et al. (2009) further argued that the principal beliefs of a paradigm can be summarised in three fundamental points which include ontology, epistemology, and methodology. The next paragraph summarises the positivistic approach's principal beliefs as it applies to this research.

The epistemological assumptions of the positivistic approach require that the researcher is detached from the data. The researcher in this study did not participate by answering questionnaires, thus assuring the fundamental epistemological assumption of the positivistic studies (Saunders et al., 2009). According to Grobler & Louwrens (2006) digital forensic readiness is a multicomponent subject whose constructs can be studied independently and the relationships thereof. This supports the choice of this research's positivistic philosophy from an ontological point of view (Saunders et al., 2009). Furthermore, positivist's ontological stance posits that the objective reality is constructed through systematic and rational empirical study. This will be approached by using established research methodologies – survey and statistical techniques for data analysis since positivism is grounded in mathematical and statistical techniques (Saunders et al., 2009).

## **4.2 Research Purpose and Approach**

This research follows a deductive approach to the theory. The research used the proposed conceptual framework based on the literature reviewed, followed by data collection, and then data analysis using statistical techniques (Saunders et al., 2009). The study is quantitative in nature and will benefit greatly from statistical analysis to provide scientific evidence to verify or refute hypotheses. Therefore, this approach was thought to be suitable for this study since it will assist to explain how the constructs impact on school readiness and ability to investigate mobile bullying in township schools. The purpose of this research is exploratory since it will explore ways schools can better prepare themselves to handle mobile bullying from a readiness perspective.

## **4.3 Sampling Method and Timeframe**

Saunders et al. (2009) posited that it is of utmost importance to carefully consider the research participants so that the correct representation of the general population is obtained. The nature and objectives of the research typically dictate who should participate in that research (Saunders et al., 2009).

Participants in this research were high school teachers in two townships in South Africa. The first township is called Lebowakgomo, and is located in the Limpopo province. The second township is called Letlhabile, and it is located in the North West province. The schools that participated in the research were targeted on the basis that they were located in the townships and aligned with the objectives of this research.

It is worth noting that learners in townships use mobile devices to proportions similar to those of learners in urban areas, reports Kreutzer (2009). However, mobile bullying is not as prevalent in townships compared to the prevalence levels in urban areas (Burton & Leoschut, 2013). Hence the interest in finding out how schools in townships deal with mobile bullying.

The sampling technique used in this research is random clustered sampling (Saunders et al., 2009). This sampling approach was used in similar studies, ‘assessing cell phone usage in a South African Township school’ by Kreutzer (2009). Another study by Gunzo and Dalvit (2012) entitled ‘A Survey of Cell Phone and Computer Access and Use in Marginalised

Schools in South Africa' also used similar sampling technique. In this research, the schools were treated as clusters within the township locations. The clustering is defined with no intentions to imply representativeness of the general South African township schools. Three schools in Lebowakgomo, Limpopo, were included in the cluster. Two schools in Letlhabile, North West, were also included in the cluster to make a total of five schools in the sample.

All participants were over the age of 18 years, male and female participants were targeted to participate in the research, and participant's race and nationality did not bear any concern in this research. The participants were required to have professional teaching experience in township high school, and previously dealt with mobile bullying incident(s) in school or have some knowledge of what mobile bullying entails as defined on the front page of the questionnaire. A total of eighty nine responses were received. However seven of the responses were excluded from the final sample because participants completed no further than the demographics section of the questionnaire. These seven responses were deemed as invalid responses. A total of eighty-two validated responses were then used for further data analysis in this research. A sample size of about eighty-two responses was deemed sufficient for quantitative research as other researchers had used comparable sample sizes in previous research (Grover, Lee & Durand, 1993).

The timeframe for this study was cross-sectional because individual's perspectives were studied as at the snapshot at which the research was conducted.

#### **4.4 Pilot Testing**

The pilot testing was conducted with a first round of data collection after research design phase of this research. Pilot testing was meant to test and ensure that the questionnaire is clear to the participants, accurate, and captured the data that this research hoped to gather. The pilot test benefitted from feedback from some participants who recommended clarity on some of the questions. A few adjustments were made to the original questionnaire and the ethics department at the University of Cape Town was advised accordingly. A revised questionnaire was submitted to the ethics committee for review and approval; the second approval was obtained. The final questionnaire was then re-piloted with users who had provided feedback in the initial pilot study. No concerns were raised and consequently no further changes were made to the

second version of the survey questionnaire. The pilot participants advised that the questionnaire was clear and understandable. This was important as the area of this research, forensic readiness, was not a speciality of South African township high school teachers.

#### **4.5 Data Collection**

This section presents data collection techniques employed in this research. Firstly, permission was sought from the Limpopo Department of Education to conduct research in schools. A further permission was obtained from the Lebowakgomo circuit office to allow research to be conducted in schools managed by that specific circuit office. Furthermore, researcher had to produce three letters to show that correct permission had been obtained:

- Permission from the University of Cape Town's research ethics department,
- Permission from the Department of Education in Limpopo province,
- Permission from the Lebowakgomo circuit office.

Once the letters were produced, school principal then had to arrange how and when data could be collected. Data was collected through a hardcopy or print version of the questionnaire onsite in schools. As mentioned in the research sampling section, some of the responses were not valid and were excluded from the data.

The online version of the survey was setup in Qualtrics, and the link was distributed through email and Whatsapp. This approach managed to gather twelve responses in six weeks before the survey was closed down. All the online responses were found to be valid with regards to questionnaire completion percentage.

The responses were captured in a spreadsheet, Microsoft Excel 2013, to enable easier data manipulation and formatting. Each response was allocated a reference number for easier identification of each participant. The spreadsheet containing the recorded data is attached in Appendix D for records and reference purposes.

##### **4.5.1 Questionnaire Design**

Table 4-1 below presents a grouping of research questionnaire items in relation to the factor address by each group of items. The grouping provides guidelines of what questions addressed which factor in the research framework. The questionnaire had thirty-eight questions whereby

three questions were of qualitative in nature and required participants to write down their experiences instead of choosing from the options given in the Likert-scale.

**Table 4-1: Constructs and their relating questionnaire items**

<b>Construct</b>	<b>Questionnaire items</b>	<b>Reference</b>
<b>Incident Identification</b>	<p>Q8. I can identify mobile bullying messages</p> <p>Q9. I can identify mobile bullying incidents that must be referred to SAPS or law enforcement e.g. child porn</p> <p>Q10. I can identify mobile bullying incidents that must be referred to social works e.g. child protection issues</p> <p>Q11. I can classify mobile bullying incidents according to severity and jurisdiction.</p>	(Reith et al., 2002; Carrier, 2003)
<b>People</b>	<p>Q28. School administrators are readily available to assist teachers in dealing with mobile bullying incidents</p> <p>Q29. School committees and governing body are readily available to assist teachers in dealing with mobile bullying</p> <p>Q30. Other community services such as SAPS are readily available to assist teachers in dealing with mobile bullying</p> <p>Q31. Our school has dedicated and readily available teachers who assist with mobile bullying incident investigations.</p> <p>Q32. Learners know where and how to report mobile bullying</p>	(De Lange & Von Solms, 2011; Serra & Venter, 2011; Sonhera et al., 2012; Walaza, 2014)
<b>Legal Awareness</b>	<p>Q22. I am aware or know of the law that governs investigations of mobile bullying in schools</p> <p>Q23. Our school receives external law support from legal counsel</p> <p>Q24. I am aware of the legal requirements of handling evidence obtained as a result of mobile bullying investigation</p>	(Stephenson, 2003; Barske et al., 2010; De Lange & Von Solms, 2011; Singh et al., 2015)

<p><b>Processes, Procedures, and Policies</b></p>	<p>Q18. Our school has a procedures and/or processes we use when responding to mobile bullying incidents</p> <p>Q19. If you disagree, do you think your school should have procedures to use when responding to mobile bullying?</p> <p>Q20. Our school has policies to address mobile bullying</p> <p>Q21. If you disagree, do you think that your school should have policies to address mobile bullying?</p>	<p>(Serra &amp; Venter, 2011; Sonhera et al., 2012; Singh et al., 2015)</p>
<p><b>Post-incident Reporting</b></p>	<p>Q25. I am able to write post-incident investigation report</p> <p>Q26. I can keep records of action (chain of custody) until incident conclusion.</p> <p>Q27. Our school has post-incident report archive/filing system in place for record keeping of mobile bullying incidents</p>	<p>(Barske et al., 2010)</p>
<p><b>Improvements</b></p>	<p>Q33. How often does your school review archived files to improve on school mobile bullying policies?</p> <p>Q34. How often are teachers trained to support learners with regards to dealing with mobile bullies?</p> <p>Q35. How often does the school run awareness programs for teachers and learners?</p>	<p>(Serra &amp; Venter, 2011; Walaza, 2014)</p>
<p><b>Readiness and ability to investigate</b></p>	<p>Q12. I can investigate mobile bullying on different mobile devices e.g. tablets, smartphones</p> <p>Q13. I can investigate mobile bullying on different mobile operating systems e.g. Android, Blackberry OS</p> <p>Q14. I know what evidence is required when escalating incidents to external parties for further investigations.</p> <p>Q15. I know various external parties who handle and/or investigate escalated incidents e.g. SAPS, Social Workers</p> <p>Q16. Our school is generally ready and prepared to handle mobile bullying incidents.</p> <p>Q17. Our school has readily available people who respond to mobile bullying incidents.</p>	<p>(Tan, 2001; Pangalos &amp; Katos, 2010; Serra &amp; Venter, 2011; Poee &amp; Labuschagne, 2012)</p>

Construct	Questionnaire items	Reference
<b>Incident Identification</b>	<p>Q8. I can identify mobile bullying messages</p> <p>Q9. I can identify mobile bullying incidents that must be referred to SAPS or law enforcement e.g. child porn</p> <p>Q10. I can identify mobile bullying incidents that must be referred to social works e.g. child protection issues</p> <p>Q11. I can classify mobile bullying incidents according to severity and jurisdiction.</p>	(Reith et al., 2002; Carrier, 2003)
<b>Readiness and ability to investigate</b>	<p>Q12. I can investigate mobile bullying on different mobile devices e.g. tablets, smartphones</p> <p>Q13. I can investigate mobile bullying on different mobile operating systems e.g. Android, Blackberry OS</p> <p>Q14. I know what evidence is required when escalating incidents to external parties for further investigations.</p> <p>Q15. I know various external parties who handle and/or investigate escalated incidents e.g. SAPS, Social Workers</p> <p>Q16. Our school is generally ready and prepared to handle mobile bullying incidents.</p> <p>Q17. Our school has readily available people who respond to mobile bullying incidents.</p>	(Tan, 2001; Pangalos & Katos, 2010; Serra & Venter, 2011; Poee & Labuschagne, 2012)
<b>Processes, Procedures, and Policies</b>	<p>Q18. Our school has a procedures and/or processes we use when responding to mobile bullying incidents</p> <p>Q19. If you disagree, do you think your school should have procedures to use when responding to mobile bullying?</p> <p>Q20. Our school has policies to address mobile bullying</p> <p>Q21. If you disagree, do you think that your school should have policies to address mobile bullying?</p>	(Serra & Venter, 2011; Sonhera et al., 2012; Singh et al., 2015)
<b>Legal Awareness</b>	<p>Q22. I am aware or know of the law that governs investigations of mobile bullying in schools</p> <p>Q23. Our school receives external law support from legal counsel</p>	(Stephenson, 2003; Barske et al., 2010; De Lange & Von Solms,

	Q24. I am aware of the legal requirements of handling evidence obtained as a result of mobile bullying investigation	2011; Singh et al., 2015)
<b>Post-incident Reporting</b>	Q25. I am able to write post-incident investigation report Q26. I can keep records of action (chain of custody) until incident conclusion. Q27. Our school has post-incident report archive/filing system in place for record keeping of mobile bullying incidents	(Barske et al., 2010)
<b>People</b>	Q28. School administrators are readily available to assist teachers in dealing with mobile bullying incidents Q29. School committees and governing body are readily available to assist teachers in dealing with mobile bullying Q30. Other community services such as SAPS are readily available to assist teachers in dealing with mobile bullying Q31. Our school has dedicated and readily available teachers who assist with mobile bullying incident investigations. Q32. Learners know where and how to report mobile bullying	(De Lange & Von Solms, 2011; Serra & Venter, 2011; Sonhera et al., 2012; Walaza, 2014)
<b>Improvements</b>	Q33. How often does your school review archived files to improve on school mobile bullying policies? Q34. How often are teachers trained to support learners with regards to dealing with mobile bullies? Q35. How often does the school run awareness programs for teachers and learners?	(Serra & Venter, 2011; Walaza, 2014)

As shown in the table above, four questions addressed incident identification, and another four questions captured availability of procedures, processes, and policies. Readiness and ability to investigate had six questions. Legal awareness was grouped with post-incident reporting in the questionnaire, with each factor contributing three questions respectively. Another grouping was done for people and improvements, with each factor having four questions respectively.

All the questions were derived from digital forensics and security literature. However efforts were taken to adapt the questions to be of less or non-technical since forensics is a complex and very technical subject matter. If the questions were to be left as technical, for instance how to image a mobile phone, very few to no teacher in toenships would have answered the questionnaire. It would have deprived teachers an opportunity to shared their experiences of school readiness and ability to investigate mobile bullying.

The quantitative section of the questionnaire used a five-point Likert scale for capturing data. The anchors were set at 1-5 with the scale in increasing form (1-very poorly, 2-Poorly, 3-Adequately, 4-Well, & 5-Very Well), some questions used a scale of (1-strongly disagree, 2-disagree to some extent, 3-disagree, 4-agree, & 5-strongly agree). The respondents selected the answers by placing a cross or a tick in a box to represent their answer. The scale was thought to be suitable for this study since mobile bullying was still in its infancy in South Africa (Badenhorst, 2011). Thus, the expectation was that most of the participants may be lacking experience dealing with mobile bullying in schools. Consequently, a Likert scale with odd numbered scale ideally compels the participants to make a selection (Saunders et al., 2009).

The qualitative section of the questionnaire had three open-ended questions. The questions were meant for the participants to share their understanding and experiences with regards to how mobile bullying should be handled in schools. Furthermore, it was hoped that open-ended questions would capture the ideal incident handling procedure based on the participant's experiences. Lastly, it was hoped that the open-ended questions would allow teachers to share their experiences regarding the improvements they would like to see in terms of training and support. The research questionnaire is attached in Appendix C for reference purposes.

#### **4.6 Summary**

This chapter discussed the research methodology. To determine the most suitable research design for this study, the objectives of the study were the chief driver towards the construction of the research design. A summary of the philosophy, approach, purpose, sampling, timelines, and methodology was conferred in this chapter.

## 5. CHAPTER FIVE: Data Analysis

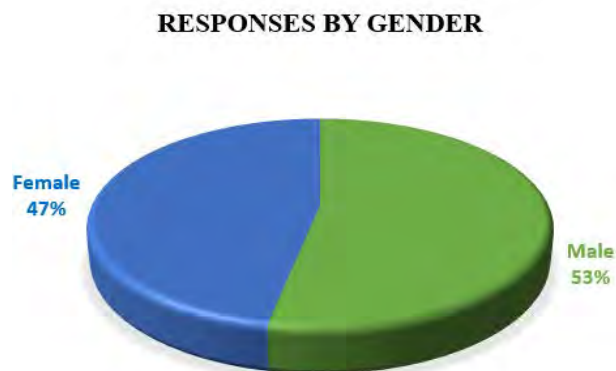
This chapter presents a discussion on data analysis and the findings from the analysis. As stated in the research methodology chapter, a total of eighty-two responses were accepted as valid and useful for analysis. The validated responses is attached in the Appendix D and marked as survey data for reference. The statistical analysis conducted in this study employed a use of statistical analysis software, Statistica version 12.5, to conduct the statistical analysis. Furthermore, Microsoft Excel 2013 was used for data manipulation. The next section presents finding from the descriptive statistics.

### 5.1 Descriptive Statistics

This section presents the descriptive statistics of the research. The demographics and profile of the respondents are outlined as well as a general item and questionnaire descriptive statistics.

#### 5.1.1 Gender

A question relating to gender was asked to determine the gender of the participants who have participated in this research. The majority of the participants answered the gender question with one participant choosing not to answer the gender question. The participant's gender distribution is presented in figure 5-1. The number of female participants was thirty-eight (47%) compared to forty-three (53%) male participants. The distribution is fairly even, and the difference between the two genders is about five responses.



**Figure 5-1: Responses by Gender**

### 5.1.2 Age

The age distribution shows that the majority of the participation, with twenty-six responses (33%), of the participants were in the 41 to 50 years age bracket. The least represented group, with only one response (1%), was the youngest age group of 21 or younger; this age group represents those who have just started their career in the teaching field. The 31 to 40 years old age bracket was represented by twenty-three (29%) participants. Those in the 22 to 30 years old age bracket were represented by twenty-five respondents (31%), and the 51 or older age group was represented by five (6%) of the participants. Figure 5-2 below presents the sample distribution by age.

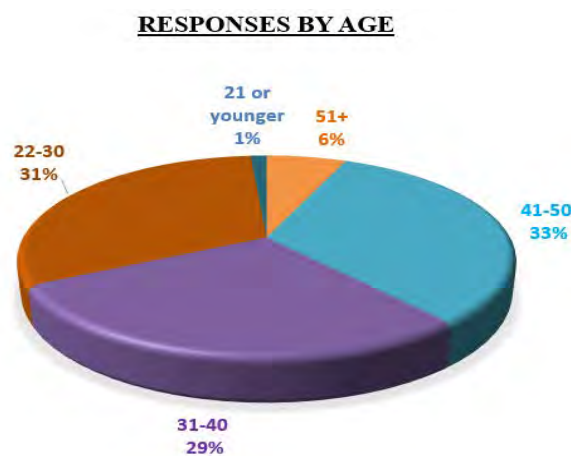


Figure 5-2: Responses by Age

### 5.1.3 Teaching Experience

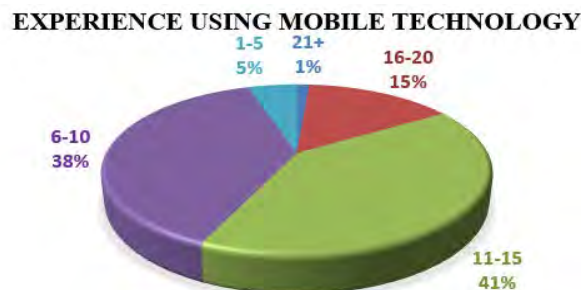
Regarding participants' teaching experience, the responses received came from about nineteen (23%) of the participants with teaching experience of 1 to 5 years. Participants who had about 6 to 10 years teaching experience were about twenty-five (26%). Nineteen responses (23%) came from teachers who had teaching experience of between 11 and 15 years. The participants with teaching experience in group of between 16 and 20 years' experience had a representation of about fourteen (17%) participation in this study. Those with 21 or more years' experience in teaching were represented by nine (11%) responses. The distribution is summarised by Figure 5-3 below.



**Figure 5-3: Responses by Teaching Experience (years)**

#### 5.1.4 Experience Using Mobile Technology

Responses to a question relating to the participants' experience using mobile technology show that four (5%) had 1 to 5 years' experience using mobile technology. The majority of the responses were in the 11 to 15 and 6 to 10 years' experience with thirty one (41%) and thirty-three (38%) of responses respectively. The 16 to 20 years' experience had twelve (15%) responses while one (1%) response was recorded in the 21 or more years' experience using mobile technology. The distribution of experience using mobile technology is summarised in Figure 5-4 below.



**Figure 5-4: Experience Using Mobile Technology (years)**

#### 5.1.5 Experience Handling Mobile Bullying

The number of years of experience dealing with mobile bullying was asked. The majority of the responses was forty-five (55%) who answered that they had between zero and five years' experience dealing with mobile bullying. Those that said they had 6 to 10 years of experience handling mobile bullying were about twenty-three (28%) out of the total responses. The 11 to

15 years' experience handling mobile bullying group accounted for about twelve (15%) of responses from the participants. The 16 to 20 and 21 or more years' experience handling mobile bullying both recorded one response (1%) in each grouping respectively. The distribution is summarised by figure 5-5 below.



**Figure 5-5: Experience Handling Mobile Bullying Incidents (years)**

The participants were asked about the number of mobile bullying incidents they had dealt with in their teaching career. Forty (49%) of the participants indicated that they have dealt with between 0 and 5 mobile bullying incidents in their career. About thirty (37%) of the responses indicated that participants handled 6 to 10 mobile bullying incidents in the past. Eight (10%) participants indicated that they had handled 11 to 15 incidents in their teaching career. Those who have handled 16 to 20 and 21 or more mobile bullying incidents and were two (3%) and one (1%) participants, respectively. Figure 5-6 summarises the distribution.



**Figure 5-6: Number of Mobile Bullying Incidents Handled**

### ***Section Summary***

The section presented respondents' descriptive statistics. It was interesting to note that the participants who indicated that they had handled more than 6 incidents was about 51% of the total response compared to 49% of those who had handled between zero and five incidents. The trend was thought to be encouraging in the context of this study because it indicates that a fair representation of the sample had experience or at least have encountered mobile bullying incident(s) in school. The number of years handling mobile bullying by some of the respondents indicates that mobile bullying is not a new problem, and it has been around for some time. The next section discusses reliability and validity tests conducted against the data.

### **5.2 Reliability and Validity Testing**

The reliability was tested to determine how well the questions fit together for each variable in the study. The test is typically referred to as checking the research instrument for internal consistency (Mendenhall et al., 1996). A Cronbach alpha scored of "0.7" is sufficient and acceptable as proof of construct reliability (Mendenhall et al., 1996). Cronbach alpha scores for all the items in this study produced values above "0.8" apart from one item, *processes*, which produced an alpha value of "0.47". While Santos & Clegg (1999) and Van de Ven and Ferry (1980) had indicated that alpha value of "0.4" could be acceptable under different conditions, measures were taken to improve the alpha value of *processes*. Statistica 12.5, a statistical package, helped to identify items that caused low reliability. One question "IfNoProcess" was omitted, the question relates to participant's views about whether schools should develop investigatory processes in instances where processes did not exist. Cronbach alpha score for item *processes* then improved to "0.64". Alpha value of "0.6" is generally acceptable in research (Mendenhall et al., 1996). It was then thought that this question "IfNoProcess" is of high importance and should not be omitted in the context of the study. The views captured by the question can be considered by authorities in considerations, planning ahead, and in implementations of forensic readiness in township schools. The alpha loadings for both tests, with and without "IfNoProcess", is indicated in the Appendix section. A summary of all the Cronbach alpha scores can be found in Table 5-1 below.

**Table 5-1: Item Reliability Analysis Results**

(* - alpha value when “IfNoProcess” is omitted)Construct Name	Code	Items	Cronbach alpha ( $\alpha$ )
School Readiness and ability to investigate incidents	READY&INV	5	0.84
Ability to identify incidents	IDENTIFY	4	0.87
Processes, procedures and policies	PROCESS	4	0.47 <b>(*0.64)</b>
Legal awareness	LEGAL	3	0.81
Ability to write post-incident report	REPORT	3	0.84
Availability of people	PEOPLE	4	0.81
Improvements to readiness program	IMPROVE	4	0.84

Another test was conducted to determine construct validity. Factor analysis was performed with the following criterion:

- Rotation Method: Varimax normalised
- Highlight Factor Loading: > 0.5
- Minimum Eigenvalue: 1.000
- Maximum Factors: 7

The summary of the results of that factor analysis is presented in Table 5-2 below. The complete Table of factor loading is attached in the appendix section and labelled Factor Analysis Data.

The results show that most of the items loaded well with factors matching their proposed constructs. *Processes, procedures, and policies* did not have an accurate factor grouping that was suspected since the item loaded low Cronbach alpha value of “0.47”. *People* was another one with inaccurate factor grouping. However it was not expected nor suspected that that would be the case because *people* loaded with good alpha value of “0.81”. It was interesting to note that in general the factors loaded with values greater than “0.60” except for few factors in the *improvements* section. Two items loaded with two factors, and the loading in the second factor was removed based on relevance and higher loading score for the factors. Therefore, the results of the exploratory factor analysis show acceptable validity for the constructs of the research instrument as per factor loadings and groupings presented in Table 5-2.

**Table 5-2: Factor Analysis Results**

Q #	Variable	Factor Loadings (Varimax normalized) (Sheet1 in SchoolReadinessData) Extraction: Principal components (Marked loadings are >.500000)						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
12	CanInvestigateOnDiffModels	0.630						
14	EvidenceToExternalSupport	0.648						
15	KnowExternalSupport	0.691						
16	SchoolReady	0.826						
17	PeopleReady	0.774						
8	CanIdentifyMBmessages			0.686				
9	CanIdentifyIncForSAPS			0.692				
10	CanIdentifyIncForSocialWrk			0.829				
11	CanClassfyIncidents			0.794				
18	SchoolHasInvestigateProcess						0.607	
19	IfNoProcess							
20	SchoolHasMBPolicy						0.788	
21	IfNoPolicy							-0.773
22	AwareOfLaws		0.744					
23	ExternalLawSupport		0.829					
24	AwareOfLegalRequirements		0.801					
25	CanWritePostIncidentReport					0.776		
26	ChainOfCustody					0.742		
27	SchoolIncArchive					0.634		
28	SchoolAdmnReady					0.565		
29	SchoolCommReady	0.647						
30	CommunityServicesReady						0.645	
31	TeachrsReady				0.503			
32	LearnrKnwWhereToReport				0.848			
33	FrequencyReviewArchivedInc				0.738			
34	FrequencyTeachrsTrained					-0.618		
35	FrequencyScholRunAwareness				0.525			0.554
	Expl.Var	3.847	2.516	3.613	2.346	3.178	2.021	1.718
	Prp.Totl	0.142	0.093	0.133	0.086	0.117	0.074	0.063

Five items loaded onto Factor 1. It can be deduced from Table 5-2 that the five factors all relate to “school readiness and ability to investigate incidents”. This factor presents the perceptions about teachers’ ability to investigate incidents and whether schools are ready to handle such incidents. Thus factor is labelled as “READY&INV”.

Four items loaded onto Factor 3 which relates to the “ability to identify and classify incidents”. This factor deals with teachers’ ability to adequately identify mobile bullying incidents and classify incidents according to escalation points. This factor was labelled “IDENTIFY”.

Three items loads onto Factor 2. Therefore it follows from Table 5-2 that these three items relates to “legal awareness”. This factor caters for the awareness of legislature and legal requirement from teachers when they respond to mobile bullying incidents. This factor is labelled as “LEGAL”.

Factor 5 best describes the ability to write post incident report by teachers who respond to mobile bullying incidents. This factor is called the “ability to write post-incident report”, and it is labelled “REPORT”.

The three items that groups and loads well for Factor 4 relates to the “availability of people to the readiness program”. This factor presents the perceptions of teachers about the availability of themselves and other role players in the readiness program. The factor is labelled as “PEOPLE”.

The last two factors, did not load well. However Factor 6 has a good grouping relating to the “availability of investigatory processes, procedure, and policies” in support of readiness program. This factors looks at whether schools have adequate processes and policies specifically to address mobile bullying. The factor is labelled “PROCESSES”.

Factor 7 had question 21 and 35 loading on it, however question 35 loaded on both factor 4 and factor 7. Thus, factor 7 did not have enough items loading on it and therefore not enough evidence to label it.

Furthermore, the Eigenvalue analysis was conducted. The results of the Eigenvalue analysis for this research shows that the items loaded into seven factors with an accumulated variance of about 71%. This was thought to be acceptable for this research and gives an acceptable account of the overall construct validity. The results are presented in Table 5-2 below.

**Table 5-3: Eigenvalues**

Value	Eigenvalues (Sheet1 in SchoolReadinessData) Extraction: Principal components			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	6.516	24.135	6.516	24.135
2	3.552	13.158	10.069	37.293
3	2.466	9.134	12.535	46.427
4	2.103	7.789	14.638	54.216
5	1.889	6.997	16.527	61.213
6	1.536	5.689	18.063	66.902
7	1.180	4.371	19.243	71.273

### 5.3 Hypotheses Testing and Findings

This section presents the results of the correlation and regression analysis conducted against the hypotheses and to test the relationship between constructs. The reason for conducting non-parametric testing, Spearman Rank Correlation, was that it is robust, and it is capable of handling data obtained through the use of Likert scales similar to the one used in this study (Mendenhall et al., 1996). The results of the correlation analysis are presented in Table 5-3 below.

**Table 5-4: Correlation Analysis Results**

Variable	Spearman Rank Order Correlations (Sheet1 in SchoolReadinessData) MD pairwise deleted Marked correlations are significant at $p < .05000$						
	READY&INV	IDENTIFY	PROCESSES	LEGAL	REPORTS	PEOPLE	IMPROVE
READY&INV	1.0000						
IDENTIFY	0.4542	1.0000					
PROCESSES	-0.3442	0.0468	1.0000				
LEGAL	0.0469	0.1684	0.0840	1.0000			
REPORTS	0.3312	0.5769	0.2365	0.2719	1.0000		
PEOPLE	0.4956	0.4548	-0.0189	0.1615	0.4122	1.0000	
IMPROVE	-0.1756	0.1400	0.3479	0.2293	0.2533	0.2194	1.0000

The results of the correlation analysis summarised in Table 5-3 above shows that the constructs had a significant positive correlation with one another at a significance level of 5% ( $p < 0.05$ ).

The only proposed relationship in the study that yielded a significant negative relationship was that of processes, procedures, and policies (PROCESSES) and school readiness and ability to investigate mobile bullying (READY&INV) with  $r=-0.34$ . The proposed relationships that yielded significant positive correlation includes the ability to identify incidents (IDENTIFY) and school readiness and ability to investigate incidents (READY&INV) with  $r=0.45$ . The ability to document incident reports (REPORTS) and school readiness and ability to investigate incidents (READY&INV) with  $r=0.33$ . Lastly, the availability of people (PEOPLE) and school readiness and ability to investigate incidents (READY&INV) showed significant correlation with  $r=0.49$ . The other two relationships which were expected to be significant were in fact not significant according to the analysis. These were legal awareness (LEGAL) and school readiness and ability to investigate incidents (READY&INV); and general readiness improvements and school readiness and ability to investigate incidents (READY&INV).

**Table 5-5: Correlation Analysis Results Summary**

Hypotheses	Relationships tested	Correlation Value (r)	Relationship status
H <sub>1</sub>	IDENTIFY vs. READY&INV	0.45	Significant
H <sub>2</sub>	PEOPLE vs. READY&INV	0.49	Significant
H <sub>3</sub>	LEGAL vs. READY&INV	0.04	Non-significant
H <sub>4</sub>	REPORTS vs. READY&INV	0.33	Significant
H <sub>5</sub>	PROCESSES vs. READY&INV	-0.34	Significant
H <sub>6</sub>	IMPROVE vs. READY&INV	-0.17	Non-significant

The next subsections present hypotheses testing and clarifies which hypotheses were accepted or rejected based on the results of the statistical analysis.

### 5.3.1 Hypothesis H<sub>1</sub>

H<sub>01</sub>: The ability to identify incidents has no effect on the school readiness and ability to investigate mobile bullying incidents.

H<sub>1</sub>: The ability to identify incidents has a positive effect on the school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>1</sub> can be summarised as follows.

**Table 5-6: Regression Summary: Identify vs. readiness and ability to investigate.**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.393780	Correlation coefficient	YES
p-value	0.000252	Highly significant with p<0.01	YES
R <sup>2</sup>	0.155062	16% of the framework is explained by the influence of identification on school readiness and ability to investigate.	YES
Variables		Independent IDENTIFY does influence (READINESS and INVESTIGATE)	YES

**FINDING:** The analysis supports the hypothesis that the ability to identify incidents has a positive effect on the school readiness and ability to investigate mobile bullying incidents, as a consequence the null hypothesis is rejected.

**DISCUSSION:** The finding is in support of literature which suggested that evidence identification was fundamental in the investigatory process. It is at this stage that key evidence used for disciplinary and prosecution is identified and preserved (Mumba & Venter, 2014; Omeleze & Venter, 2013, Punja & Mislán, 2008). Similar calls have been made by researchers who had focused their studies in South African schools. For instance, calls were made for online security awareness in schools to improve incident identification and incident reporting to the authorities (Walaza et al., 2014; Sonhera et al., 2012; De Lange & Von Solms, 2011). Furthermore, schools should be able to classify incidents according to escalation points and know how and where to escalate incidents that are beyond their jurisdiction. For example,

manufacturing and/or distribution of child pornographic material should be escalated to the police as soon as such content is identified (Sonhera et al., 2012).

Though very little studies examine the application of digital forensics readiness in South African schools, this finding is in support of the literature of studies conducted for private organisations. The reason are somewhat comparable even though organisations can afford to spend sufficient funds towards nurturing skills in their forensic departments, schools cannot fund adequate forensic readiness. The finding also supports calls for swift incident identification, classification and preservation of evidence as a result of the online misconduct in South African schools.

### 5.3.2 Hypothesis H2

H<sub>0</sub>2: The availability of investigatory facilitators (people) has no effect on the school readiness and ability to investigate mobile bullying incidents.

H<sub>1</sub>2: The availability of investigatory facilitators (people) has a positive effect on the school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>2</sub> can be summarised as follows.

**Table 5-7: Regression Summary: People vs. readiness and ability to investigate.**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.552694	Correlation coefficient	YES
p-value	0.000000	Highly significant with p<0.01	YES
R <sup>2</sup>	0.305470	31% of the framework is explained by the influence of identification on school readiness and ability to investigate.	YES
Variables		Independent PEOPLE does influence (READINESS and INVESTIGATE)	YES
<pre> graph LR     A[PEOPLE] -- "Explained variance = 31% r = 0.55" --&gt; B[READINESS AND INVESTIGATE]           </pre>			

**FINDING:** The analysis supports the hypothesis that the availability of people to incident response has a positive effect on school readiness and ability to investigate mobile bullying incidents; as a consequence the null hypothesis is rejected.

**DISCUSSION:** The implications of this finding suggests that organised and readily available incident response teams indeed have a positive effect on school readiness and ability to investigate mobile bullying. It can only be possible if incident respondents have the essential skills and tools to conduct the investigation (Serra & Venter, 2011; Pangalos, & Katos, 2010; Williard, 2007; Reith, Carr, & Gunsch, 2002). This approach can be more practical in modern schools who typically have onsite IT personnel available to assist the school with IT related matters. Enforcing teachers to be readily available presents the potential of depriving other learners of valuable learning time when their teacher responds to incidents. Again, this may well be a beginning of a new learning curve for those willing to be readily available to respond to incidents, because non-technical forensic skills will be required for incident respondents. It is, however, common in the private sector that dedicated people are appointed to form the digital forensic readiness team (Pooe & Labuschagne, 2012; Barske, Stander, & Jordaan, 2010; AL-Zarouni, 2006).

### **5.3.3 Hypothesis H3**

H<sub>0</sub>3: Legal awareness amongst incident response team has no effect on school readiness and ability to investigate mobile bullying incidents.

H<sub>1</sub>3: Legal awareness amongst incident response team has a positive effect on school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>3</sub> can be summarised as follows.

**Table 5-8: Regression Summary: Legal vs. readiness and ability to investigate**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.012027	Correlation coefficient	NO
p-value	0.914590	Fail to reject null hypothesis with $p > 0.05$	NO
R <sup>2</sup>	0.000144	0.014% of the framework is explained by the influence of legal awareness on school readiness and ability to investigate.	NO
Variables		Independent variable LEGAL does not influence (READINESS and INVESTIGATE)	NO
<p>The diagram illustrates the relationship between the independent variable 'LEGAL' and the dependent variable 'READINESS AND INVESTIGATE'. An arrow points from 'LEGAL' to 'READINESS AND INVESTIGATE'. Above the arrow, it states 'Explained variance = 0.014%'. Below the arrow, it states 'r = 0.01'.</p>			

**FINDING:** The analysis supports the null hypothesis that legal awareness amongst incident response team has no effect on school readiness and ability to investigate mobile bullying incidents; as a consequence the null hypothesis is accepted.

**DISCUSSION:** The finding can be interpreted as that the incident responder responsible for investigating mobile bullying in schools do not necessarily have the correct legal knowledge and awareness even though they conduct successful investigations. It can also be noted from the mean value of teachers' legal requirements (1.9753), that teachers generally lack legal knowledge required when conducting investigations. This risks the legality and admissibility of evidence resulting from such investigations (Barske et al., 2010; AL-Zarouni, 2006). Furthermore, this practice has a likelihood of compromising the privacy of perpetrators when non-legal aware incident responders handle the investigation. They may not know their limits with regards to what information they may or may not access during the investigation (Reddy & Venter, 2009). For instance, it is required by law to report child pornography to the law enforcement or police even though the incident under investigation is not related to child porn (Ferraro, & Casey, 2004). The finding is in opposition to much of the literature in digital forensics and forensic readiness.

### 5.3.4 Hypothesis H4

H<sub>04</sub>: The ability of incident responders to document adequate post-incident reports has no effect on school readiness and ability to investigate mobile bullying incident.

H<sub>14</sub>: The ability of incident responders to document adequate post-incident reports has a positive effect on school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>4</sub> can be summarised as follows.

**Table 5-9: Regression Summary: Reports vs. readiness and ability to investigate**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.282229	Correlation coefficient	YES
p-value	0.010201	Significant with p<0.05	YES
R <sup>2</sup>	0.079653	7.9% of the framework is explained by the influence of identification on school readiness and ability to investigate.	YES
Variables		Independent variable REPORTS does influence (READINESS and INVESTIGATE)	YES

**FINDING:** The analysis supports the hypothesis that the ability of incident respondents to document adequate post-incident reports has a positive effect on school readiness and ability to investigate mobile bullying incidents; as a consequence the null hypothesis is rejected.

**DISCUSSION:** The finding implies that in order to maintain adequate levels of readiness and ability to investigate mobile bullying incidents in schools, it is important that incident responders know how to construct adequate post-incident reports. The finding is consistent with literature of studies conducted for private corporates. Systematic documentation and accurate chain of custody forms important part of the investigation process and forensic

readiness (Carrier, 2003; Jansen & Ayers, 2007; De Lange & von Solms, 2011; Yadav, 2011). Incident responders in schools are also required to have reporting skills if schools were to develop and maintain readiness and ability to investigate mobile bullying (Vandebosch et al., 2012; Willard, 2007).

### 5.3.5 Hypothesis H5

H<sub>05</sub>: The existence of policies, investigatory processes and procedures has no effect on school readiness and ability to investigate mobile bullying incidents.

H<sub>15</sub>: The existence of policies, investigatory processes and procedures has a positive effect on school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>5</sub> can be summarised as follows.

**Table 5-10: Regression Summary: processes vs. readiness and ability to investigate.**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.289365	Correlation coefficient	YES
p-value	0.008370	Highly significant with p<0.01	YES
R <sup>2</sup>	0.083732	8.3% of the framework is explained by the influence of identification on school readiness and ability to investigate.	YES
Variables		Independent variable PROCESSES does influence (READINESS and INVESTIGATE)	YES

**FINDING:** The existence of policies, investigatory processes and procedures have a positive effect on school readiness and ability to investigate mobile bullying incidents; as a consequence the null hypothesis is rejected.

**DISCUSSION:** The finding implies that the existence of policies, processes and procedures that are crafted to prevent mobile bullying, or to guide the process of responding to incidents enhances school readiness and ability to investigate mobile bullying. These result are consistent with earlier research conducted in the corporate sector by various researchers (Barske et al., 2010; Pooe & Labuschagne, 2012; Valjarevic & Venter, 2012). Therefore, schools interested in formulating adequate non-technical forensic readiness and ability to investigate incidents should document processes, procedures, and policies. The development of processes and policies can be done with the aid of experts in digital forensics to ensure adequacy of the processes and ensure that acceptable methods are used by incident respondents (Taylor et al., 2007).

### 5.3.6 Hypothesis H6

H<sub>0</sub>6: General periodic improvements to non-technical school readiness program has no effect on the overall school readiness and ability to investigate mobile bullying incidents.

H<sub>1</sub>6: General periodic improvements to non-technical school readiness program has a positive effect on the overall school readiness and ability to investigate mobile bullying incidents.

The hypothesis test results for H<sub>6</sub> can be summarised as follows.

**Table 5-11: Regression Summary: improve vs. readiness and ability to investigate**

FACILITY	RESULT	EXPLANATION	SUPPORTED
r	0.219481	Correlation coefficient	YES
p-value	0.047567	Significant with p<0.05	YES
R <sup>2</sup>	0.048172	5% of the framework is explained by the influence of legal awareness on school readiness and ability to investigate.	YES
Variables		Independent variable IMPROVE does indeed influence (READINESS and INVESTIGATE)	YES

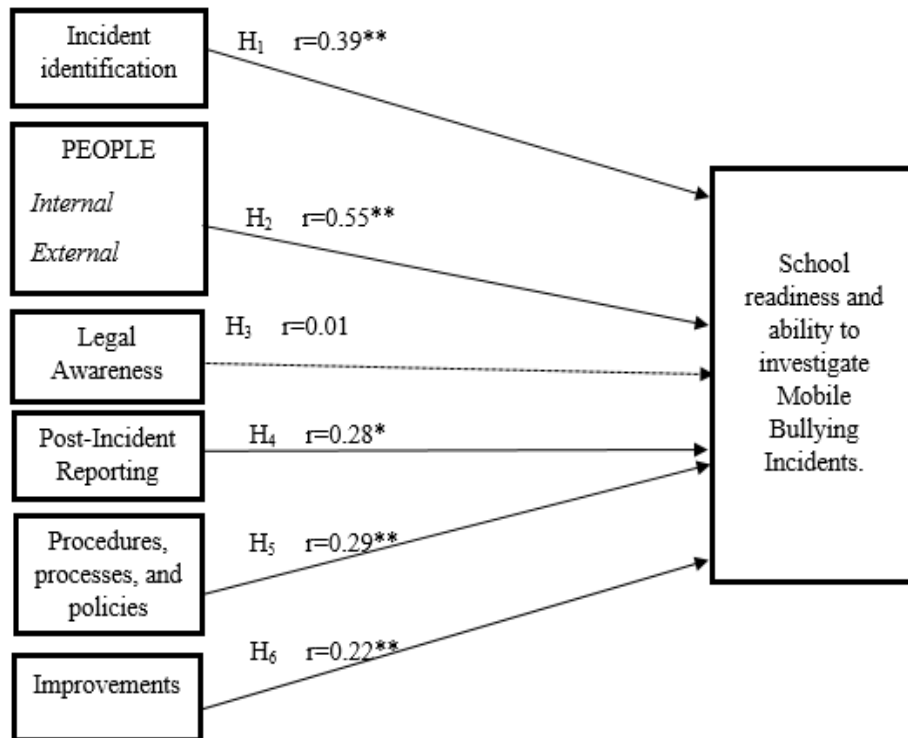
**FINDING:** The analysis supports the hypothesis that general periodic improvements to non-technical school readiness program has a positive effect on the overall school readiness and ability to investigate mobile bullying incidents. Thus, the null hypothesis is rejected.

**DISCUSSION:** The finding for this hypothesis suggests that general periodic improvements to non-technical school readiness program has a positive effect on the overall school readiness and ability to investigate mobile bullying incidents. The finding is supported by the literature. Valjarevic & Venter (2012) found that regular training of forensic staff members improves levels of their abilities to investigate incidents adequately. Training also helps incident responders to keep up with latest trends and evolving technology so that they can be able to investigate offences committed with the aid of latest technology (Barske et al., 2010). Awareness programs are effective in improving the overall forensic readiness. Furthermore, awareness has been reported to be effective in increasing incident reporting amongst victims of online aggression (De Lange & von Solms, 2011; Sonhera et al., 2012). The finding is in agreement with earlier literature.

#### **5.4 Summary of Results and Refined Framework**

This section presents a summary of the results and the refined model based on the findings presented in the above section. It is important to recall factors (IDENTIFY, REPORT, PROCESSES, LEGAL, PEOPLE, and IMPROVE) which were thought to influence school readiness and ability to investigate mobile bullying in schools (READY&INVST).

Following extensive statistical analysis of the data acquired from the teachers involved in handling mobile bullying incidents in schools, the majority of the initial hypotheses were supported. One hypothesis was not supported. It is then imperative to revisit the initially proposed model, show the significant relationships, and present the refined version of the proposed framework. The refined framework is presented in Figure 5-9 with a summary of the correlation coefficient ( $r$ ) values. The values with (\*) indicate that the analysis found the relationships to be significant at  $p < 0.05$  and (\*\*) showing the relationships that were highly significant at  $p < 0.01$ .



**Figure 5-7: Refined Framework for Non-technical School Forensic Readiness**

## **6. CHAPTER SIX: Conclusions**

This chapter presents conclusion of the dissertation. The concluding discussion covers the background, tests for research framework, key findings, implications, limitations, and recommendations for future research.

### **6.1 Background**

It is a fact that the South African government took a decision to embrace the use of technology, specifically mobile devices (tablets), in classrooms to enhance learning. However, the increased usage of mobile technology by learners has a potential of increasing mobile bullying in schools. With poor policies and lack of enforcement of mobile bullying policies, it remains hard for teachers to curb mobile bullying in township schools. Hence mobile bullies continue to torment victims.

This research was intended to respond to the lack of school readiness and investigatory skills of teachers in township schools. Therefore, the main objective of this research was to provide insight into the non-technical factors influencing forensic readiness in township schools. The researcher conducted a comprehensive literature review to determine what factors to prioritise. The literature was synthesised to develop a conceptual framework to guide the research. A positivistic approach to theory was adopted and quantitative data was collected through online survey and paper-based questionnaires. Statistical data analysis ensued to examine the views of township high school teachers regarding readiness and ability to investigate mobile bullying.

### **6.2 Testing Research Framework**

It was imperative that the research instrument is tested to determine consistency, quality and validity. A pilot study was conducted to test the research instrument, and improvements were made to the initial instrument. Statistical data analysis methods were employed to subject the acquired data to vigorous data analysis to test the hypotheses that were developed for this research. The research instrument was tested for reliability and validity. The final tests included correlation and multiple linear regressions analysis to test the hypotheses. The next section summarises key findings.

### **6.3 Key Findings**

The results from this research found that five independent variables of the proposed research framework (IDENTIFY, PEOPLE, REPORT, PROCESSES, and IMPROVE) had a significant impact on the dependent variable (READY&INVST). The findings suggests that in order to implement an adequate township school readiness program, it is important to consider the five significant factors.

One independent variable (LEGAL) was found to have no significant influence on the dependent variable (READY&INVST). The finding was against literature and it was thought to be a major finding in this study. According to the participants, the lack of legal awareness did not bother them when investigating mobile bullying incidents in township schools. The finding suggests that many legal boundaries may be violated by teachers when they respond to incidents. This risks evidence and credibility of their investigations. The practice has a potential of presenting many legal issues in future if the situation is not remedied by the officials. The next two sections presents implications for academic and practice, respectively.

Furthermore, the descriptive statistics indicated that the majority of the participants, about 51%, have had handled at least six mobile bullying incidents in their teaching career. It was noted that teachers do not necessarily know how to conduct basic investigations nor how to preserve evidence for incident escalation to the relevant parties. However, teachers appear to know how to classify incidents according to where incidents must be escalated for further investigation. Other role players were found to be generally ready and willing to assist teachers in dealing with mobile bullying in schools.

### **6.4 Implications for Academics**

Even though there is a number of published researches looking at mobile bullying, its impact and prevalence in South Africa, very little is published about how teachers can conduct basic incident investigation. This study contributes to the body of knowledge in information systems research by contributing with starting point for further research of forensic readiness in South African schools. As stated in the discussion of the findings, most of the literature in forensic readiness erupts from studies conducted specifically for private and large organisations.

This research challenges the norm and takes the study of forensic readiness to its unusual territories where the role players in those territories do not necessarily specialise in forensics. It is hoped that this research will ignite research from academics to explore the opportunities

of employing forensic readiness in schools. This research produced a proposed frameworks which academics can use in future studies, challenge the framework, and refine it if needs be.

### **6.5 Implications for Practice**

Firstly, the findings of this research challenges how schools currently handle mobile bullying incidents, in a haphazard manner. The call is made for collaboration between various external people to assist schools to employ forensic readiness principles to handle mobile bullying incidents in a structured manner. Furthermore, this may reduce load on an already overburdened teaching staff through the use of established processes and procedure to investigate incident much quicker and simpler.

Adopting the findings from this research would require buy-in from top management, in this case the Department of Education. The department is required to assist schools and to fund the implementation of forensic readiness and the support of the program. Since this would be new avenues for teachers, it would be essential conduct training programs. Awareness programs would be very helpful to all the role players involved including learners.

However, for the whole readiness program to be successful, schools are challenged to establish incident reporting channels to encourage victims to report mobile bullying. The investigation can only start after the incident is brought to light, thus the importance of reporting channels. The next section therefore presents answers to the research question.

### **6.6 Revisiting Research Question**

It is important that researcher revisits the research question and sub-questions after summarising the key findings. The revisit of the initial research question allows the researcher to check if the research question is answered or not. The main research question:

*‘What are the non-technical factors influencing school’ forensic readiness and the ability to investigate mobile bullying incidents in schools?’*

The question was answered comprehensively. The findings indicated that the significant non-technical factors influencing forensic readiness and ability to investigate mobile bullying in South African schools are:

- i. Ability to identify and classify mobile bullying incidents.

- ii. Availability of people who support school readiness program.
- iii. The ability to write adequate post-incident reports.
- iv. Well-documented processes, procedures and policies.
- v. Periodic improvements to the overall forensic readiness program in school.

The sub-questions and their answers are as follows:

- i. *How does mobile bullying incident identification proficiency of teachers affect the readiness and ability of teachers to handle mobile bullying incidents in schools?*

This question was answered and it is addressed in greater detail in the findings' discussion section. In short, it was found that incident identification has a significant positive effect readiness and ability to handle mobile bullying incidents.

- ii. *How does the availability of people affect readiness and the ability of teachers to handle mobile bullying incidents in schools?*

It was found that readily available people have a significant positive effect readiness and ability to handle mobile bullying incidents. Thus, the question is answered and elaborated upon in the findings and discussion section.

- iii. *How does well-documented processes, procedures, and policies affect readiness and the ability of teachers to handle mobile bullying incidents in schools?*

It was found that well-documented processes, procedures, and policies have a significant positive effect readiness and ability to handle mobile bullying incidents. Thus, the question is answered and elaborated upon in the findings and discussion section.

- iv. *How does teachers' legal awareness affect teachers' readiness and ability to handle mobile bullying incidents in schools?*

The statistical analysis showed that legal awareness does not have a significant positive effect readiness and ability to handle mobile bullying incidents. Therefore the question was answered and further discussion is given in findings section.

- *How does general readiness program improvements in schools affect the readiness and ability of teachers to handle mobile bullying incidents in schools?*

The analysis showed that the overall periodic improvements of the readiness program has a significant effect on readiness and ability to handle mobile bullying incidents. Thus, the question was answered.

This section therefore reviewed research question and sub-questions. A summarised answer of each question was provided. However the detailed discussion of the answers is in the findings and discussion section of this dissertation. The next section discusses limitations.

### **6.7 Limitations and Possible Future Research**

The limitations can be improved upon by refining the present study in future, hence the platform is laid for future research. The limitations identified includes sampling. South Africa is a big country with a very large number of schools. Basing the research on five schools, with about eighty responses is not a large enough sample representative of the schools and teachers in South Africa. Future studies may consider targeting a large number of responses.

Another limitation relates to the location where the sample was drawn. If the same sample size or participation is drawn from a different location with South African borders, it is possible to obtain totally different results. Again it is recommended that future studies must spread their reach when drawing the sample so that it is better representative and the findings are more robust.

The major limitation in this research was the fact that the participants targeted are school teachers only. Future studies may look at expanding the participation to other role players, especially the forensic specialists. Interviews with forensic specialists regarding readiness in schools may complement this research very well.

Another limitation relates to the fact that the researcher did not explore data to levels where comparisons are drawn at demographics level. For instance, the research did not compare the ability of female participants to investigate mobile bullying incidents versus their male

counterparts. Future studies may look at such comparisons to tease out themes relating to gender, or teaching experience in relation to the ability to investigate incidents.

Another limitation relates to the fact that a Cronbach alpha score of “0.47” loaded for one factor (PROCESS). As discussed in the reliability and validity testing section, one question (IfNoProcess) can be removed from the questions making up that factor to improve the Cronbach alpha score. Future studies may consider removing that question to improve reliability of that construct. The next section presents recommendations from this research.

## **6.8 Recommendations**

Recommendations for practice:

It is important that the Department of Education in South Africa assist schools in setting up adequate non-technical forensic readiness to prepare for mobile bullying incidents. The officials must form partnerships with external role players who must provide support to schools in maintaining forensic readiness program. It is imperative to establish well-defined processes, procedures, and policies that will provide guidelines for basic incident investigations in schools. It is further recommended that clear, and possibly anonymous, incident reporting channels are established to encourage victims to report incidents. It is also important that the regular reviews are conducted in schools to ensure that their readiness program is up to date. Awareness programs and regular training will also add to the adequacy and enhancement of forensic readiness in schools.

It is recommended that support is obtained from the external legal counsel to ensure legality of all the operations relating to forensic readiness and investigations in schools.

Recommendations for academics:

It was not the focus of this study to examine the relationship of the non-technical factors that influence forensic readiness in schools, it is recommended that future studies may test such relationships.

## **6.9 Conclusion**

This research developed a framework that presented the non-technical factors influencing forensic readiness in schools and the ability to investigate incidents. Following statistical analysis, it was found that the ability to identify and classify incidents had positive influence

on readiness and ability to investigate incidents. The same finding was noted for the availability of people versus readiness and ability to investigate. Furthermore, regular improvements to the readiness program was noted to influence readiness and ability to investigate incidents in school.

This research contributes to the body of knowledge regarding mobile bullying and forensic readiness. The research further proposes how mobile bullying can be tackled in schools by employing forensic readiness principles. It is hoped that the findings of this research provides guidelines to the Department of Education in South Africa to assist schools in combating the mobile bullying epidemic.

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## 8. Appendixes

### Appendix A: Cover Letter



#### Department of Information Systems

Leslie Commerce Building  
Engineering Mall, Upper Campus  
OR  
Private Bag X3 - Rondebosch - 7701  
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280  
Internet: <http://www.commerce.uct.ac.za/informationssystem/>

07 April 2015

#### Request to conduct research and participation consent form

Dear Sir/Madam,

In terms of the requirements for completing a Masters Degree in Information Systems at the University of Cape Town a research study is required.

The researcher, in this case Phillimon Nembandona, has chosen to conduct a study entitled “*Towards a School Mobile Forensic Readiness Process for managing Mobile Bullying in High Schools*”. The researcher would like to request permission to conduct this study at your school. The objective of the research is to:

- Determine whether schools are prepared to manage mobile bullying when incidents arise.
- Subsequent to that objective, it is aimed that a school mobile forensic readiness process would be proposed at the end of the study.

Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for the purpose of this study. Neither individual nor school names will be published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The data collection method will be a questionnaire directed at school teachers. The questionnaire will be completed at school premises and will take +- 15 minutes. If you are willing to participate in this study, kindly sign the attached form and return to me at your earliest convenience.

Should you have any questions regarding this research, please feel free to contact me on 0823822424.

Your participation in this study would be greatly appreciated, but is entirely voluntary.

Sincerely,

**Phillimon Nembandona**  
Researcher \ M.Com Student,  
University of Cape Town  
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**Professor Michael Kyobe**  
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## **Appendix B: Permission**

## Appendix C: Research Questionnaire

<b>Mobile Bullying and School Forensic Readiness Survey</b>					
Mobile bullying can be defined as a form of electronic online bullying through email, chat rooms, instant messaging and small text messages using mobile phones (Kowalski <i>et al.</i> 2007).					
Forensic readiness is defined as “the ability of an organisation where certain controls are implemented to facilitate digital forensic processes and to anticipate malicious actions which may be disruptive to the business operations” (Pangalos & Katos, 2010) “Organisation” may be interpreted as “school” where “business operations” implies “school operations”.					
<b><i>This questionnaire is confidential and no one in your school will know your answers. It is anonymous, so please don't put your name anywhere on it.</i></b>					
<b><i>This questionnaire is completely voluntary and you can decide to exit at any time.</i></b>					
<b><i>Please mark with an X in the relevant box provided. It should take approx. 15 minutes to complete.</i></b>					
<b>A. General Information - Demographics</b>					
1. Gender	Female		Male		
2. Teach Grade(s)	8	9	10	11	12
3. Age	21 or less	22 - 30	31 - 40	41 - 50	51 or older
4. Teaching experience (years)	1 - 5	6 - 10	11 - 15	16 - 20	21 +
5. Mobile technology experience (years)	1 - 5	6 - 10	11 - 15	16 - 20	21 +
6. Experience dealing with mobile bullying (years)	0 - 5	6 - 10	11 - 15	16 - 20	21 +
7. Number of mobile bullying incidents dealt with	0 - 5	6 - 10	11 - 15	16 - 20	21 +
<b>B. Ability to Identify Mobile Bullying Incidents</b>					
	Very poorly	Poorly	Adequately	Well	Very well
8. I can identify mobile bullying messages	1	2	3	4	5
9. I can identify mobile bullying incidents that must be referred to SAPS or law enforcement e.g. child porn	1	2	3	4	5
10. I can identify mobile bullying incidents that must be referred to social works e.g. child protection issues	1	2	3	4	5
11. I can classify mobile bullying incidents according to severity and jurisdiction.	1	2	3	4	5
<b>C. Readiness and Ability to Investigate Mobile Bullying</b>					
	Very poorly	Poorly	Adequately	Well	Very well
12. I can investigate mobile bullying on different mobile devices e.g. tablets, smartphones	1	2	3	4	5
13. I can investigate mobile bullying on different mobile operating systems e.g. Android, Blackberry OS	1	2	3	4	5
14. I know what evidence is required when escalating incidents to external parties for further investigations.	1	2	3	4	5
15. I know various external parties who handle and/or investigate escalated incidents e.g. SAPS, Social Workers	1	2	3	4	5
16. Our school is generally ready and prepared to handle mobile bullying incidents.	1	2	3	4	5
17. Our school has readily available people who responds to mobile bullying incidents.	1	2	3	4	5
<b>D. Processes, Procedures, and Policies to Address Mobile Bullying</b>					
	Strongly disagree	Disagree to some extent	Disagree	Agree	Strongly agree
18. Our school has a procedures and/or processes we use when responding to mobile bullying incidents	1	2	3	4	5
19. If you disagree, do you think your school should have procedures to use when responding to mobile bullying?	1	2	3	4	5
20. Our school has policies to address mobile bullying	1	2	3	4	5

21. If you disagree, do you think that your school should have policies to address mobile bullying?	1	2	3	4	5
---	---	---	---	---	---

**E. Legal Awareness and Post-incident Reporting**

	<b>Strongly disagree</b>	<b>Disagree to some extent</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>
22. I am aware or know of the law that governs investigations of mobile bullying in schools	1	2	3	4	5
23. Our school receives external law support from legal counsel	1	2	3	4	5
24. I am aware of the legal requirements of handling evidence obtained as a result of mobile bullying investigation	1	2	3	4	5
25. I am able to write post-incident investigation report	1	2	3	4	5
26. I can keep records of action (chain of custody) until incident conclusion.	1	2	3	4	5
27. Our school has post-incident report archive/filing system in place for record keeping of mobile bullying incidents	1	2	3	4	5

**F. People and Improvements**

	<b>Strongly disagree</b>	<b>Disagree to some extent</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly agree</b>
28. School administrators are readily available to assist teachers in dealing with mobile bullying incidents	1	2	3	4	5
29. School committees and governing body are readily available to assist teachers in dealing with mobile bullying	1	2	3	4	5
30. Other community services such as SAPS are readily available to assist teachers in dealing with mobile bullying	1	2	3	4	5
31. Our school has dedicated and readily available teachers who assist with mobile bullying incident investigations.	1	2	3	4	5
32. Learners know where and how to report mobile bullying	1	2	3	4	5
33. How often does your school review archived files to improve on school mobile bullying policies?	Never	Less often	Often	More often	Frequently
34. How often are teachers trained to support learners with regards to dealing with mobile bullies?	Never	Less often	Often	More often	Frequently
35. How often does the school run awareness programs for teachers and learners?	Never	Less often	Often	More often	Frequently

36. If your school has a mobile bullying investigation process or procedure please describe it.	
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37. Using your own experience and knowledge in handling mobile bullying in schools, please describe what an ideal process or procedure would entail for handling mobile bullying in schools.	
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38. What would you like to be improved regarding training and support for teachers in terms of handling mobile bullying?	
--	--

**Complete**

You have now completed all the questions. All of the sections are confidential, so please do not discuss your answers with anyone. If you have been bullied or mobile bullied and would like to discuss it with someone then please contact a teacher or parent/caregiver. If you are not comfortable with this then call Childline (08000 55 555), they are experienced at giving advice and support. Childline is a free 24-hour support.

**THANK YOU FOR TAKING THE TIME TO COMPLETE THIS SURVEY.**



2			1			2	1	2	2	2	1	1	1	1	1	1	5	5	5	5	5	4	5	1	1	1	1	5	4	3	4	1	1	1	1	1	2	2	2	2	2	2	
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## Appendix E: Descriptive Statistics

Variable	Descriptive Statistics (Sheet1 in SchoolReadiness)							
	Valid N	Mean	Median	Min	Max	Std.Dev.	Coef. Var.	Standard Error
CanInvestigateOnDiffModels	81	2.7407	3.0000	1.0000	5.0000	1.137	41.512	0.1264
EvidenceToExternalSupport	78	2.8717	3.0000	1.0000	5.0000	0.944	32.895	0.1069
KnowExternalSupport	79	2.9240	3.0000	1.0000	5.0000	1.022	34.967	0.1150
SchoolReady	81	2.0864	2.0000	1.0000	5.0000	0.938	44.959	0.1042
PeopleReady	79	1.8734	2.0000	1.0000	5.0000	0.978	52.248	0.1101
CanIdentifyMBmessages	79	2.9113	3.0000	1.0000	5.0000	1.134	38.965	0.1276
CanIdentifyIncForSAPS	81	2.9629	3.0000	1.0000	5.0000	0.993	33.514	0.1103
CanIdentifyIncForSocialWrk	81	2.7160	3.0000	1.0000	5.0000	0.977	35.996	0.1086
CanClassifyIncidents	82	3.0731	3.0000	1.0000	5.0000	0.926	30.154	0.1023
SchoolHasInvestigateProcess	79	2.0253	2.0000	1.0000	5.0000	1.061	52.429	0.1194
IfNoProcess	71	4.3521	4.0000	2.0000	5.0000	0.738	16.973	0.0876
SchoolHasMBPolicy	81	2.0123	2.0000	1.0000	5.0000	1.188	59.056	0.1320
IfNoPolicy	70	4.2857	4.0000	2.0000	5.0000	0.662	15.458	0.0791
AwareOfLaws	81	2.1358	2.0000	1.0000	5.0000	0.958	44.880	0.1065
ExternalLawSupport	71	1.7746	2.0000	1.0000	4.0000	0.759	42.805	0.0901
AwareOfLegalRequirements	81	1.9753	2.0000	1.0000	5.0000	0.851	43.087	0.0945
CanWritePostIncidentReport	81	2.8271	3.0000	1.0000	5.0000	0.984	34.832	0.1094
ChainOfCustody	74	2.5405	2.5000	1.0000	5.0000	0.924	36.385	0.1074
SchoolIncArchive	77	2.4415	2.0000	1.0000	5.0000	0.850	34.838	0.0969
SchoolAdmnReady	82	2.1585	2.0000	1.0000	5.0000	0.922	42.739	0.1018
SchoolCommReady	81	2.3456	2.0000	1.0000	5.0000	0.950	40.533	0.1056
CommunityServicesReady	81	2.9876	3.0000	1.0000	5.0000	1.078	36.085	0.1197
TeachrsReady	81	2.5679	3.0000	1.0000	5.0000	0.947	36.912	0.1053
LearnrKnwWhereToReport	80	1.6125	1.0000	1.0000	3.0000	0.720	44.669	0.0805
FrequencyReviewArchivedInc	80	1.4875	1.0000	1.0000	3.0000	0.636	42.777	0.0711
FrequencyTeachrsTrained	81	1.4074	1.0000	1.0000	3.0000	0.586	41.700	0.0652

## Appendix F: Item Analysis

### i. Readiness and Ability to investigate:

variable	Summary for scale: Mean=12.6143 Std.Dv.=4.01552 Valid N:70 (Sheet1 in SchoolReadiness) Cronbach alpha: .838812 Standardized alpha: .841859 Average inter-item corr.: .537143				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
CanInvestigateOnDiffModels	9.84286	9.38959	3.064244	0.713260	0.786339
EvidenceToExternalSupport	9.74286	10.13388	3.183375	0.814921	0.761667
KnowExternalSupport	9.65714	11.42531	3.380134	0.486185	0.848004
SchoolReady	10.48571	10.76408	3.280866	0.673096	0.798675
PeopleReady	10.72857	11.19775	3.346305	0.557907	0.828300

### ii. Ability to identify and classify incidents

variable	Summary for scale: Mean=11.6104 Std.Dv.=3.47607 Valid N:77 (Sheet1 in SchoolReadiness) Cronbach alpha: .866751 Standardized alpha: .868576 Average inter-item corr.: .628223				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
CanIdentifyMBmessages	8.701299	6.417272	2.533233	0.727047	0.829163
CanIdentifyIncForSAPS	8.662337	7.132737	2.670718	0.704640	0.834807
CanIdentifyIncForSocialWrk	8.922078	6.980941	2.642147	0.765108	0.811211
CanClassifyIncidents	8.545455	7.494687	2.737643	0.684521	0.843235

### iii. Processes, procedures, and policies

variable	Summary for scale: Mean=12.2813 Std.Dv.=1.97981 Valid N:64 (Sheet1 in SchoolReadiness) Cronbach alpha: .469923 Standardized alpha: .438820 Average inter-item corr.: .176528				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
SchInvProcess	10.45313	2.21655	1.488809	0.396212	0.265007
IfNoProcess	7.87500	3.60937	1.899835	-0.061966	0.626826
SchMBPolicy	10.53125	1.81152	1.345928	0.406922	0.233288
IfNoPolicy	7.98438	2.57788	1.605578	0.377841	0.313098

**Processes, procedures & Policies can improve ('IfNoProcess' removed):**

variable	Summary for scale: Mean=7.83582 Std.Dv.=1.90372 Valid N:67 (Sheet1 in SchoolReadiness) Cronbach alpha: .636653 Standardized alpha: .626316 Average inter-item corr.: .370504				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
SchInvProcess	6.029851	1.760303	1.326764	0.530023	0.419641
SchMBPolicy	6.104477	1.347293	1.160730	0.567881	0.349206
IfNoPolicy	3.537313	2.517265	1.586589	0.284595	0.723540

**iv. Legal Awareness**

variable	Summary for scale: Mean=5.82609 Std.Dv.=2.12102 Valid N:69 (Sheet1 in SchoolReadiness) Cronbach alpha: .807988 Standardized alpha: .810374 Average inter-item corr.: .594079				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
AwareOfLaws	3.710145	1.858013	1.363090	0.681634	0.719874
ExtLawSuppt	4.057971	2.518378	1.586940	0.575309	0.816347
AwareOfLegalReq	3.884058	2.102499	1.450000	0.734604	0.657742

**v. Post-incident reporting**

variable	Summary for scale: Mean=7.57353 Std.Dv.=2.40221 Valid N:68 (Sheet1 in SchoolReadiness) Cronbach alpha: .839831 Standardized alpha: .842320 Average inter-item corr.: .640804				
	Mean if deleted	Var. if deleted	StDv. if deleted	ltn-Totl Correl.	Alpha if deleted
CanWriteReport	4.838235	2.488538	1.577510	0.703958	0.783523
ChainOfCtdy	5.117647	2.721453	1.649683	0.727955	0.753973
SchlArchv	5.191176	2.978158	1.725734	0.689576	0.794133

**vi. Availability of people**

variable	Summary for scale: Mean=10.0759 Std.Dv.=3.11643 Valid N:79 (Sheet1 in SchoolReadiness) Cronbach alpha: .814357 Standardized alpha: .818042 Average inter-item corr.: .534977				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
SchoolAdmnReady	7.911392	6.030124	2.455631	0.630761	0.769490
SchoolCommReady	7.721519	5.441436	2.332689	0.726034	0.722615
CommunityServicesReady	7.113924	5.569300	2.359936	0.566797	0.804592
TeachersReady	7.481013	5.869893	2.422786	0.628151	0.769531

**vii. Periodic improvements**

variable	Summary for scale: Mean=5.89610 Std.Dv.=2.12494 Valid N:77 (Sheet1 in SchoolReadiness) Cronbach alpha: .841054 Standardized alpha: .841430 Average inter-item corr.: .589861				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
LearnsKnwWhrToRprt	7.911392	6.030124	2.455631	0.630761	0.769490
FreqRevArchIN	4.402597	2.526227	1.589411	0.752946	0.763920
FreqTeachersTraind	4.467533	2.898296	1.702438	0.601552	0.828911
FreqSchRunAwarncss	4.519481	2.717153	1.648379	0.654688	0.807263

## Appendix G: Factor Analysis

Variable	Factor Loadings (Varimax normalized) (Sheet1 in SchoolReadinessData) Extraction: Principal components (Marked loadings are >.500000)						
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
CanInvestigateOnDiffModels	0.630	0.372	0.387	-0.081	0.291	0.114	-0.077
EvidenceToExternalSupport	0.648	0.112	0.509	-0.207	0.042	0.007	0.185
KnowExternalSupport	0.691	-0.164	0.411	0.030	0.080	0.079	0.001
SchoolReady	0.826	-0.188	0.124	0.018	0.044	-0.169	0.072
PeopleReady	0.774	0.039	-0.041	-0.142	-0.038	-0.142	0.004
CanIdentifyMBmessages	0.158	0.228	0.686	-0.191	0.367	0.123	0.140
CanIdentifyIncForSAPS	0.338	0.155	0.692	0.184	0.238	0.017	-0.076
CanIdentifyIncForSocialWrk	-0.027	0.113	0.829	0.099	0.018	0.022	0.128
CanClassifyIncidents	0.164	-0.178	0.794	0.061	0.129	0.021	-0.062
SchoolHasInvestigateProcess	-0.201	0.099	-0.008	0.283	0.047	0.607	0.116
IfNoProcess	-0.135	0.135	-0.126	0.225	-0.204	-0.385	-0.484
SchoolHasMBPolicy	-0.185	0.119	0.237	0.027	0.215	0.788	-0.116
IfNoPolicy	-0.154	-0.196	-0.161	0.210	0.131	-0.003	-0.773
AwareOfLaws	-0.201	0.744	0.249	0.162	0.198	0.067	0.099
ExternalLawSupport	0.066	0.829	-0.207	-0.174	0.057	0.212	0.140
AwareOfLegalRequirements	0.081	0.801	0.190	0.312	0.114	0.039	-0.020
CanWritePostIncidentReport	-0.186	0.120	0.287	-0.094	0.776	0.086	0.039
ChainOfCustody	0.118	0.311	0.032	-0.020	0.742	0.171	-0.094
SchoolIncArchive	-0.024	0.123	0.508	-0.088	0.634	0.240	-0.067
SchoolAdmnReady	0.299	-0.068	0.111	0.172	0.565	0.038	0.390
SchoolCommReady	0.647	0.157	-0.133	-0.003	0.405	0.359	0.127
CommunityServicesReady	0.414	0.152	-0.036	0.101	-0.075	0.645	0.143
TeachersReady	0.272	0.012	0.083	0.503	0.508	-0.087	-0.018
LearnrKnwWhereToReport	-0.051	0.043	-0.042	0.848	-0.144	0.175	-0.061
FrequencyReviewArchivedInc	-0.177	0.108	0.237	0.738	0.038	0.135	-0.137
FrequencyTeachersTrained	-0.291	0.076	-0.110	0.095	-0.618	0.214	0.449
CanInvestigateOnDiffModels	-0.088	0.123	-0.239	0.525	-0.041	-0.021	0.554
Expl. Var	3.847	2.516	3.613	2.346	3.178	2.021	1.718
Prp. Totl	0.142	0.093	0.133	0.086	0.117	0.074	0.063

## Appendix H: Eigenvalues

Eigenvalues (Sheet1 in SchoolReadinessData) Extraction: Principal components				
Value	Eigenvalue	% Total	Cumulative	Cumulative
1	6.516452	24.13501	6.51645	24.13501
2	3.552759	13.15837	10.06921	37.29338
3	2.466202	9.13408	12.53541	46.42746
4	2.103032	7.78901	14.63845	54.21647
5	1.889203	6.99705	16.52765	61.21351
6	1.536092	5.68923	18.06374	66.90274
7	1.180224	4.37120	19.24397	71.27394

## Appendix I: Spearman Rank Order Correlations

Spearman Rank Order Correlations (Sheet1 in SchoolReadinessData) MD pairwise deleted Marked correlations are significant at p <.05000							
Variable	READY &INV	IDENTIF Y	PROCE SSES	LEGAL	REPOR TS	PEOPL E	IMPRO VE
READY&INV	1.0000	0.4542	-0.3442	0.0469	0.3312	0.4956	-0.1756
IDENTIFY	0.4542	1.0000	0.0468	0.1684	0.5769	0.4548	0.1400
PROCESSES	-0.3442	0.0468	1.0000	0.0840	0.2365	-0.0189	0.3479
LEGAL	0.0469	0.1684	0.0840	1.0000	0.2719	0.1615	0.2293
REPORTS	0.3312	0.5769	0.2365	0.2719	1.0000	0.4122	0.2533
PEOPLE	0.4956	0.4548	-0.0189	0.1615	0.4122	1.0000	0.2194
IMPROVE	-0.1756	0.1400	0.3479	0.2293	0.2533	0.2194	1.0000

## Appendix J: Multiple Regression Analysis

i. Dependent variable is READY&INVESTIGATE; Independent variable is IDENTIFY

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .39378032 R <sup>2</sup> = .15506294 Adjusted R <sup>2</sup> = .14450123 F(1,80)=14.682 p<.00025 Std.Error of estimate: .78309						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			1.431291	0.310305	4.612526	0.000015
IDENTIFY	0.393780	0.102770	0.373044	0.097358	3.831659	0.000252

ii. Dependent variable is READY&INVESTIGATE; Independent variable is PROCESSES

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .28936564 R <sup>2</sup> = .08373247 Adjusted R <sup>2</sup> = .07227913 F(1,80)=7.3107 p<.00837 Std.Error of estimate: .81547						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			3.733129	0.438354	8.51624	0.000000
PROCESSES	-0.289366	0.107020	-0.349693	0.129332	-2.70384	0.008370

iii. Dependent variable is READY&INVESTIGATE; Independent variable is PEOPLE

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .55269412 R <sup>2</sup> = .30547079 Adjusted R <sup>2</sup> = .29678917 F(1,80)=35.186 p<.00000 Std.Error of estimate: .70997						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			1.116928	0.257714	4.333979	0.000042
PEOPLE	0.552694	0.093175	0.563264	0.094957	5.931774	0.000000

iv. Dependent variable is READY&INVESTIGATE; Independent variable is LEGAL

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .01202798 R <sup>2</sup> = .00014467 Adjusted R <sup>2</sup> = -----						
F(1,80)=.01158 p<.91459 Std.Error of estimate: .85186						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			2.547382	0.257497	9.892877	0.000000
LEGAL	0.012028	0.111795	0.012084	0.112316	0.107589	0.914591

v. Dependent variable is READY&INVESTIGATE; Independent variable is REPORTS

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .28222909 R <sup>2</sup> = .07965326 Adjusted R <sup>2</sup> = .06814893						
F(1,80)=6.9238 p<.01020 Std.Error of estimate: .81728						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			1.767478	0.319220	5.536870	0.000000
REPORTS	0.282229	0.107258	0.291043	0.110608	2.631304	0.010202

vi. Dependent variable is READY&INVESTIGATE; Independent variable is IMPROVE

Regression Summary for Dependent Variable: READY&INV (Sheet1 in SchoolReadinessData)						
R= .21948189 R <sup>2</sup> = .04817230 Adjusted R <sup>2</sup> = .03627445						
F(1,80)=4.0488 p<.04757 Std.Error of estimate: .83114						
N=82	b*	Std.Err.	b	Std.Err.	t(80)	p-value
Intercept			3.039326	0.249188	12.19694	0.000000
IMPROVE	-0.219482	0.109077	-0.303371	0.150768	-2.01217	0.047568