

Continued Forensic Development – Investigation into Current Trends and Proposed Approach for Digital Forensic Practitioners

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Abstract

Continuous professional development has been looked at in many professions over the years, most notably in primary and secondary education and in the medical fields. With digital forensics being cast into the limelight due to the rapid advancements in technology, academic institutions have added courses to address the void created by the boom in the industry. Little research has been done to address the issues that have now become apparent concerning continued learning in this field. The purpose of this research was to investigate the kinds of frameworks and methods used in other professions, and how the practitioners themselves see career development, and to create a framework that could be used to keep abreast of developments in the field of digital forensics, be it changes in the law, case law, or changes in software.

The data analysis showed quite a number of continued learning approaches that could be employed in the digital/computer forensic fields to achieve the objective of keeping abreast of changes in the field. Some, understandably, are due to the nature of the discipline. As part of practitioners' current approach to continued learning, they rely heavily on knowledge sharing in the form of learning from other professionals, through self-study by reading books, articles and research conducted in the forensic field, the use of Information and Communications Technology (ICT) for education, and the use of Internet sources such as user forums, Facebook groups, and web-blogs. The majority of the respondents had received formal training in digital forensics, and of the total number of participants, only six percent had not been involved in any form of continued learning activities in the past five years.

When looking at the data obtained, and because there are no formal requirements to perform continued learning in the digital/computer forensic field, it becomes clear that individuals themselves need to be self-driven to keep up to date with changes in the field. As seen in studies focused on continued learning activities in other professions, the research shows that digital/computer forensic practitioners experience similar barriers to their own approaches to continued learning.

The responses from the survey were from participants from all over the world, with a higher number of respondents based internationally, compared to those based in South Africa. The majority of the respondents were in favour of a statutory body overseeing continued learning.

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List of abbreviations and acronyms

AAC	Assessment Advisory Committee
ACPO	Association of Chief Police Officers
CAWFE	Certified Advanced Windows Forensic Examiner
CE	Continued Education
CFCE	Certified Forensic Computer Examiner
CISSP	Certified Information Systems Security Professional
CL	Continued Learning
CLE	Continued Legal Education
CME	Continued Medical Education
CPD	Continued Professional Development
CPL	Continued Professional Learning
DHET	Departments of Basic Education and Higher Education and Training
DNA	Deoxyribonucleic Acid
ECSA	Engineering Council of South Africa
FBI	Federal Bureau of Investigation
GMC	General Medical Council
HPCSA	Health Professions Council of South Africa
IACIS	International Association for Computer Information Systems
ICT	Information and Communications Technology
IOCE	International Organization of Computer Evidence
KB	Knowledge Barriers
KM	Knowledge Management
KS	Knowledge Sharing
KSM	Knowledge Sharing Management
KT	Knowledge Transfer
NRGD	Netherlands Register of Court Experts
NCFS	National Commission on Forensic Science
PD	Professional Development
RCGP	Royal College of General Practitioners
SANS	SysAdmin, Audit, Networking, and Security
SWGDE	Digital Evidence from the Standard Working Group on Digital Evidence

1. Introduction

The research undertaken in this paper looked at the current state of continued professional development (CPD) in the field of computer forensics. Previous research conducted on CPD in other professions such as medical, legal, engineering and teaching, has shown that there have been successes and failures with regard to CPD. The current research looked at ways to address the need for continued learning within the discipline of digital forensics, as no such study has yet been undertaken. Other disciplines have sought to include continued learning as a method to ensure practitioners are kept up to date with advancements in their respective fields, as knowledge changes from when students complete their studies throughout their careers.

Digital forensics as a discipline is relatively in its infancy due to the steep curve that advancements in technology have brought. This has highlighted deficiencies in how the law deals with digital evidence, as well as how digital forensic practitioners need to collect and analyse evidence. Even though forensics as a discipline has been used by experts to present evidence for hundreds of years, only recently has there been an attempt to capture a list of digital forensic practitioners, and identify what the best approach would be to ensure that best practice be maintained through possible accreditation and certification.

From the literature review, it became apparent that different approaches might need to be explored, and possibly to include other learning techniques to address issues in continuous professional development. Different areas need to be investigated, namely issues with CPD, knowledge sharing management, the use of information and communication technology (ICT) for CPD, and digital forensics as a discipline.

A structured on-line questionnaire was sent to the study population and analysed to test if the hypotheses played a significant role in continued learning activities. The conclusions drawn from the analysis of data was used to compile a second structured on-line questionnaire, which used Likert-type scale questions to test the findings obtained from the initial data collection. The second research instrument was sent to a number of professionals in the

digital forensic field to discover whether they agreed or disagreed with the findings from the data analysis. As this is the first research of this type focusing specifically on continued education for digital/computer practitioners, only two iterations were required to get a fairly conclusive picture.

The analysis of the data was on four distinct topics, namely re-evaluation period; responsibility for quality and content for continued education activities; biggest contributors to continued education; and finally, best approaches for continued education.

2. Literature Summary

2.1 Evolution of Forensic Science

The definition of forensics can be traced back to the 17th century and is derived from the Latin word *forensis*, which means ‘in open court, public’ (Oxford English Dictionary, 2014). Evidence collected should be done following the principles of science.

Reyes and Wiles (2007) outline the history of forensics, which dates back to the time of the Neanderthals, and even in that era a set of rules existed to protect their homes and family life. Some of the most noticeable breakthroughs in forensics as a science that most people are aware of are fingerprinting, blood grouping, handwriting analysis, firearms and bullet comparison (ballistics) and, more recently, the advancements in terms of deoxyribonucleic acid (DNA). All of the forensic sciences mentioned previously had to be proved reliable in order to ensure that the people responsible for criminal acts could be brought to justice in a court of law. Many of the developments in the science of forensics occurred in the late 1800s, for instance the study of fingerprinting performed by Francis Galton. Blood typing was the result of the study performed by Leone Lattes, Calvin Goddard is credited with the science of comparing firearms and bullets, which resulted in many cases being closed, and forensic examination of documents was performed by Albert Osborn. All the developments from the studies in forensics were later used by the Austrian Hans Gross (1847-1915) when he headed criminal investigations, and he is referred to as the founder of the field of criminalistics.

2.2 Digital and Computer Forensics History

Parker (2007) provides a bit of history on digital and computer forensics, stating that throughout the 1950s and 1960s few experts could agree on what defines computer crime. At this point in history, employees would frequently swap computer codes amongst themselves; consequently, businesses and governments started to realise the implications and possible risks that could be exposed through computer system installation.

The history of the first computer crime dates back to 1958 (Casey, 2011). The first recorded criminal prosecution where a computer was used to alter bank records dates back to 1966, in Minneapolis. The first case dealing with common law concepts, in the case of State versus

Hancock, served later that same year in Texas. Hancock was a programmer at Texas Instruments and was found guilty of stealing 59 programmes (Wilson, 1991). These cases revealed that there was a real need to have laws to deal with the use of computers in criminal activities. Highlighting the need to have clear definitions of terms used, in the case of *Hancock v State* (1966), the court ruled that computer programs fell under the description "all writing of every description, provided such property possesses any ascertainable value". This classification sparked a dispute as to whether or not broad terminology or precise description would be the best approach to protect a person's property effectively.

There has been an ever-increasing flow of information through computers, fax and mobile communication devices. The seizing of evidence by police in the form of computers and digital storage devices is ever increasing. In the past the interception of data by means of wire-taps was restricted to fax messages; today, wire-taps (or the evidence that can be obtained from internet service providers) contain a variety of messages, and the need to analyse this data has led to the rapid growth of the digital forensic field (Henseler, 2000).

2.2.1 Evolution of the Definition of Computer Crimes

Saari (1987, p. 111) lists what is defined as computer crime as three different types based on the Parker (1976) definition. They include computer crime, computer-related crime and computer abuse. Computer crime is described as illegal computer abuse; however, it must mean that computers were directly used to commit the crime. Computer-related crime is defined as a broader term, meaning that there was knowledge of a computer in committal of the crime in order to get a successful prosecution. Lastly, computer abuse is defined as the intentional act where one or more persons intentionally made use of a computer to attempt to gain access that resulted, or could have resulted, in loss to victims. Subsequently, an Audit Commission in the United Kingdom defined computer fraud as "any fraudulent behaviour connected with computerization by which someone intends to gain dishonest advantage" (Saari, 1987, p. 111).

Henseler (2000) further expanded the definition of computer crime into five different types of computer crime: fraud by manipulation, computer forgery, damage to, or modification of computer data or programs, unauthorised access to a computer system and service, and unauthorised reproduction of legally protected computer programs, each of which will be

described in further detail. Fraud by manipulation is described as intangible assets that are represented as data sources. Most common examples are deposits of money, or manipulation of the number of recorded hours worked. Computer forgery is described as where documents that are stored in a computerized form have been subjected to manipulation, common example of this being forging of documents that are being used in commerce. Damage to, or modification of computer data or programs is described as either directly or indirectly introducing access to computer systems, common examples of this being viruses, malware, and 'worms'. Regarding unauthorised access to a computer system and service, there are several reasons why criminals may wish to access a computer system, for example, where a hacker gains access purely out of curiosity, or to gain access for sabotaging the computer system. Unauthorised reproduction of legally protected computer programs could lead to substantial financial losses to the holder of the copyright, for example the use of illegal copies of Microsoft Windows and Office.

2.2.2 Evolution of Computer Forensics towards Digital Evidence

The term digital evidence was first mentioned because of the US Postal Inspection Services Laboratory, which had established a Computer Forensic Unit in 1996-97. This unit worked closely with the Federal Bureau of Investigation (FBI), and around the time of the unit's creation there were also significant advances in audio and video capabilities, which were now moving towards digital format from the known analogue. The question started to be asked "should the same standards be applied to all the various forms of Digital Evidence regardless of the outputs?" (Whitcomb, 2002, p. 2). This concept of digital evidence was discussed in 1998 with the help of technical experts from the FBI Computer Labs and the Department of Justice, after which a task force was created to specifically deal with forensic issues that needed to be addressed with regard to digital evidence (Whitcomb, 2002).

Casey (2000) adapted the definition of digital evidence from the Standard Working Group on Digital Evidence (SWGDE) and the International Organization of Computer Evidence (IOCE), because the definitions primarily focused heavily on proof, while not paying enough attention to data. The all-encompassing definition for digital evidence is thus defined as "any data that can establish that a crime has been committed or can provide a link between a crime and its victim or a crime and its perpetrator" (Casey, 2000, p. 7).

According to ACPO (2008), computer-based electronic evidence can also be viewed as latent evidence, similar to fingerprints or DNA. This computer-based evidence by its nature is fragile, and this means it can be altered, damaged, or even destroyed due to improper handling during collection or examination.

2.3 Defining Cyber-crime

A good up-to-date definition that is available to explain the meaning of cyber-crime has come from Symantec (2012). The definition is derived from many definitions of cyber-crime. Cyber-crime is defined as any crime that is committed using a computer, network or hardware device. The computer or the device may be the agent of the crime, the facilitator of the crime, or the target of the crime. The crime may take place on the computer alone, or may be carried out in other locations. Cyber-crime can best be understood by dividing it into two categories. The two categories will be defined as Type I and Type II.

Characteristics of Type I cyber-crime:

- This is generally a once-off event, from the victim's perspective.
- It is usually facilitated by malware or cyber ware such as keystroke loggers, viruses, and rootkit or Trojan horses.
- Software flaws or known vulnerabilities provide the attacker with the intrusion method. An example of this would be a Trojan horse being installed when a user navigates to a web site that has vulnerabilities.

Examples of Type I cyber-crime could include, but are not limited to, phishing, cache poisoning, theft or manipulation of data and/or services by hacking or by use of a virus, identity theft, bank fraud, e-commerce and m-commerce fraud.

Characteristics of Type II cyber-crime are on the other end of the spectrum:

- Generally a series of on-going events, it involves repeated interactions with the target.
- It is generally facilitated by programs not covered under the classification of cyber ware.

Examples of Type II cyber-crime include, but are not limited to, cyber stalking, harassment, cyber bullying, extortion, blackmail, stock market manipulation, espionage and planning and carrying out acts of terrorism (Symantec, 2012).

2.4 Potential Sources for Digital Evidence

As technology advancements are made, the potential sources for evidence also change. When looking at potential sources for digital evidence, Sommer (2012) provides one of the most comprehensive lists, including personal computers; mobile/smart phones; telephone records; transaction logs; emails; access control logs; Internet activity logs; anti-virus logs; digital photographs with/without geo-tagging enabled; mobile phone and social media applications that use geo-tagging; Global Positioning System (GPS); digital storage devices such as flash drives; removable hard drives; Compact Discs (CDs); Data Versatile Discs (DVDs); and printers. It is important to note all potential sources, and to be aware of any new sources that become available.

As the potential sources for digital evidence are ever changing with advances in technology, Henseler (2000) states that evidence collected for forensic analysis can be subdivided into three categories, namely embedded computer systems, open computer systems and networks, and communications systems. Embedded computer systems can be found in a plethora of consumer electronics, most noticeably the growth that has been seen in mobile telecommunications and mobile communication devices such as the smart-phone. Open computer systems and networks, operating systems and databases evolve, and this requires that forensic practices need to adapt in order to be able to analyse and interpret these changes. Communications systems have also changed rapidly over the years; faster means of communication and the various protocols that exist could determine the type of information being transmitted. The explosion of social media also requires that methods of collecting and analysing evidence need to adapt to these developments.

2.5 Current and Future Challenges Affecting Digital Forensic Development

Because of the rapidly advancing technology, digital forensics is currently facing challenges. Garfinkel (2010) predicts that one of the factors that could contribute to the stagnation in the development of digital forensics as a discipline currently, and for years to come, is the rapidly

growing size of storage media. The increased size results in time constraints to make the forensic image as well as the processing of the evidence once it has been created. Other contributing factors would be the use of embedded flash memory in devices, which means that the evidence can no longer be removed or imaged. Furthermore, improvements in encryption sometimes prevent or hinder processing of evidence once it has been obtained. The variety of operating systems used on computers and mobile devices, the various types of file formats, tools and the cost of the tools, cloud storage for processing and storage mean that data is sometimes no longer available, and the use of volatile memory for storing malware means that RAM forensics is required, which needs special skills and collection techniques.

Garfinkel (2010) contends that legal challenges are another factor that is a cause for concern in the future, with legal systems not being able to keep up with the advancements in technology. Lawless (2011) further shows that moves by government and politics also affect the discipline of forensics; for example, the Government of the United Kingdom decided in 2010 to close the Forensic Science Service (FSS) due to the on-going financial losses sustained.

2.6 Crime in South Africa

While digital forensics can be performed to determine whether someone is guilty, no collection of crime statistics looks specifically at the extent of cyber-crime in businesses in South Africa. The only data available is in the form of online surveys and surveys done as part of research. Currently all forms of fraud are classified under commercial crime, for instance, and are captured as such in the police statistics, as reflected in the annual report released by the South African Police Service (SAPS, 2013). Commercial crime is still on the increase, and has increased by more than 45 percent since the 2004-05 period.

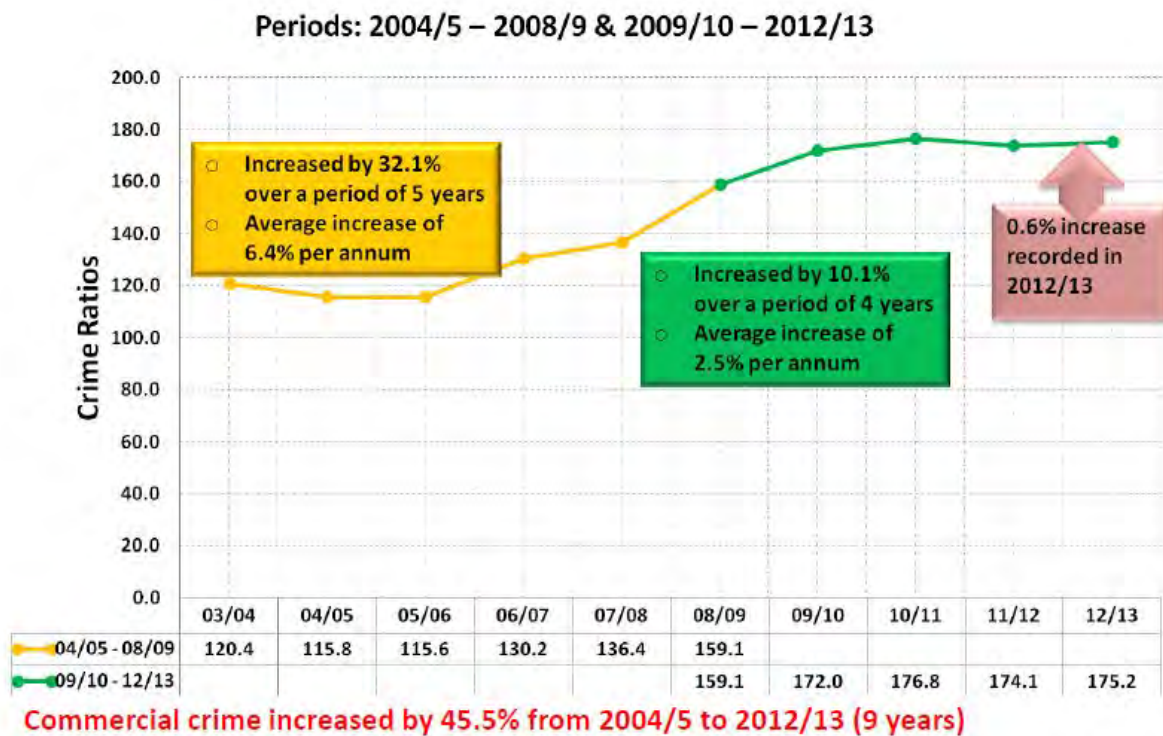


Figure 1: Commercial Crime Statistics (2004-2013)

2.7 Education versus Training

Barbara (2008) highlights that a distinction needs to be made between education and training. It should be noted that these terms are not interchangeable and that they should rather be seen as complementary. Education as defined in the Cambridge Dictionary (2013) is the process of teaching or learning in a school or a college, or the knowledge that you gain from this, whereas training is defined as learning the skills in order to do a certain job.

Education programs are designed to develop the problem-solving skills of students, which is achieved by instilling fundamental knowledge and skills regarding a specific subject. For the purposes of this paper, the use of the terms education and learning are interchangeable. Training programs are seen as more focused on procedural knowledge, a step-by-step approach to completing a certain task.

2.8 Accreditation versus Certification

The National Commission on Forensic Science (NCFS) deemed it necessary to define what is meant by accreditation and certification in its recommendations for accreditation of Forensic Science Service Providers (FSSPs). Accreditation and certification are different programs

used to assess and evaluate different aspects of forensic practitioners and FSSPs. It should also be noted that there are distinct differences between what is defined by accreditation and what is defined by certification; the terms are not interchangeable, but both are required to strengthen forensic science (NCFS, 2015).

Accreditation is defined as an independent third-party assessment of the quality, administrative and technical systems of an FSSP (which can consist of one or many practitioners). The process of accreditation uses generally accepted standards and processes to assess FSSPs on various areas to ensure the quality of the management systems in place. These include ensuring calibration and maintenance of test equipment; methods used to analyse evidence; appropriateness and validation of testing methods; documentation; evidence testing environment where testing of evidence is carried out; handling of evidence; sampling and quality assurance of reporting on tested items; examining the competency of staff; and management of training and continued education of staff (NCFS, 2015).

Professional certification occurs when the individual in question has successfully managed to demonstrate the knowledge or skills to an acceptable standard to complete the tasks associated with their profession. The various certification programs could include written and/or practical examinations, evaluation of education, training and experience in the field, any requirements for continuing education, and possible adherence to a code of conduct or ethics. Certification does not evaluate the quality, administrative, technical systems, procedures, reports, documentation, evidence handling, equipment, validation, security, and safety procedures used by an individual (NCFS, 2015).

2.9 Need for Forensic and Digital Forensics Practitioners and the Need to keep up to Date

“The rate of computer crime continues to increase year to year. The sophistication of the crimes, and the variety of technological devices employed in these offences, are becoming critical challenges to the investigators” (Sophos, 2009; U.S. Department of Justice, 2007, cited in Kahvedzic & Kechadi, 2009, p.1).

Even though digital forensics is required more and more as the uses of technology expand, there are still few graduate and under-graduate courses available. Some universities offer digital forensics as either a minor or a major. An example of this is a degree in Computer Science, Information Systems, or Engineering with a major/minor in Digital Forensics (Barbara, 2008). The University of Cape Town has one such offering, a postgraduate course in Information Systems, majoring in Digital Forensics. Available training programs teach anything from fundamentals of digital forensics to primary software tools, usually provided by the software vendor.

Sommer (2012) also states that ICT infrastructure is constantly changing in terms of hardware, software, communications protocols, operating systems, and social and commercial infrastructures. ICT technologies are expected to change significantly over a five-year period. Digital forensic practitioners are required to keep up to date with changes in technologies in addition to maintaining a high level of quality at a rate that is unlike the requirements in any other profession.

As a discipline, digital forensics at an academic postgraduate level is still in its infancy. In South Africa, a paper by Johnston and Stander (2007) sketches the need for a Forensic Information Systems and Computer Science course at the University of Cape Town. The paper outlines the need for tertiary institutions to play a role in filling the gap that exists with a current shortage of digital forensic practitioners.

Research in digital forensics is needed to keep forensic practitioners up to date with developments in technology, detection techniques, and tools used in the field (Casey, 2011). Garfinkel (2010) points out that research at an academic level in the form of a thesis (which is a requirement) results in good information for the forensic field, but this type of information does not normally make it to the end user.

The European Union (EU) has a vision to create a European Forensic Science Area by 2020. The main aim of this initiative is to improve the co-operation between the judiciary and the police forces. This would also aid in cross-border investigations and prosecutions (Council of the European Union, 2011).

The draft document states that the Commission and Member states would be working towards ensuring even-handed, consistent and efficient administration of justice and security of the citizens of the European Union. Some of the areas that would have an impact on individual forensic practitioners would include a minimum competence criterion for forensic science personnel, proficiency test exercises in forensic science on an international level, and the application of minimum quality standards for crime-scene and evidence management from the crime scene to the courtroom. Other areas that would have an impact on forensic laboratories and institutes include establishing best-practice manuals used in their daily work, accreditation of forensic science laboratories and institutes, and recognition of law enforcement activities in order to avoid duplication and reduce delays in cross-border investigation. There are also areas that would affect law enforcement and the judiciary, such as forensic awareness through appropriate education of law enforcement and the justice community (Council of the European Union, 2011).

Similarly, in the United States of America the NCFSS compiled a paper on universal accreditation for FSSPs. The draft paper was released in 2014 and was finalized in 2015. It is a set of 13 recommendations to move towards best practices, standardization and improving the quality of service, including the accreditation of FSSPs. The areas within accreditation that deal specifically with education and training include the competency of staff, and management of training and continued education (NCFSS, 2015).

2.10 Continued Learning Approaches

The following section examines the various types of approaches that can be used for continuing education. When looking at digital forensics, it is possible that much can be gained from combining some of the approaches discussed in this section.

2.10.1 Continued Professional Development

A challenge for continued professional development is to have a robust definition. The term is very broad and its interpretation is open to debate, depending on the practitioners (Brekelmans, Poell & Van Wijk, 2012). Webster-Wright (2009) argues that the term lifelong learning is used primarily in political and academic research. Other terms are also used to

describe the same type of learning but change depending on the context; for instance, continued learning in a work environment is argued to be continued professional learning (CPL). This term is used to define learning by professionals, as it deals with practices rather than learning through research, which is often referred to as professional development (PD), continued professional development (CPD) or continued education (CE). The distinction made by Webster-Wright (2009) is that PD, CPD and CE require some formal courses and evaluation of knowledge. Further to this argument, undergraduate studies are also seen as continued learning (CL), as this is where learners are taught how to practise the chosen field of study.

Continually updating one's knowledge is not questioned in many professions and is required in most cases, as in professions such as education at a primary and secondary education level and the medical field. Research around the world concerning CPD at a postgraduate level is primarily aimed at the medical field and education. Governing bodies spend time and resources designing strategies to align teachers and medical staff with curriculum and medical advances respectively.

2.10.2 CPD in the Medical Profession

Internationally, there is a need for CPD in the medical field: in some countries, this is a legal requirement, and in others, it is voluntary. In some countries, CPD is also referred to as continued medical education (CME). In 2011, the General Medical Council (GMC) in the United Kingdom conducted a study into countries that required some form of continued learning. The research was done using international academic literature, regulatory guidelines, legislation, online documentation and other studies on CPD. The results of this study are shown in Table 1.

Research conducted in the United Kingdom by Taylor, Parsons, Sparrow, Gerada, Hunter and Howe (2012) resulted in a new initiative titled 'First5' being implemented by the Royal College of General Practitioners (RCGP) to support general practitioners who were members during the first five years after completing their studies. The training is conducted through small work-groups or by accessing training and support through on-line resources.

Country	CPD Requirement	Credits / Year	CPD Scheme Delivered By...	CPD Activities Accredited By...	Sanctions
EUROPE					
Austria	Voluntary	50	Regulator	Regulator	No sanctions
Belgium	Voluntary	20 + 2 PRs	Accredited Providers	Regulator	No sanctions
France	None	-	-	-	-
Germany	Compulsory	50	Accredited Providers	Regulatory Body (Regional)	Licence loss /fees reduced.
Greece	Compulsory	20	Accredited Providers Medical Assoc.	Medical Association	No sanctions
Hungary	Compulsory	50	Accredited Providers	Medical societies	Retake examinations
Italy	Compulsory	50	Accredited Providers	Regulatory Body (Regional)	-
Netherlands	Compulsory	40 inc. PR	Professional societies +Providers	Professional societies	Annual registration
Norway	Compulsory	40	Universities + societies	Medical Association	Loss of status + fees
Poland	Compulsory	40	Regulator (Regional)	Regulatory Body (Regional)	-
Slovakia	Compulsory	50	Accredited Providers + Council	Regulator	-
Slovenia	Compulsory	15	Accredited Providers	Regulator	-
Spain	Voluntary	-	-	-	-
Sweden	Voluntary	~50 (10 days)	Accredited Providers	Professional Association	-
AUSTRALASIA					
Australia	Compulsory	40	Specialist societies	Societies or Regulator	Suspension from register
New Zealand	Compulsory	50	Regulator or Specialist boards	Specialist boards	Can suspend from register
NORTH AMERICA					
Canada	Compulsory	80	Specialist Colleges	Specialist Colleges	Possible removal of licence
Jamaica	Compulsory	10	Accredited Providers	Regulator	-
USA	Compulsory	12 - 50	Accredited Provs/Specialty Boards	Medical Association / Committee	Varies – fine, reprimand
AFRICA					
Kenya	Compulsory	5	Accredited Providers	-	-
South Africa	Compulsory	30	Universities, Specialist societies	Regulator	Removal from register
ASIA					
Japan	Voluntary	-	Medical Association	Medical Association	-
Malaysia	Voluntary	-	-	-	-
Pakistan	Voluntary	-	-	-	-
Singapore	Compulsory	25	Accredited Providers	Regulator	Removal of licence

Table 1: Worldwide Study into CPD for Medical Practitioners (GMC, 2011, page 13)

In South Africa, there is a legal requirement for medical practitioners to complete compulsory training in order to retain their medical licence. This is administered through the Health Professions Council of South Africa (HPCSA). The medical professions in South Africa that are required to maintain their competency levels through CPD include Dietetics, Emergency Care, Environmental Health, Medical, Dental, Occupational Therapy, Optometry and Dispensing Opticians, Physiotherapy, Podiatry, Bio-kinetics, Radiography, Clinical Technology, Speech Language and Hearing, Dental Therapy, Oral Hygiene and Psychology (HPCSA, 2014a).

The HPCSA (2014a) states the reasons for the introduction of a CPD requirement in the medical profession as the following: the knowledge, information and skills learned during the practitioners' formal education become obsolete at some point, and while there are continuous advancements in the medical field, this knowledge is not always easily communicated to the professionals. Finally, it protects the public by ensuring that the professionals are committed to lifelong learning, and that they keep abreast of changes in

their fields while ensuring they are improving their knowledge, skills and ethical attitude towards the public.

Statistics from the HPCSA for 2014 show that there were 221 508 registered professionals, of which 175 223 were qualified, 41 018 were students and 5 267 were interns (HPCSA, 2014b).

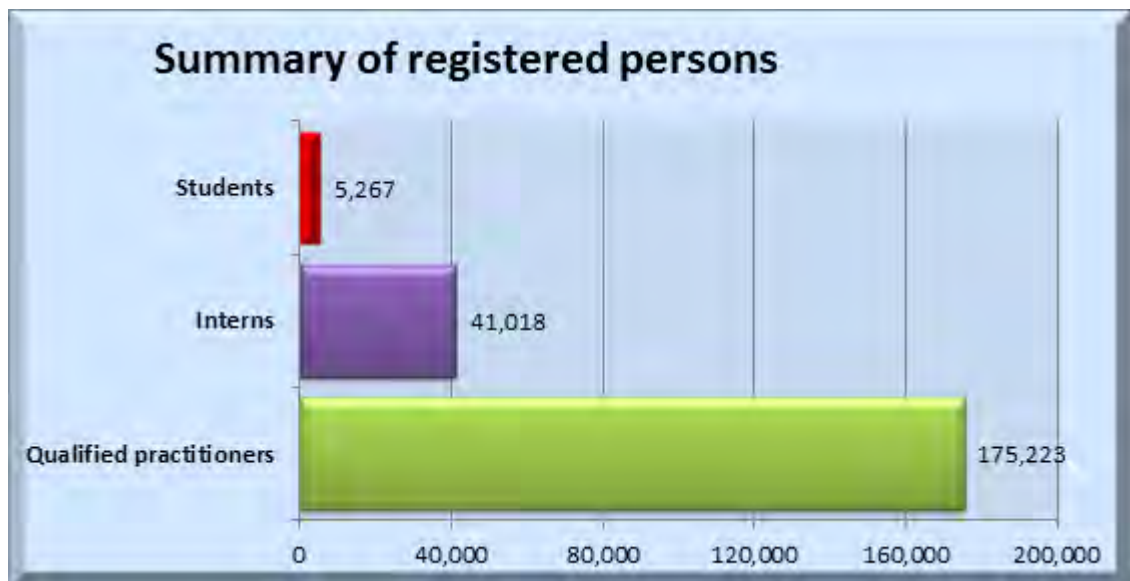


Figure 2: HPCSA registered professional 2014 (HPCSA, 2014b)

2.10.3 CPD in the Legal Profession

In the United States of America the history of Continued Legal Education (CLE) can be traced back to 1916 (Friday, 1975, 2012). Some states have a requirement that legal practitioners participate in continued learning, which is referred to as Continued Legal Education (CLE). Canada and the Philippines have similar requirements for their legal practitioners to perform CLE activities. Legal practitioners can obtain the needed credits by attending seminars, be it in person or online, workshops, and courses through accredited training institutes. In South Africa there is currently no compulsory requirement for legal practitioners to continually update their knowledge of changes in the law or rulings that result in case law. There are, however, initiatives that are being put into place by tertiary institutions that help to keep legal practitioners up to date with changes in their field, for example the Law @ Work Project being run at the University of Cape Town. With the use of digital evidence in court on the increase globally, it would be imperative that legal

practitioners be made aware of the added benefit that could be gained from digital evidence, to help prove or disprove an individual's involvement in crimes.

2.10.4 CPD in the Teaching Profession

Dadds (2014) states that continued development for teachers is imperative to a good national plan, and should be welcomed by society in general. After all, the right to education is seen as a basic right for everyone, and is stated in the South African Constitution (1996). In 2011, the South African Department of Education published their technical report for the strategy framework for the training of teachers from 2011 until 2025 (Department of Education and the Department of Higher Education and Training, 2011).

2.10.5 CPD in Engineering

The engineering profession in South Africa has a governing body that oversees the continuous learning in the form of CPD, the Engineering Council of South Africa (ECSA). It is not compulsory for engineers to belong to ECSA or to participate in any form of CPD to retain the right to practice the profession. ECSA (2013) explains that through the culture of CPD all registered professionals maintain their competency level throughout the period that they are registered with the body, to meet the requirements of the Engineering Profession Act (Act 46 of 2000), to be an acceptable means in order to renew the individual's registration, to meet the requirements with the ECSA assessment process in order to meet their international agreements, and to ensure that registered South African professionals maintain their international registration (ECSA, 2013).

2.10.6 Continued Professional Development, Certification, Accreditation and Administering Bodies in Forensics

Digital forensics as a profession is in its infancy when compared to the other forensic science fields, and as such it needs to make bigger advancements to be able to get up to the same standard as the other professions. Sommer (2011) shows that the use of expert testimony in the United Kingdom dates back to the 14th century (1345 AD). In 1985 a dedicated computer crime unit was formed in the UK, while tools to analyse computer forensic data also started to appear in the 1980s. Sommer (2011) adds that the laws governing computer crimes and digital forensic evidence are non-existent or need to be revised. There have been no successful attempts at the accreditation of forensic practitioners. Such attempts have essentially stalled. The main contributing factor to issues being experienced when looking at

other professions is a lack of clarity on the roles that the accrediting bodies play in the process. From the research done by Sommer (2011) the need for forensic practitioners (be that digital or otherwise) is evident, while accreditation is important when these professionals are used to present evidence in a court of law.

To date there are no known continuous professional development courses or strategies aimed at digital forensic practitioners. There are various certification paths for organizations and software vendors, many of which require maintenance every couple of years or when a new software version is made available. The certification by vendors indicates that the holder has demonstrated that they are proficient with the tools and procedures that need to be used when analysing evidence within the software. Vendor certification usually requires hands-on practising as well as a test to show competency (Barbara, 2008).

Boud and Hager (2012) investigated approaches by governing bodies to ensure that members retain their registration status. The research highlighted the views of Webster-Wright (2009) that the approaches of a crediting system to retain affiliation focus on the delivery of content, more than professional education. The research conducted by Boud and Hager (2012) also examined the reasoning behind this approach and to identify suitable alternatives. While looking at what is termed metaphors associated with continuous development, three main points were identified, namely participation, construction and becoming accredited. Furthermore, the research investigated the complexities that can arise from the approach that professionals take to continuous development. When studying how professionals learn, it was noted that learning is part of being in the work environment, as one needs to deal with issues as they would arise in the work place. Two ideas emerge when looking at learning in the work place, namely a practical approach, and how learning in the work place affects continued learning.

Barbara (2008) mentions one noteworthy body in the certification of digital forensic practitioners, namely the International Association for Computer Information Systems (IACIS). IACIS currently offers two certifications, namely Certified Forensic Computer Examiner (CFCE), and Certified Advanced Windows Forensic Examiner (CAWFE). The certification for CFCEs is completed in two phases, a peer-review phase, and a certification

phase. The peer-review phase applicants need to complete four problems and submit assessment documents or reports. This process is overseen by mentoring of a forensic professional. In the certification phase, the applicant needs to complete an independent practical exercise and a final written assignment. Each CFCE member is required to recertify every three years. The certification for the CAWFE requires members to hold a CFCE certificate already, in addition to two additional processes: firstly, candidates need to complete a written examination, and secondly, complete a practical assessment, which requires analysis of a series of image files and windows artefacts and answering related questions (IACIS, 2015).

In the Netherlands in 2009, the Register of Court Experts in Criminal Cases Decree was signed into effect. The act was aimed at ensuring that forensic experts who testified in criminal court cases were of a high standard and in so doing ensuring quality reports. In 2010, the Netherlands Register of Court Experts (NRGD) was established by law to maintain the list of registered forensic experts. At present, there are ten areas of expertise, with 700 experts already having been assessed, 20 percent of which were denied registration. The expertise area that would cover digital or computer forensics is still under discussion. The assessment for registration is completed by an Assessment Advisory Committee (AAC) that consists of three members, two of which are industry experts and one is a criminal lawyer. The applicant's application is done by the AAC assessing the four to six case reports compiled by the applicant, in addition to other information including the applicants' curriculum vitae (Smithuis, 2014).

As discussed in an earlier section in the literature review, the NCFE is looking at the accreditation of FSSPs to assess their capacity to generate and interpret results. There are areas of an institute's accreditation that would have an effect on the staff's continued education (NCFE, 2015).

2.11 Knowledge Sharing Management

As there are no formal systems in place where advances or experiences in digital forensics can be captured and shared, it is necessary to identify what kinds of resources could potentially be used to address issues currently being experienced in forensics and digital

forensics; more specifically, it is important to look at knowledge sharing management (KSM).

Knowledge sharing itself is also under constant research. Paulin and Suneson (2012) identify three kinds of knowledge management (KM), namely knowledge sharing (KS), knowledge transfer (KT), and knowledge barriers (KB). The research conducted was an attempt to remove the ambiguity of the terms, which had resulted from the way these concepts had been termed in literature over a decade. The authors concluded that the terms have broader or blurred meaning and need to be seen in the context of the research being conducted. Noe and Wang (2010) state that the biggest barrier to knowledge sharing would be between cultures, as there is a lack of recognition and reward. An interesting study, as part of research in the field of CPD in forensics, is the study performed by Julian, Kelty and Alastair (2012), where the objective was to examine the pitfalls that currently exist for the sharing of knowledge between the medical, forensic science and legal fields and how one could gain value in the various fields of knowledge being shared. The outcomes from the research identified five elements that need to exist for effective inter-agency knowledge sharing, namely motivation of skilled practitioners as group leaders, support from the organization, added value to participating organizations, joint venture for the group, and lastly how information and decisions are made in the group as a whole.

The research conducted by Julian *et al.* (2012) highlighted numerous pitfalls that would hinder the sharing of knowledge between the different agencies and disciplines, most notably, the errors in decision-making. This is contributed to by how the participants think as a group, social conformity, and how the evidence is seen by individuals in context, i.e. context bias and tunnel vision.

2.12 Use of ICT Solutions for CPD

The use of ICT as part of professional development is contentious. Furthermore, the use of ICT to replace or to complement classroom training is currently a matter of contention with some academics. The main question is whether an ICT solution through e-learning or m-learning is the answer to continued professional development for professions that require higher learning.

To evaluate the research into the use of computers as a tool for learning one would need to go back to the 1970s where this was initially thought of. At the turn of this century, there was also research into how mobile learning could be achieved as a way for people to learn on the move, which is commonly referred to as m-learning. In a technological age where social media is dominating how one interacts on a daily basis, one would expect to look at how ICT could aid, and ultimately complement, classroom education. The approach of learning on the move has been studied further by Gu, Gu and Laffey (2011) in research aimed at the citizens of Shanghai to aid them with lifelong learning while they were on the move.

As identified in the research performed by Biedermann, Hicks, Voisard, Taroni, Champod *et al.* (2012), caution should be exercised when implementing e-learning; the information being made available should not be limited purely to on-line content, but rather involve practical application in the field of forensics.

Biedermann *et al.* (2012) have already conducted research in the area of e-learning initiatives in the field of forensics in terms of what currently is available, and what can be expected in the future. In the field of forensics, it is expected that the quality and integrity of the work be of the highest level, as the majority of the evidence needs to stand up to scrutiny when placed under a microscope as it is presented in a court of law.

Currently the perception is that practitioners in the forensic and digital forensic field would learn by on-the-job training, as there are few recognised and formal systems where they could learn the correct practices in evaluating and interpreting the evidence as a science. The practitioners learn their trade through a kind of trial and error approach, or through in-house training, or as part of self-study.

2.13 Blended Learning for CPD

Leask and Younie (2012) conducted research into national models for CPD and how these models play a pivotal role in whether or not education is a success, based on the argument that in the twenty-first century digital technologies should be used to aid educational practices.

The use of computers is often referred to as e-learning; the use of e-learning combined with classroom lectures is considered blended learning (Glogowska, Lockyer, Moule & Young, 2011; Casey, Cooney, Houghton & Smyth, 2012). The benefit of the blended learning approach is that the content can be accessed from any location and at any time, which aids students to maintain a work-life balance. The initial argument was that the introduction of e-learning would lower the cost of education. The opposite of this is true, and maintaining and updating the material would more likely increase the costs associated with learning, from the institution's perspective.

Research has been done in recent years looking at how students perceive blended learning in the nursing and the medical professions (Glogowska *et al.*, 2011; Casey *et al.*, 2012). From the research, two themes emerged: firstly, what are the benefits of blended learning, and secondly, what are the challenges? Classroom education at a postgraduate level will always have its place, but there should be continued research with regard to e-learning to complement the formal training in other disciplines.

2.14 Summary of Section

When one considers the history of forensic science, it can be seen that as a science it is continuously evolving. The field of forensics has exploded over the past two centuries, where advancements have been made from fingerprinting techniques to the advancements in the analysis of DNA. Similarly, digital forensics is trying to catch up with the advances made in technology through formal education and training courses. It is no longer enough to be given all the information at an educational level, as the advancements in technology create an ever-changing technological landscape. A practitioner's knowledge would need to adapt to the challenges that are created, and that will assist in the investigation of crimes being committed through the exploitation of deficiencies in new technology. As can be seen from current international initiatives in the EU and USA, which aim to ensure that the quality of the analysis of evidence and reporting on the evidence that is to be delivered in a court of law is of a higher standard, the accreditations for institutions also include areas that require continued education of staff. The literature survey investigated how other disciplines have approached continued learning. The medical field is most notably the forerunner in this

respect worldwide, as it is very important for medical staff to be kept up to date with changes in their field. The literature has also shown that currently there is a focus on the forensic science not only on digital/computer forensics, but on all disciplines in the forensic science field. In the Netherlands, the NRGD have already established a national database of registered court experts who have been through the accreditation process that is administered through peer-review. Not all forensic disciplines have been added and they are still in the process of finalizing categorising certain fields and accreditation processes. Similarly, the NCFS in the United States of America are also looking at an overseeing body for the accreditation of FSSPs. Part of this accreditation process examines how staff at the FSSPs are trained and the individuals' involvement with continued learning activities.

3 Research Objective and Research Question

The primary objective of this study was to determine how digital forensic practitioners and students who have completed their studies at postgraduate, masters, or doctorate level in computer forensics currently keep up to date with changes in technology such as software, hardware and social media trends, in addition to changes in the law, or case law with regard to digital evidence. This was coupled with investigation of literature about how other professions currently approach continued learning strategies.

Understanding how continued learning approaches are being used in other professions will help to understand the shortcomings in said fields. From the collection of the data through the structured online questionnaire, a framework would be identified that could be used for continued learning for digital forensic practitioners.

The research question is: “How do digital forensic practitioners currently do continued learning to keep up to date with changes in this field?”

3.1 Research Methodology

Development of the questionnaire used as the first research instrument to collect the data from the participants relied on the information drawn from valuable research that has already been done with regard to CPD in other professions. From research conducted in other fields, it was noted that individuals’ approach to continued education also varied, based on age, gender, and whether or not they had higher education degrees and/or diplomas.

The research methodology section is broken down into the following sub-sections and will be discussed in greater detail.

3.2 Philosophy

The research adopted a positivistic philosophy. As explained by Bhattacharjee (2012), positivism requires that the creation of science and/or knowledge creation should be restricted to what can be observed and measured. It also tends to rely on theories that can be directly tested.

3.3 Purpose

The purpose of this study was exploratory. Exploratory research is conducted in new areas of research, as there has never been any research into continued learning approaches in digital forensics and compiling a framework to address any shortfalls, or to align with best practice principles (Bhattacharjee, 2012).

3.4 Approach

The approach that this research took was both inductive and deductive. Inductive research is the developing of theory, whereas deductive research is the testing of theory (Saunders, Lewis & Thornhill, 2009).

3.5 Time frame

The time frame used for this research was cross-sectional. As Saunders *et al.* (2009) point out, cross-sectional research is the study of a particular phenomenon at a particular point in time.

3.6 Research Strategy and Instruments

The research strategy consisted of a structured online survey conducted with the participation of digital forensic practitioners to determine current trends in the field with regard to continued learning.

The research instrument that was employed to undertake this study was quantitative through the means of an online surveys. The structured questionnaire that was used as the first research instrument to collect the data for the initial survey was based on research conducted by the General Medical Council (GMC) in the United Kingdom into the effectiveness of continued professional development, looking into personal approaches to CPD as well as their effectiveness (GMC, 2010).

3.7 Method

As has been discussed in earlier sections of this paper, there has been little or no research conducted into continued education in the discipline of digital forensics. As such, one needs

to look at a framework that would allow meaningful research to be conducted in this area. A model or technique that would prove to be useful in this area would be the Delphi model. Saunders *et al.* (2009) state that the Delphi technique is useful for researchers to refine their ideas by involving a group of people who either are involved, or have a particular interest in the topic being researched. The benefit of this approach was to gain the insight of experts in the field of digital forensics, in addition to what had been obtained from literature. Once data had been collected from the first survey, the experts could then evaluate the results and proposed solution for viability.

Okoli and Pawlowski (2004) wrote a research paper on how to approach research using the Delphi technique in order to ensure that the correct process is used to select the correct experts in addition to aiding the design process to ensure a successful study. The Delphi model can also be useful in the building of theory, firstly through ranking that can be of great value during the initial stages of the development of the research; secondly, as experts are being used the knowledge of the topic will aid in building grounded theory for the research; thirdly, it can be used to understand the experts' reasoning; and lastly, the method can be used to construct validity. In so doing, the Delphi technique can be used to contribute directly and, more importantly, immediately to theory and in practice.

3.8 Data Collection

Data was collected by means of structured surveys, which were drawn up by analysing literature and other research done in other professions with specific bearing on continued professional development. The data collected during the first online survey, referred to in this document as the first research instrument, was analysed and then put to a group of digital forensic experts through an additional online survey, referred to as the second research instrument, in order to test the findings and conclusions that were made from the analysis of the quantitative study.

3.9 Target Participants and Sampling

The population target for this research project was to approach digital forensic practitioners for participation. The sample consisted of students who have completed their studies at postgraduate, masters, or doctorate level in computer forensics, as well as current practising

digital forensic practitioners. Participants were also asked to distribute to contacts in the industry that would be able to contribute to the research topic. The researcher presented a lightning talk at the 2015 European Digital Forensic Research Workshop (DFRWS), in addition to participating in an interview with Forensic Focus (an online digital forensic portal for computer forensic and eDiscovery professionals) to explain the type of research being conducted and request participation from practitioners who read articles and contribute to content on Forensic Focus.

3.10 Data Analysis, Reliability, Validity and Output

Saunders *et al.* (2009) define quantitative analysis as taking the raw data, which has little meaning to most people, and to process the data into information.

The data that was collected was initially analysed as quantitative, and the conclusions from the findings would be compiled as a framework for continued learning for digital practitioners. The conclusions from the quantitative data collection from the first research instrument were then subjected to an additional quantitative analysis by means of a follow-up survey with experts in the field of digital forensics.

Conducting research of this nature should be considered as both reliable and valid. Reliability as defined by Saunders *et al.* (2009) is the extent to which the data collection techniques would yield consistent findings or observations if the research were to be conducted by other researchers, or if the raw data would result in the same conclusion if it were analysed by other researchers. Saunders *et al.* (2009) define validity as the extent to which the data collection methods accurately measure what the research intended it to measure.

By subjecting the findings from the quantitative research to review by experts in the field of digital forensics, both the validity and the reliability of the research conducted were scrutinized, resulting in a useful framework that can be utilized by digital forensic practitioners.

3.11 Research Approach Summary

Research Methodology Topic	Selection
Philosophy	Positivism (Creation of Knowledge)
Purpose	Exploratory (Conducting research into new area)
Approach	Inductive, and Deductive (Inductive, creating theory: Deductive, testing theory)
Time Frame	Cross-Sectional (Conducting research at a specific point in time)
Research Strategy	Structured Questionnaires: first survey to collect data, and second survey to test the findings obtained from first survey
Method	Delphi Method
Target Participants	UCT Students who have completed their studies at postgraduate, masters, or doctoral level in Computer Forensics, and Digital Forensic Practitioners
Sample Size	30 + Participants (Practitioners) 10 Participants (Experts to test findings)
Research Instruments	Online Survey (Quantitative), Delphi Review survey (Quantitative)

Table 2: Research Approach Summary

3.12 Ethical Issues

When conducting research of this nature, it is important to consider any ethical implications. Participation in the online survey was purely voluntary and all data collected was done anonymously. No interviews were conducted without consent from an informed participant. The data was to be collected from various digital forensic practitioners, and hence some of the information could be seen as sensitive. With this in mind, all data was treated with the strictest confidentiality to protect the identity of the respondents and the companies that they represent (Bhattacharjee, 2012).

The research proposal was submitted to the University of Cape Town Research Ethics Committee for approval. Only once permission had been granted did the researcher proceed

with the research, and could then approach participants to see if they were willing to participate. Participation in the online surveys was done completely voluntarily, harmlessly and only with consent (Bhattacharjee, 2012).

4 Data Analysis

The data was collected through an anonymous online survey on Qualtrics. The survey had 40 responses, four of which were incomplete, and these were removed prior to beginning the analysis in order to present accurate data. The analysis was undertaken using only *valid* responses ($n = 36$). The survey can be broken down into four separate sections, namely background, current continued learning involvement, approaches and barriers to continued learning, and continued learning opinions. This section will provide a summary of the findings followed by an in-depth analysis. The survey instrument, which contains the question logic, is available in Appendix A. The initial report of the data supplied by Qualtrics is available in Appendix B.

Where direct references have been made to the survey instrument, the question has been represented as a “*Q*” followed by the number of the related question, for example, “*Q1*” is related to the question of “*Gender*”. In some instances, the question number and question text have been included, for example “*Q1, Gender*”. Wherever possible the figures in this section represent both the number of responses for each selection with the percentage of total responses, and example of this taken from Figure 3 where the number of male participants are indicated on the bar-graph with “*32(89%)*”, where “*32*” is the number of responses, and “*89%*” is the percentage of the total number of responses for the specific Question.

4.1 Background of Population

4.1.1 Demographics

Of the thirty-six responses, eighty-nine percent (32) of the valid responses ($n = 36$, $SD = 0.32$) were from male respondents (*Q1, Gender*). Figure 3 shows a graphical representation of gender.

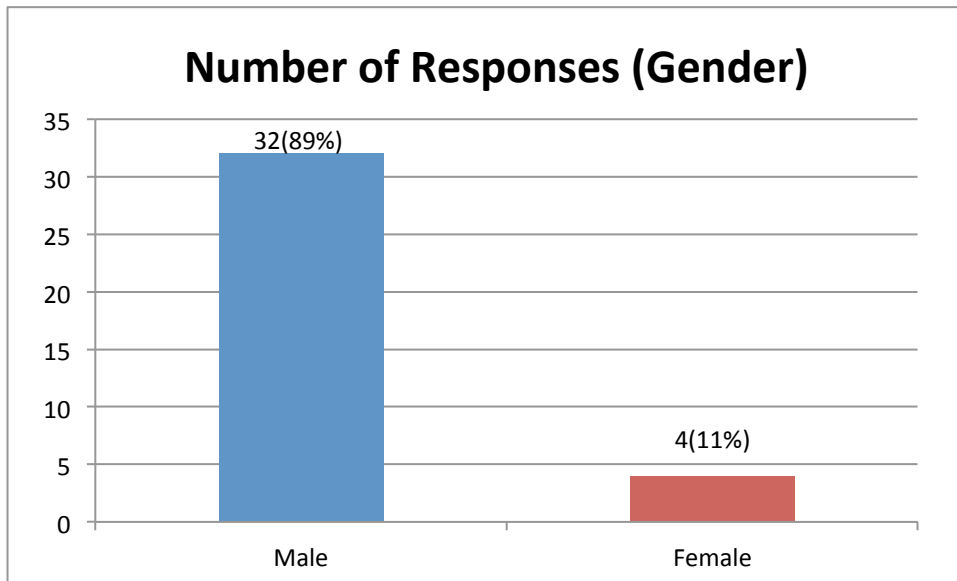


Figure 3: Respondents by Gender (Q1, Gender)

The majority (64%) of the responses ($n = 23$, $SD = 0.49$) were internationally based (Figure 4); the international respondents were from a variety of countries, which can be seen in Table 3 (Q2, Geographic Location).

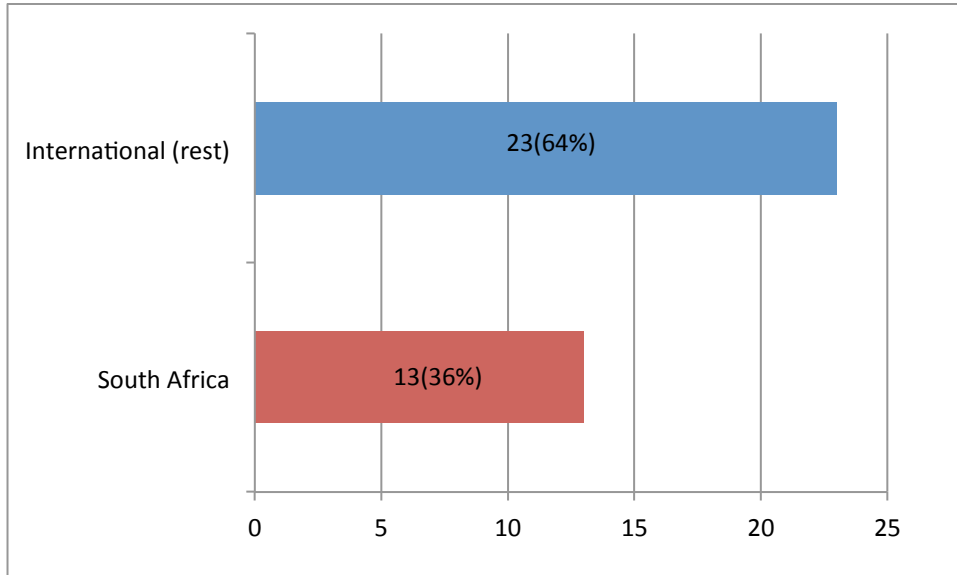


Figure 4: Geographic Location of Respondents (Q2, Geographic Location)

The majority of the respondents ($n = 36$) ranged in age between 30 and 59 years old ($n = 31$, $SD = 1.05$); the spread across the age groups (30-59 years old) was fairly even: those aged between 30-39 years of age (33%), aged 40-49 years (28%) and those 50-59 years of age

(25%). One respondent was over the age of 60, while the remaining four (11%) were aged between 20 and 39 years old (Figure 5).

Country	Number of Responses
Australia	1
Canada	2
United States of America	2
Europe	14
Caribbean	1
Namibia	1
Asia	1
India	1
Total Number of Respondents	23

Table 3: Breakdown of International Respondents (Q2, Geographic Location)

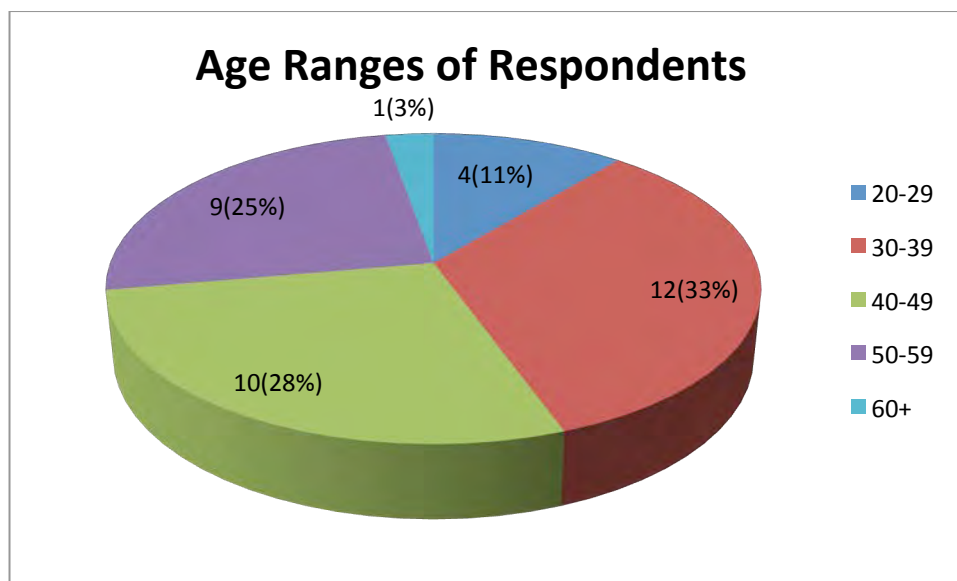


Figure 5: Age Groups of Respondents (Q3, Age Group)

4.1.2 Work Experience

There were equal numbers ($n = 18$, $SD = 0.51$) of respondents who currently work as digital or computer forensic examiners (Q4, *Currently working as Digital/Computer Forensic Practitioner*). The remaining respondents ($n = 18$) were split between being employed in other industries (10), and the further eight (8) were currently employed in academia, research and development or were currently unemployed (Figure 6).

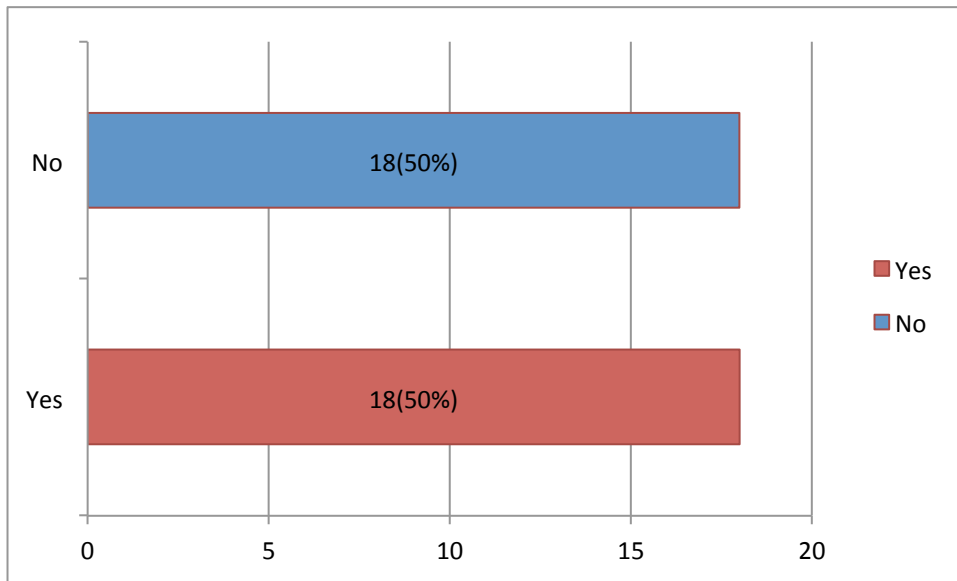


Figure 6: Currently Practising as a Digital/Computer Forensic Examiner Responses

For the respondents ($n = 18$, $SD = 0.81$) who were currently practising digital/computer forensic examiners (*Q4, Years in Industry*), the majority (44%) had been in the industry for longer than ten years, with 22 percent between one and five years and the rest (33%) between five and ten years' experience in the industry. Figure 7 shows a graphical representation of the years in the industry for current practising examiners.

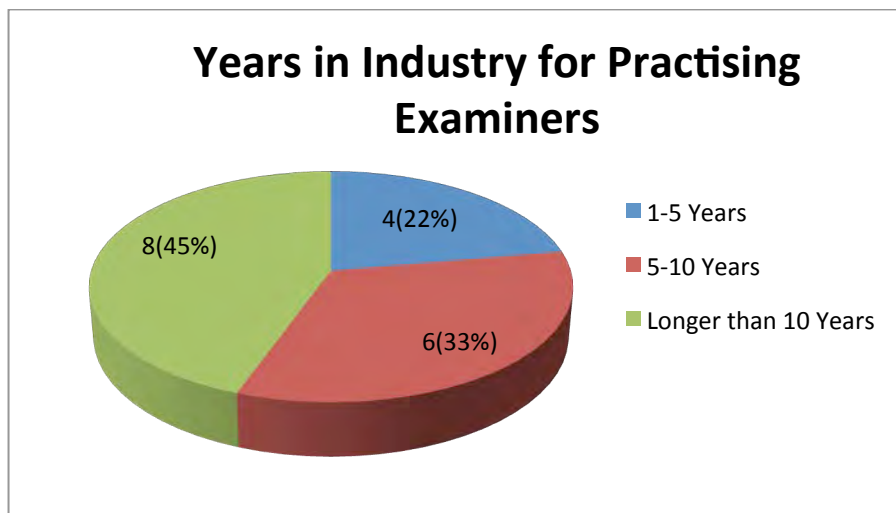


Figure 7: Years in Industry for Practising Examiners

4.1.3 Education

Seventy-two percent ($n = 26$, $SD = 0.45$) of the respondents had received formal or tertiary education specifically in the digital/computer forensic discipline (Figure 8).

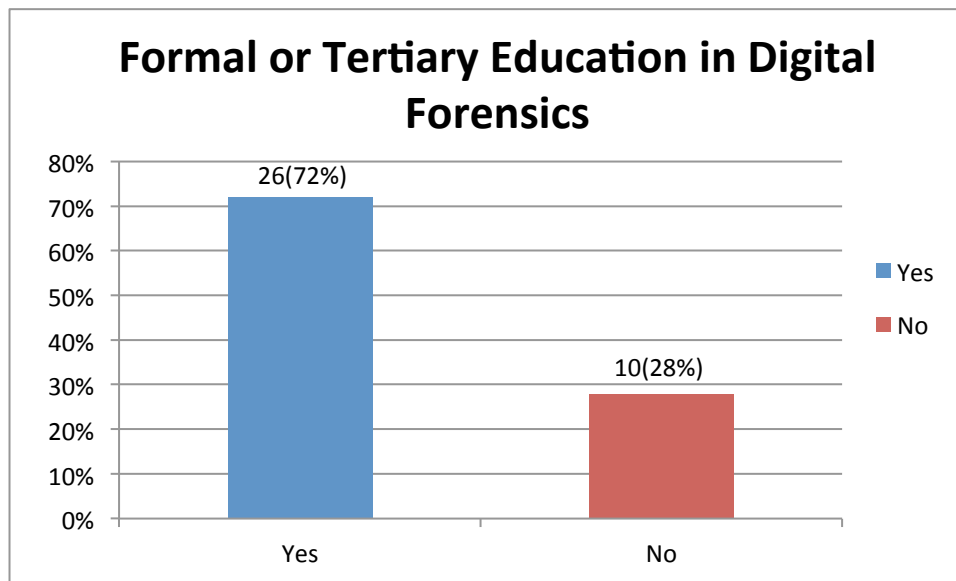


Figure 8: Responses with Formal or Tertiary Education in Digital Forensics

The majority (21) had received the tertiary education at a university, thirty-eight percent (10) had received vendor-specific training, and the remaining respondents had received training from a Technical University (3), usually referred to in South Africa as either a Technikon, or a University of Technology, or from other specialist institutions (4). The different weightings can be seen in Figure 9. Examples given of additional training received were from the Federal Bureau of Investigation (FBI), International Association for Computer Information Systems (IACIS), SysAdmin, Audit, Networking, and Security (SANS) Institute, and Canadian Police College. It is important to note that some of the respondents have received training from more than one higher learning institute, which is why the question was structured to allow more than one selection to identify possible sources for education with specific bearing on digital or computer forensic examinations (*Q8, Institutions where Higher Education was received*).

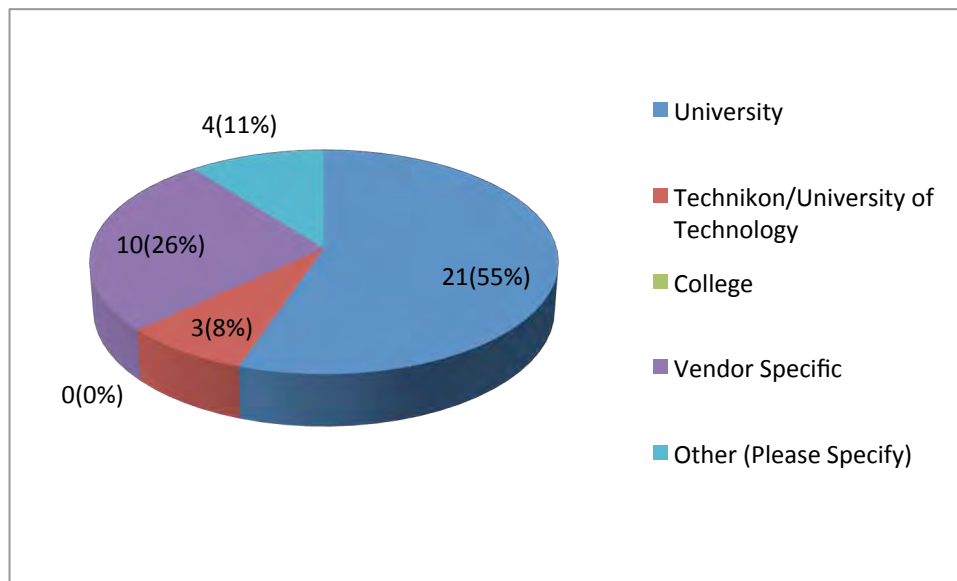


Figure 9: Institutions where Education was received

4.2 Continued Learning Involvement Section

It was noted when the analysis was being done that there was a grammatical error on Continued Education Involvement (*Q9_6*), which was corrected for analysis and presentation. In the original survey, it was shown that 5th-year involvement in continued learning was shown as 48-50 months (only 2 months), and not 48-60 months (for the entire year). From the survey, data (*Q9, CPD activities in the past 5 years since completing studies*) was obtained from thirty-one respondents ($n = 31$, $SD = 1.48$) with respect to CPD activities in the last five years. The majority (94%) had completed some form of CPD Learning in the past five years, while the remaining respondents (2) had not done any CPD learning activities in the past five years. Most respondents (19) had completed CPD in the last 12 months, while the other respondents' activity was more evenly spread over the years above 12 months. The data obtained can be seen in Figure 10.

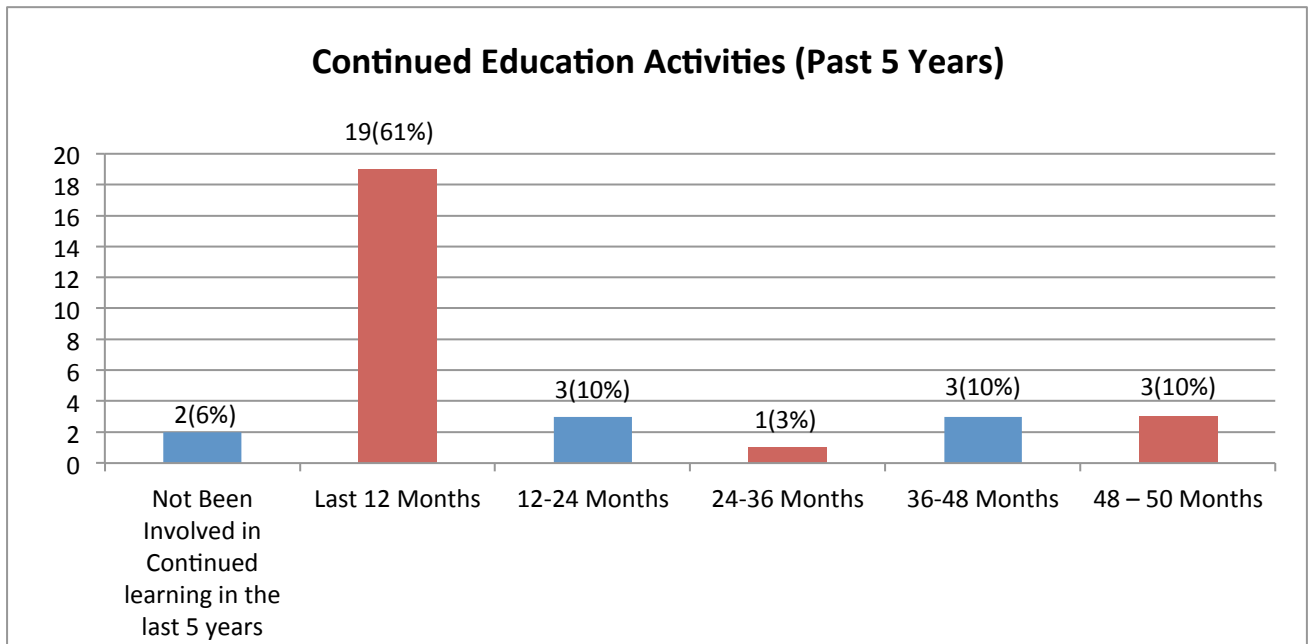


Figure 10: Involvement in Continued Learning Activities in the Past five Years

As part of the research to fully understand how the respondents ($n = 31$) currently approach maintaining their level of competency with regard to CPD, the research instrument (*Q10, Applicable methods used for Continued Learning Activities*) probed the current methods used. This can be seen in Table 4. Additional methods pointed out by the participants (2) were security related but not forensics, and Facebook forensic groups.

Method	Response	%
Reading journals/articles	26	84%
Web-based subject content (such as Web Blogs or User Forums)	25	81%
Conference attendance	21	68%
Teaching (Classroom)	21	68%
Conducting Research	19	61%
Reading Research conducted in Forensic Field	18	58%
Reading books published in Forensics	17	55%
Vendor training or Vendor Documentation	13	42%
In-house Training	13	42%
On-line Modules (Virtual Classroom)	11	35%
Court Proceedings (e.g. Case Law)	7	23%
On-line conferences	5	16%
CD ROM/DVD learning	4	13%
Other	2	6%

Table 4: Applicable Methods Used for Continued Learning

It is important to understand why respondents ($n = 31$) engaged in CPD activities (*Q11, Driving Force behind completing CPD activities*). The complete graphical representation can be seen in Figure 11. The top four responses (above 50%), were because of changes in technology (74%), career progression (65%), changes in tools used for analysis (58%), and to address a skills gap (58%). The respondents (5) also listed the following as driving forces: understanding possible threats, professional or Certified Information Systems Security Professional (CISSP) requirement, and for enjoyment gained from studying.

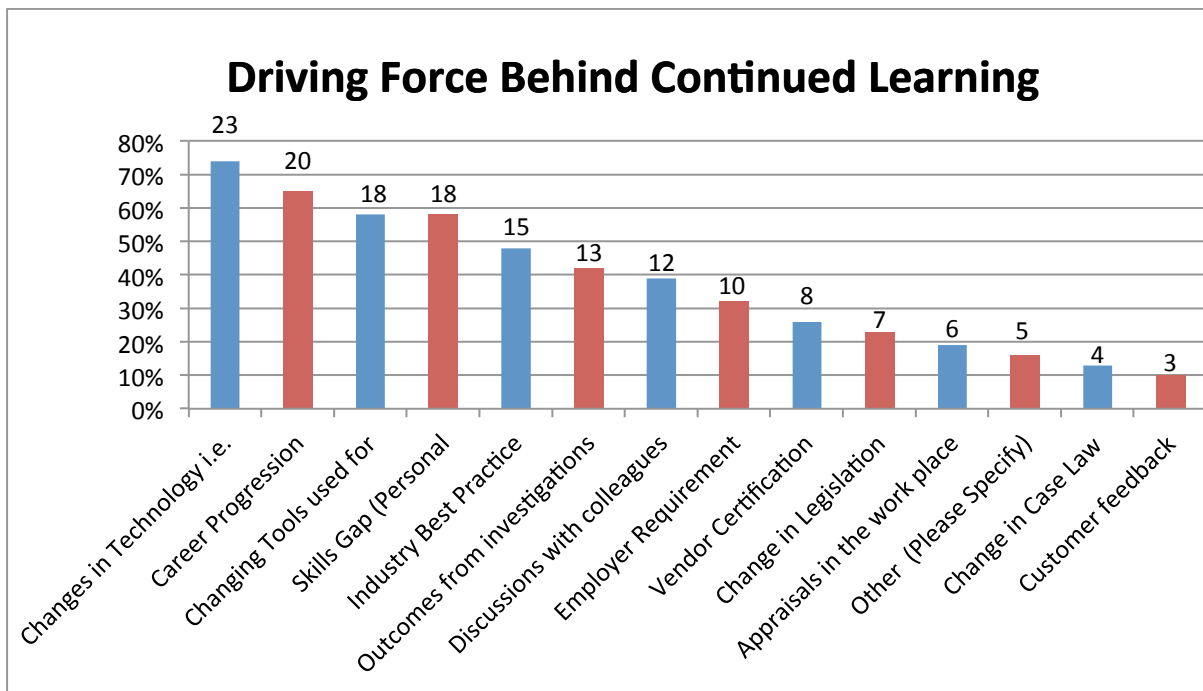


Figure 11: Driving Force behind CPD

4.3 Approaches and Barriers to Continued Learning and Individual Approach

While understanding how respondents currently approach CPD activities, it was important to include questions to understand what barriers existed, if any, in addition to understanding what they believed would be the best approaches that should be used to deliver information when completing continued learning (*Q12, Opinion of method that could aid with CPD in Digital/Computer Forensics field*). The data presented here is based on the respondents ($n = 29$) that completed this section of the survey instrument. The best methods, based on the responses, are shown in Figure 12. Additional methods not covered on the list but mentioned by respondents (2) were to gain knowledge in the form of on the job training, and shadowing professionals currently performing forensic investigations.

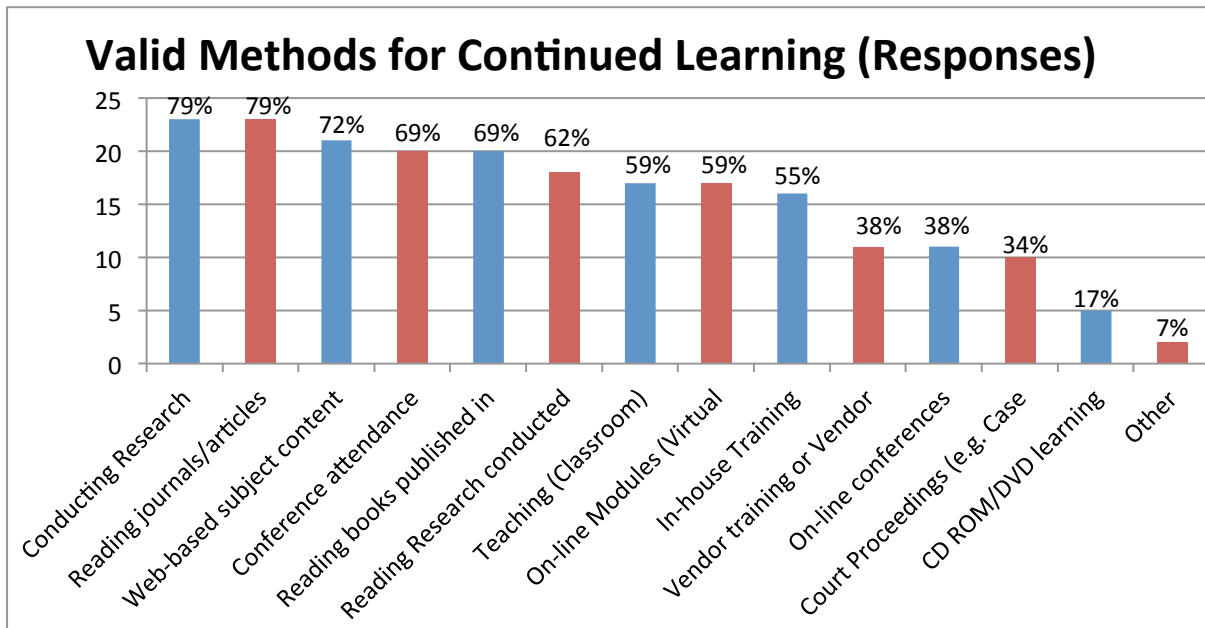


Figure 12: Valid Methods to Deliver Content

Understanding what approaches would work best for respondents is important, as it would help to understand better the approaches that should be looked at when introducing continued learning activities to digital/computer forensic practitioners (*Q13, Approaches to learning that works best*). The most responses listed work experience (79%), speaking with other professionals in the field (76%), and reading (66%) as the best approach to keeping up to date with changes in the industry. The other approaches were spread across the other options, as can be seen in Figure 13, with one respondent stating that performing their own research was also an effective way of implementing changes in the industry.

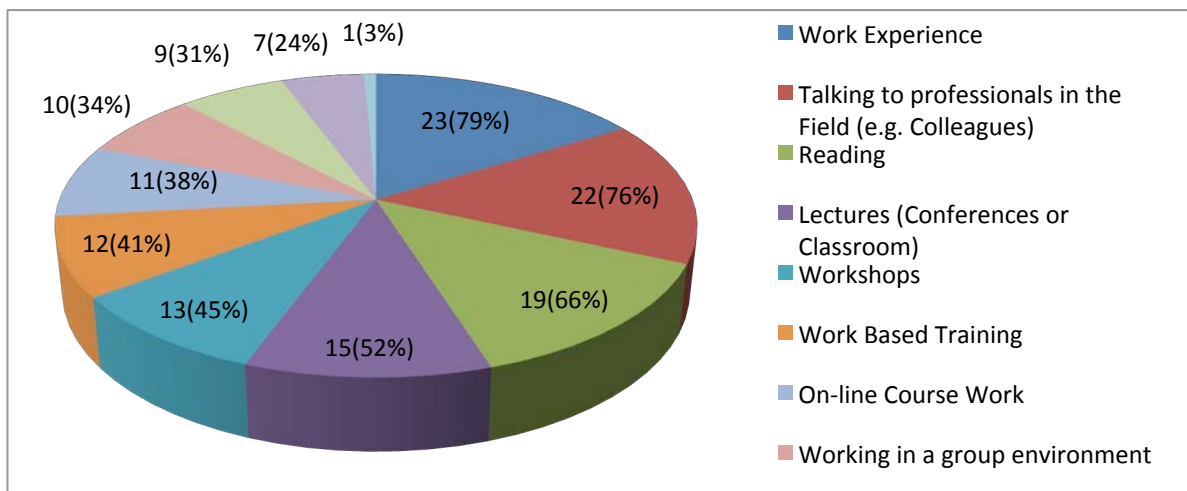


Figure 13: Approaches Employed Currently for Continued Learning

Keeping up to date with latest developments in the industry can be time consuming and high workloads are the greatest barrier, based on the responses ($n = 19$), followed by the cost of available learning initiatives (14), and time off (11) to participate in CPD activities. Numbers of barriers that exist are shown in Figure 14.

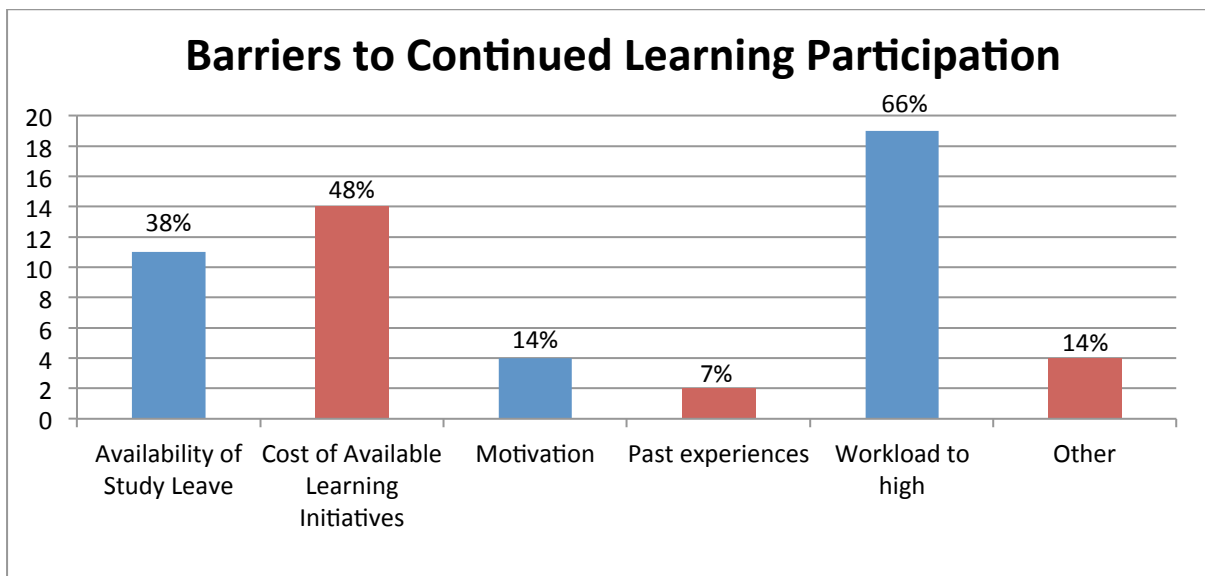


Figure 14: Current Barriers affecting Continued Learning Activities

As part of the data collection, the research needed to look at what contributes most to continued learning in digital/computer forensics (Figure 15). The two greatest contributors were by means of reading (52%), and by engaging with colleagues in the industry (45%). University and industry conferences contributed thirty-eight percent (11) to continued learning, other (2) contributors listed by participants of the survey were professional training events and conducting research on their own.

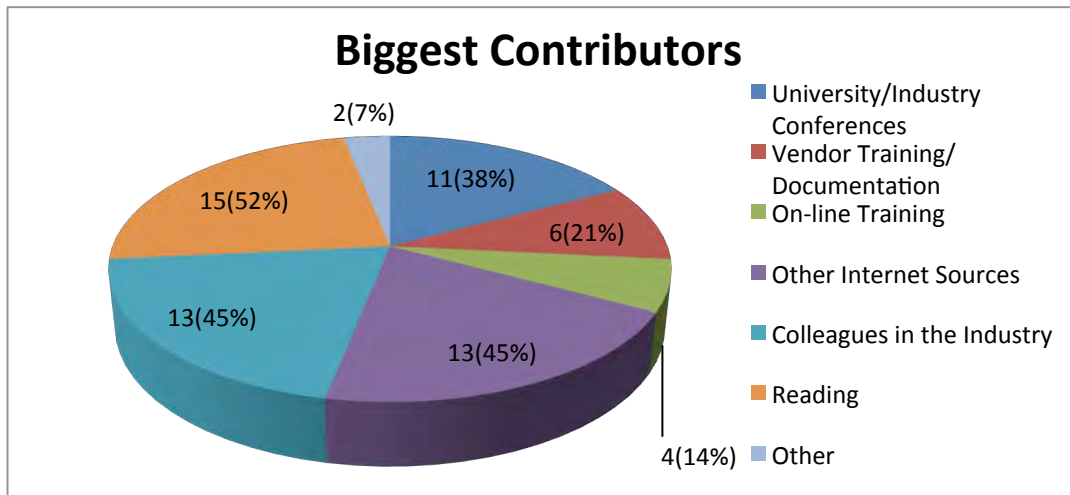


Figure 15: Biggest Contributors at Present to Continued Learning

4.4 Continued Learning Opinions

The research question was to examine how digital forensic practitioners currently perform continued learning activities. This section looks at the respondents' opinions on whether or not there should be a governing body; if so, what should the re-evaluation period be, and who should be responsible for content and quality of CPD training? The majority of the respondents ($n = 21$, $SD = 0.45$) stated that a governing body should exist to oversee CPD learning (Figure 16).

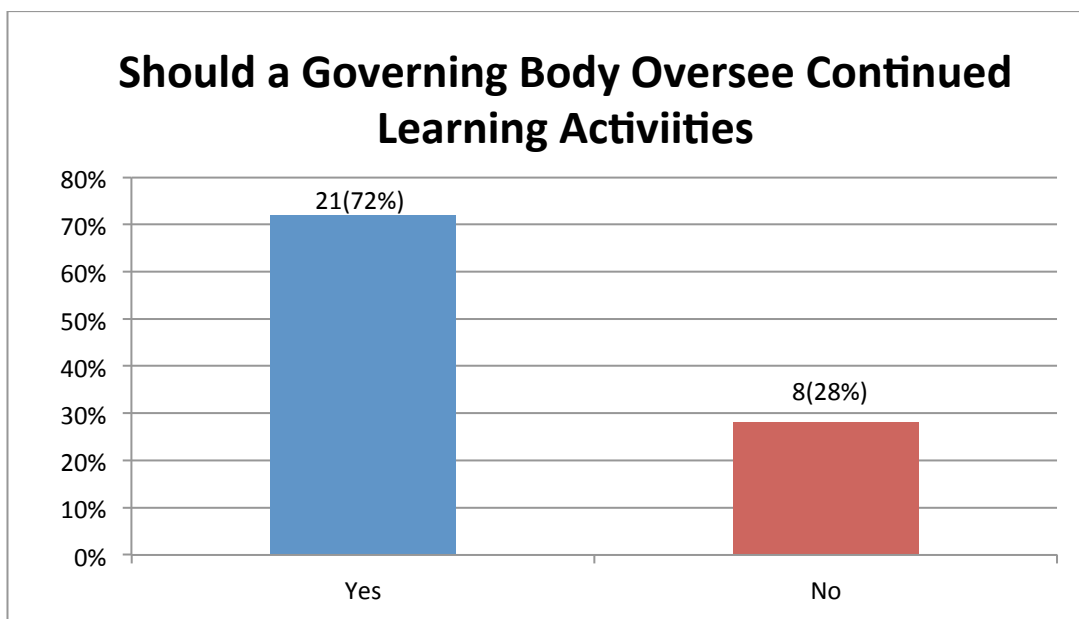


Figure 16: Should a Governing Body Exist for Digital/Computer Forensic Continued Learning Activities?

To maintain the professional level of competency as it has been seen in other professions, it is important to re-evaluate through continued learning initiatives. Of the respondents ($n = 21$, $SD = 0.93$), the majority (9) stated that the period of review should be every five years, followed (6) by a review period of two years, then (4) opting for an annual review and lastly the remaining respondents (2) at three years (Figure 17).

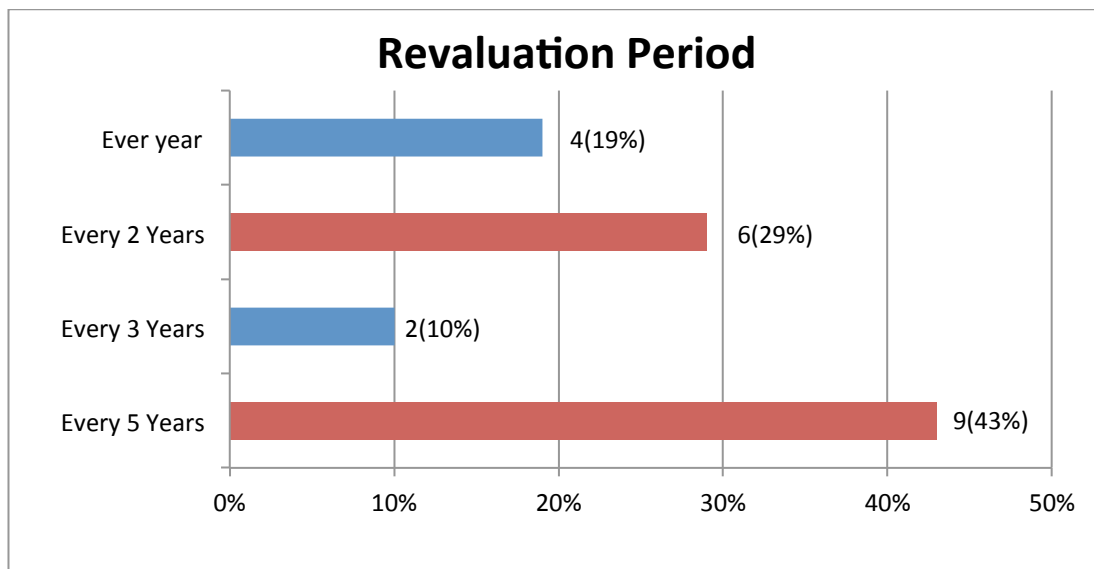


Figure 17: Re-evaluation Period

When looking at continued learning, it is important to pay great attention to quality as well as content that is presented. Firstly, which institutions should be responsible for ensuring that a high level of quality is maintained? The majority listed tertiary institutions (17), followed by specialist institutions (16). Other responses (6) listed that certification bodies, forensic associations and peer-review performed by academics should be responsible for the quality of practitioners (Figure 18).

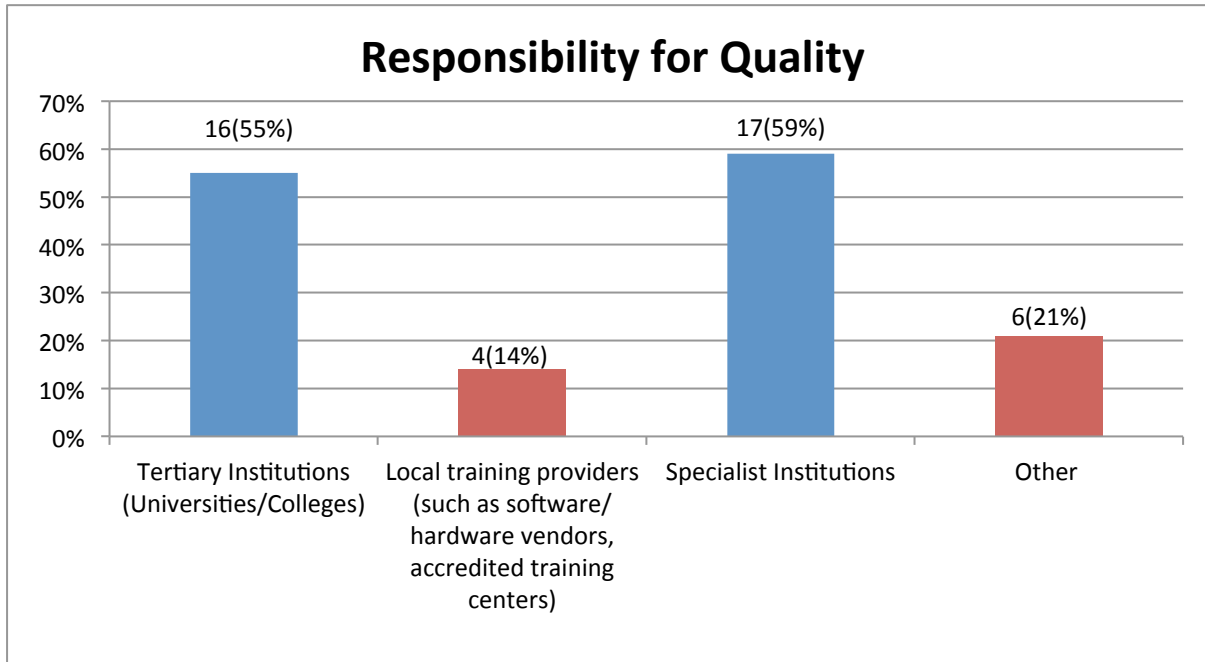


Figure 18: Responsibility for Quality

As mentioned, another important facet is looking at which institutions should be responsible for the content of curriculum. The majority of the respondents (17) indicated that Governing Bodies, followed by Tertiary Institutions (14), and Government (11) should be responsible for the content that needs to be delivered during CPD activities. Additional responses stated the following for being responsible: peer-review performed by academics and industry practitioners, and whoever is paying to maintain the level of competency (Figure 19).

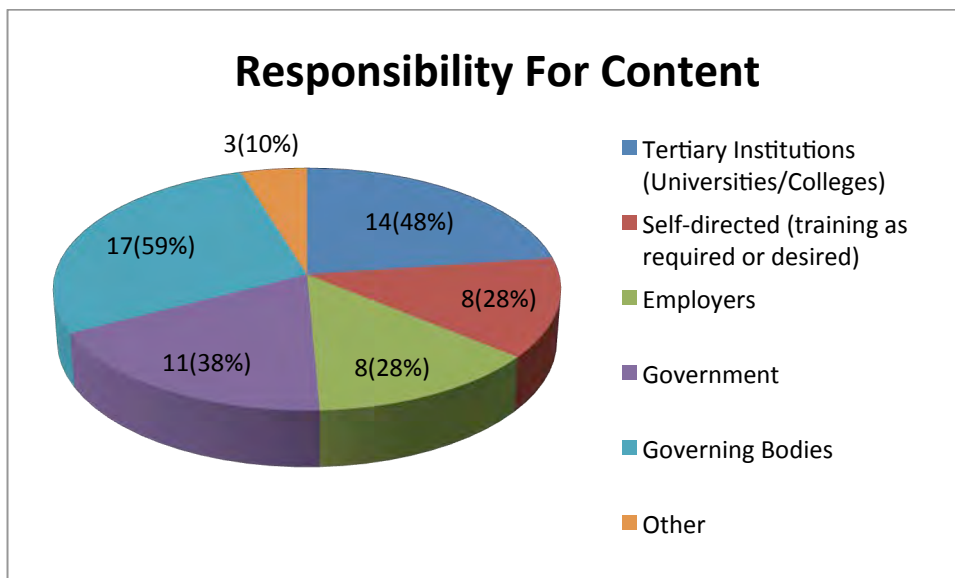


Figure 19: Responsibility for Content

5. Discussion

This section will discuss the analysis of the data. Performing the cross-tabulation analysis was done using Statistica version 12. As was stated in the previous section, when reference is made to a question from the research instrument it will be referred to as Q followed by a number, for example “*Question 1: Gender*” would be denoted as “*Q1*”.

5.1 Testing whether or not Age, or Location, or Gender play any role in obtaining Formal Education, or Continued Learning Activities

From the literature survey that was done concerning research on CPD in other professions, it was noted that approaches to continued education differed in terms of age, gender, or geographic region. As no research has been conducted in this profession, it was necessary to see if the same was true for digital forensic practitioners’ approach to CPD. The data was analysed to verify whether age or geographic location played any role in continued education involvement. As part of the analysis, the research also looked at whether or not gender played a role in continued education approaches or involvement. It should just be noted that a small number (4) of females completed the survey. Due to the low female representation among the number of respondents, no conclusions can be drawn from the data to either confirm or disprove involvement or approach in continued learning based purely on the gender of participants. It is possible that a larger sample size would yield results as to whether or not there was any relation to the significance of gender role in continued education. To do this type of analysis, a chi-square test was performed. Cross-tabulation analysis were performed to test the frequency if there was a significant relationship in the case of test gender, and whether geographic location had any significance on tertiary education approaches, or current involvement with continued learning activities. It is also possible to use analysis of variance (ANOVA) to perform a correlation. It was found that due to the low number of responses some of the analyses failed to run, as the minimum number of responses needed to be met. This was an issue when looking at the various types of methods that are currently being employed in the individuals’ continued learning activities.

5.1.1 Geographic Location’s influence on Formal Education in Digital/Computer Forensics

To test whether or not geographic location (*Q2*) plays a role in obtaining formal training or tertiary education (*Q7*). From the total number of participants, a higher number (23) of international than South African participants (13) completed the survey. When looking at the cross-tabulation analysis of geographic location to ascertain whether the participants had been on any formal training or tertiary education specifically in digital or computer forensics, international respondents had a higher percentage (78.26%) of holding a qualification when compared to South African respondents. Respondents from South Africa were more even when looking at formal qualifications in computer/digital forensics, but it is noted that the percentage (61.46%) is higher for those participants that had formal or tertiary education. Both South African and international participants had higher percentages of those who had completed formal training or tertiary education than those who had not completed either. The frequency table and expected frequencies tables results from the cross-tabulation analysis can be seen in Tables 5 and 6 respectively.

Summary Frequency Table (Continued_Education_Digital_Forensic_Practitioners-Values) Marked cells have counts > 10 (Marginal summaries are not marked)				
	(Q2) South African/International	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: Yes	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: No	Row Totals
Count	South African	8	5	13
Row Percent		61.54%	38.46%	
Count	International	18	5	23
Row Percent		78.26%	21.74%	
Count	All Grps	26	10	36

Table 5: Summary Frequency Table (Location vs Tertiary Education)

Summary Table: Expected Frequencies (Continued_Education_Digital_Forensic_Practitioners)			
Marked cells have counts > 10			
(Q2) South African/International	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: No	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: Yes	Row Totals
South Africa	3.61111	9.38889	13.00000
International	6.38889	16.61111	23.00000
All Grps	10.00000	26.00000	36.00000

Table 6: Summary Table: Expected Frequencies (Location vs Tertiary Education)

5.1.2 Geographic Location’s Relationship with Continued Learning Activities over the past five years

To test the data as to whether geographic location (Q2) had any effect on the period of participants’ involvement in continued learning activities (Q9), it would be best to perform a cross-tabulation analysis. Of the participants completing the survey question, 19 had completed continued learning activities in the past 12 months. This is true for both South African (22.58%), and international (38,71%) participants, with a combined percentage of 61.29 percent, this result suggests that geographic location does in fact play a role on continued learning involvement. The results from the cross-tabulation analysis can be seen in Tables 7 (Summary) and 8 (Frequencies).

Summary Frequency Table (Continued_Education_Digital_Forensic_Practitioners)								
Marked cells have counts > 10								
(Marginal summaries are not marked)								
	(Q2) South African/International	Not Completed In Past 5 Years	Completed Last 12 Months	Completed 12-24 Months	Completed 48 – 50 Months	Completed 36-48 Months	Completed 24-36 Months	Row Totals
Count	South Africa	1	7	2	0	1	0	11
Total Percent		0.0322580645	22.58%	6.45%	0.00%	3.23%	0.00%	35.48%
Count	International	1	12	1	3	2	1	20
Total Percent		0.0322580645	38.71%	3.23%	9.68%	6.45%	3.23%	64.52%
Count	All Grps	2	19	3	3	3	1	31
Total Percent		0.064516129	61.29%	9.68%	9.68%	9.68%	3.23%	

Table 7: Summary Frequency Table (Location on Continued Learning)

Summary Table: Expected Frequencies (Continued_Education_Digital_Forensic_Practitioners)							
Marked cells have counts > 10							
(Q2) South African/International	Not Completed in Past 5 Years	Completed 12 Months	Completed 12-24 Months	Completed 24-36 Months	Completed 36-48 Months	Completed 48 – 50 Months	Row Totals
South Africa	0.709677	6.74194	1.064516	0.354839	1.064516	1.064516	11.000000
International	1.290323	12.25806	1.935484	0.645161	1.935484	1.935484	20.000000
All Grps	2.000000	19.00000	3.000000	1.000000	3.000000	3.000000	31.000000

Table 8: Summary Table Expected Frequencies (Location on Continued Learning)

5.1.3 Age-Group’s relationship with Formal Education in Digital/Computer Forensics

When looking at whether or not the age group (Q3) of the respondents plays a role in whether they were likely to have completed a formal qualification (Q7) in digital/computer forensics.

For the analysis, a cross-tabulation analysis was performed. The age group where the highest number (11) of participants had formal training was 30-39 years. This was followed by eight in the 40-49 years of age. In these two age groups specifically, of the 22 total respondents 19 had completed formal training in the field. Analysis of the data from the research showed that age does play a role in whether or not the respondents obtained formal qualifications in digital/computer forensics, and the greatest age group contributor was the 30-39 year group. The results from the cross-tabulation analysis can be seen in Tables 9 (Summary) and 10 (Frequencies).

Summary Frequency Table (Continued_Education_Digital_Forensic_Practitioners)				
Marked cells have counts > 10 (Marginal summaries are not marked)				
	(Q3)Age Group	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: No	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: Yes	Row Totals
Count	40-49	2	8	10
Total Percent		5.56%	22.22%	27.78%
Count	30-39	1	11	12
Total Percent		2.78%	30.56%	33.33%
Count	50-59	4	5	9
Total Percent		11.11%	13.89%	25.00%
Count	20-29	2	2	4
Total Percent		5.56%	5.56%	11.11%
Count	60+	1	0	1
Total Percent		2.78%	0.00%	2.78%
Count	All Grps	10	26	36
Total Percent		27.78%	72.22%	

Table 9: Summary Frequency Table (Age-Group role in Formal Qualification)

Summary Table: Expected Frequencies (Continued_Education_Digital_Forensic_Practitioners)				
Marked cells have counts > 10				
	(Q3)Age Group	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: No	(Q7) Formal Training or Tertiary Education in Digital/Computer / Forensics: Yes	Row Totals
	40-49	2.77778	7.22222	10.00000
	30-39	3.33333	8.66667	12.00000
	50-59	2.50000	6.50000	9.00000
	20-29	1.11111	2.88889	4.00000
	60+	0.27778	0.72222	1.00000
	All Grps	10.00000	26.00000	36.00000

Table 10: Summary Table Expected Frequencies (Age-Group role in Formal Qualification)

5.1.4 Age-Group's relationship with Continued Learning involvement over the past five years

To examine the data to determine if there is a relationship between participants' involvement over the past five years with continued learning (Q9) and the age-groups of the participants

(Q3), a cross-tabulation analysis was performed. From the analysis, it can be seen that the age group does not contribute to the frequency at which they engage in continued learning activities. The analysis shows that the largest number of participants that had been involved in continued learning activities in the last five years was those aged between 30-39 years (11) and those aged between 40-49 years. The summary of the cross-tabulation analysis can be seen in Table 11 (Summary) and Table 12 (Expected Frequencies).

Summary Frequency Table (Continued_Education_Digital_Forensic_Practitioners-Values) Marked cells have counts > 10 (Marginal summaries are not marked)								
	(Q3)Age Group	Not Completed in last 5 Years	Completed in the past 12 months	Completed 12-24 Months	Completed 24-36 Months	Completed 36-48 Months	Completed 48-60 Months	Row Totals
Count	20-29	1	2	0	0	0	0	3
Total Percent		3.23%	6.45%	0.00%	0.00%	0.00%	0.00%	9.68%
Count	30-39	0	6	2	0	2	1	11
Total Percent		0.00%	19.35%	6.45%	0.00%	6.45%	3.23%	35.48%
Count	40-49	1	8	0	1	0	0	10
Total Percent		3.23%	25.81%	0.00%	3.23%	0.00%	0.00%	32.26%
Count	50-59	0	2	1	0	1	2	6
Total Percent		0.00%	6.45%	3.23%	0.00%	3.23%	6.45%	19.35%
Count	60+	0	1	0	0	0	0	1
Total Percent		0.00%	3.23%	0.00%	0.00%	0.00%	0.00%	3.23%
Count	All Grps	2	19	3	1	3	3	31
Total Percent		6.45%	61.29%	9.68%	3.23%	9.68%	9.68%	

Table 11: Summary Frequency Table (Age on Continued Learning Activities)

Summary Table: Expected Frequencies (Continued_Education_Digital_Forensic_Practitioners) Marked cells have counts > 10							
(Q3)Age Group	Not Completed in Past 5 Years	Completed Last 12 Months	Completed 12-24 Months	Completed 48 – 50 Months	Completed 36-48 Months	Completed 24-36 Months	Row Totals
40-49	0.645161	6.12903	0.967742	0.967742	0.967742	0.322581	10.00000
30-39	0.709677	6.74194	1.064516	1.064516	1.064516	0.354839	11.00000
50-59	0.387097	3.67742	0.580645	0.580645	0.580645	0.193548	6.00000
20-29	0.193548	1.83871	0.290323	0.290323	0.290323	0.096774	3.00000
60+	0.064516	0.61290	0.096774	0.096774	0.096774	0.032258	1.00000
All Grps	2.000000	19.00000	3.000000	3.000000	3.000000	1.000000	31.00000

Table 12: Summary Table Expected Frequencies Table (Age on Continued Learning Activities)

5.1.5 Summary of Cross-Tabulation Analysis

When analysing the data using cross-tabulation with the hypotheses used by other researchers in studies on continued education in other professions, it can be seen that geographic location of the participants played a role in both cases, namely whether they had formal training or tertiary education, and whether they had been involved with continued education in the past five years. This is true for both the South African as well as the international participants in the survey.

As mentioned earlier in this section, tests were conducted to see if gender played a role in either formal education or in continued learning activities, but the number of responses from

female participants were insufficient (4), and as such no conclusions could be drawn from this data.

5.2 Type of Formal Education or Tertiary Education

Part of the research instrument was to find out where participants had received their formal or tertiary education. The question was structured to allow the participants to select more than one option, as it is possible that training can be obtained from more than one institution. The basic descriptive analysis indicates that the majority (21) of the participants had received qualifications at a university; this was followed by vendor-specific training (10). Other training received was from DEFCON, BSides, IACIS (2), SANS Institute, FBI and the Canadian Police College, and lastly, three participants had received training from a Technical University (either a Technikon or University of Technology). Results from basic analysis on where education was obtained can be seen in Table 13.

(Q8) If answer to Q7 was Yes – Where was Formal Training Obtained	Responses	%
University	21	81%
Technikon/University of Technology	3	12%
College	0	0%
Vendor Specific	10	38%
Other	4	15%

Table 13: Where Formal Education on Digital/Computer Forensics was obtained

5.3 Analysis of Continued Learning Approaches

In order to test the findings based on the first survey, a basic descriptive analysis was done to see which of the selected options had the highest weightings. The highest weighed responses were then used to compile the second research instrument, which would then be completed by the experts in the field to see if they agreed on the findings. Three questions in the instrument survey dealt with approaches and methods. It was important to understand how continued learning (*Q10: Methods, Q13: Best Approaches*) was delivered for those who had completed activities in the last five years; it was also deemed important to get the opinion of participants about which methods were best suited to deliver content. Table 14 shows the various selections that were made, indicating how content was delivered during continued learning activities. As can be seen, the highest numbers were the reading of journals or

articles (84%), web-based content (81%), vendor training/documentation and classroom teaching (68%), conducting research (61%), reading research conducted in the forensic science area (58%), and reading of books related to forensic sciences (55%).

(Q10) Methods Used	Responses	%
CD ROM/DVD learning	4	13%
Conference attendance	21	68%
Vendor training or Vendor Documentation	13	42%
Teaching (Classroom)	21	68%
Conducting Research	19	61%
Reading journals/articles	26	84%
Reading Research conducted in Forensic Field	18	58%
On-line Modules (Virtual Classroom)	11	35%
On-line conferences	5	16%
In-house Training	13	42%
Court Proceedings (e.g. Case Law)	7	23%
Reading books published in Forensics	17	55%
Web-based subject content (such as Web Blogs or User Forums)	25	81%
Other	2	6%

Table 14: Methods used for Continued Learning

(Q12) Opinion on Best Methods	Responses	%
CD ROM/DVD learning	5	17%
Conference attendance	20	69%
Vendor training or Vendor Documentation	11	38%
Teaching (Classroom)	17	59%
Conducting Research	23	79%
Reading journals/articles	23	79%
Reading Research conducted in Forensic Field	18	62%
On-line Modules (Virtual Classroom)	17	59%
On-line conferences	11	38%
In-house Training	16	55%
Court Proceedings (e.g. Case Law)	10	34%
Reading books published in Forensics	20	69%
Web-based subject content (such as Web Blogs or User Forums)	21	72%
Other	2	7%

Table 15: Opinion on Best Methods to Deliver Content

Opinions on the best way to deliver content (Table 15): to determine the highest weighted responses, a basic descriptive analysis was done on the research data. From the analysis of the data with respect to the best methods to deliver content for continued learning activities, the highest weighted responses were as follows: conducting research and reading journals/articles (79%), web-based content (72%), reading of books in forensic area and

attending conferences (69%), classroom and virtual teaching (59%), and in-house training (55%).

One question from the first research instrument that was used to test the findings in the Delphi-review was on Best Approaches (Q13, Table 16). To analyse the data, a basic descriptive analysis was performed. From the responses for best approaches, the highest contributors were work experience (79%), talking to professionals in the field (76%), reading (66%), classroom lectures and conferences (54%), workshops (45%) and work-based training (41%).

(Q13) Best Approaches that Work	Responses	%
Work Experience	23	79%
Work Based Training	12	41%
Working in a group environment	10	34%
Lectures (Conferences or Classroom)	15	52%
On-line Course Work	11	38%
Workshops	13	45%
Reading	19	66%
Simulation	9	31%
Talking to professionals in the Field (e.g. Colleagues)	22	76%
One-on-one training	7	24%
Other	1	3%

Table 16: Best Approaches that Work for Continued Learning

From the analysis above it would be important to ask the experts to review the following with respect to best approaches to continued learning: work experience, talking to professionals in the field, reading books, journals, articles and research conducted in the field, on-line resources, lectures or conferences, workshops and work-based training. These questions were added to the second research instrument, which was then sent to the experts in the field for review.

5.4 Driving Force, Barriers Affecting and Greatest Contributors to Continued Learning Approaches

Other studies conducted into continued education have highlighted that barriers sometimes exist that prevent individuals from participating in continued learning activities. Other studies have explored the biggest driving force and greatest contributors in terms of continued learning activities. Table 17 shows the respondents' selections to the driving force for them to get involved in continued learning activities. To see the highest contributors, a basic

descriptive analysis was performed on the data. The highest responses to the driving force were as follows: changes in the industry (operating system, mobile device advancements, etc.), career progression, skills gap (personal development), and changes in tools used in investigations (58%).

(Q11) Driving Force Behind Continued Learning Participation	Responses	%
Appraisals in the work place	6	19%
Career Progression	20	65%
Employer Requirement (Department/Section)	10	32%
Discussions with colleagues	12	39%
Customer feedback	3	10%
Outcomes from investigations	13	42%
Change in Case Law	4	13%
Change in Legislation	7	23%
Changing Tools used for investigations	18	58%
Vendor Certification Requirement (Software/Hardware manufacturers)	8	26%
Changes in Technology i.e. Operating Systems, mobile devices advancements	23	74%
Industry Best Practice	15	48%
Skills Gap (Personal Development)	18	58%
Other	5	16%

Table 17: Driving force Behind Continued Learning Activities

Studies conducted in other industries showed that there were factors that affected individuals' involvement in continued learning activities. The biggest barriers to participants who responded to the survey can be seen in Table 18. The question was structured to allow participants to select more than one option, should they personally be affected by more than one option. To analyse the data, a basic descriptive analysis was performed. The highest weighted responses were the following: workload too high (66%), cost of available learning initiatives (48%), and availability of study leave (38%).

(Q14) Barriers Affecting Continued Learning	Responses	%
Availability of Study Leave	11	38%
Cost of Available Learning Initiatives	14	48%
Motivation	4	14%
Past experiences	2	7%
Workload too high	19	66%
Other	4	14%

Table 18: Barriers Affecting Continued Learning Involvement

In order to determine what the biggest contributors to continued learning were for participants, a basic descriptive analysis was performed on the data (Table 19). The

conclusions drawn from this analysis were added to the second research instrument used for the Delphi review. The analysis shows the biggest contributors as reading (52%), internet sources and colleagues in the industry (45%), and universities and industry conferences (38%).

(Q15) Biggest Contributors For Individual Learning	Responses	%
University/Industry Conferences	11	38%
Vendor Training/Documentation	6	21%
On-line Training	4	14%
Other Internet Sources	13	45%
Colleagues in the Industry	13	45%
Reading	15	52%
Other	2	7%

Table 19: Biggest Contributors towards Continued Learning

5.5 Governing Bodies, and Re-evaluation Period

A section of the survey was to ask respondents whether they felt that there should be a governing body overseeing continued learning activities in the discipline of digital/computer forensics, similar to those in the medical and education professions. The analysis of the data was done by performing a basic descriptive analysis. From the responses received, the majority (72%) of the respondents to the question said that there should be an overseeing body. The values seen in Table 20 include the individuals (7) who skipped this question. The research instrument allowed the participants to select who should be responsible for the curriculum and who should be responsible for the quality of the continued learning activities. The highest weighted responses with respect to quality (Table 21) were specialist institutions (59%), tertiary institutions (55%), and other responses (21%). Other responses for responsibility were given as external professionals, peer-review comprising academics and consultants, certification bodies, and forensic associations. The subject of certification, accreditation, and the use of peer review as part of continued learning is backed up with the findings from the literature review.

Category	Frequency table: (Q16) Regulatory Body overseeing CPD for Practitioners			
	Count	Cumulative Count	Percent	Cumulative Percent
Yes	21	21	58.33333	58.3333
No	8	29	22.22222	80.5556
Missing	7	36	19.44444	100.0000

Table 20: Should a Regulatory Body exist to oversee Continued Learning Activities?

(Q18) Responsibility for Quality of Continued Learning Activities	Response	%
Tertiary Institutions (Universities/Colleges)	16	55%
Local training providers (such as software/hardware vendors, accredited training centres)	4	14%
Specialist Institutions	17	59%
Other (Please Specify)	6	21%

Table 21: Responsibility for Quality of Content

Another aspect that needs to be addressed when looking at continued education is one of content, or curriculum. The data obtained during the first survey was analysed using basic descriptive analysis, and the output of the analysis can be seen in Table 22. The responsibilities of curriculum content based on highest weighted responses were Governing Bodies (59%), Tertiary Institutions (48%), and Government (38%).

(Q19) Responsibility for the Curriculum	Response	%
Tertiary Institutions (Universities/Colleges)	14	48%
Self-directed (training as required or desired)	8	28%
Employers	8	28%
Government	11	38%
Governing Bodies	17	59%
Other	3	10%

Table 22: Responsibility for Curriculum

As part of the first research instrument when looking at continued learning being overseen by a governing body, one also needs to know what the re-evaluation period needs to be. The data from the first survey was analysed using a frequency table (Table 23). The highest numbers of responses were selected as re-evaluation to be done every five years, the second highest was every two years. Medical practitioners in South Africa are required to complete continued learning activities every two years. When looking at existing certification programs such as those carried out by IACIS and CAWFE, the re-evaluation period is every three years.

N=21 Category	Frequencies (Identical resp. were ignored) (Continued_Education_I Variable: (Q17) If you answered Yes to Question 16: What should t (Simple Grouping Variable)		
	Count	Prcnt.of Responses	Prcnt.of Cases
Every 5 Years	9	42.86	42.86
Every 2 Years	6	28.57	28.57
Other (3 Years)	2	9.52	9.52
Every Year	4	19.05	19.05
Totals	21	100.00	100.00

Table 23: Re-evaluation Period (Frequencies)

From the analysis of the data obtained from the first survey, questions could be drawn up to find out which of the highest weighted responses would be best suited for this field during the review. Questions from this analysis that would be asked in the second research instrument when looking at the topic of responsibility for quality of content in continued learning would be Tertiary Institutions, Governing Bodies, and peer-review groups comprising academics and practitioners. Questions added to the second research instrument when determining where the responsibility lay for the curriculum to be used for continued learning activities in the field were Tertiary Institutions, Governing Bodies, and Government.

6. Delphi-Review Analysis and Discussion

From the analysis of the data obtained from the first research instrument, a second research instrument was compiled to test the findings. The second research instrument was used to get experts' opinion on the findings as part of a Delphi review. The main topics of the second research instrument were to verify findings with regard to the re-evaluation period, responsibility for quality and curriculum, biggest contributors, and best approaches in continued learning. The research instrument can be found in Appendix C with the full report from Qualtrics in Appendix D. For looking at the questions on biggest contributors, regulatory body, responsibility of quality and/or curriculum, and best approaches in the second research instrument, a 7-point Likert-type scale was used, ranging from Strongly Agree (1) to Strongly Disagree (7). The questions were put to the experts as separate individual questions; hence a Likert-type analysis should be performed on the data.

To analyse the data obtained from the Likert-type scale questions, Hsu and Sandford (2007) state that the use of a mean value is deemed inappropriate, as the responses are not described at equal intervals. The most appropriate way to analyse Likert-type data is to use either median, or mode values to identify the tendency. Boone and Boone (2012) furthermore state that when analysing Likert-type data it is important to understand that the responses express a greater than relationship, but by how much is not defined; as a result, Likert-type items that fall into an ordinal descriptive analysis are recommended, including mode or median for central tendencies, and frequencies to look at variance.

The second research instrument was sent to a targeted population consisting of industry experts. The survey was sent to 15 participants, of which ten people completed the review of the findings from the first data analysis. The entire questionnaire put to the participants was answered with a zero percent fall-out rate.

The analysis of the data was done in Statistica version 12; for the Likert-type data analysis, nonparametric ordinal descriptive analysis was performed using the median or mode to identify tendencies, and frequency of mode to indicate variance. The frequency of mode shows the number of reoccurrences of the mode value, for the purpose of the data analysis and discussion the value for "frequency of mode" will be referred to only as *frequency*. The

tables used in this section contain mainly the relevant data being discussed such as variable, median, valid number of responses, frequency and mode.

6.1 Re-evaluation period

To find out what the preferable re-evaluation period would be, the question was posed to the experts. Two options were put to the participants, either a five-year review period or a three-year period. All participants answered the question regarding the review period ($n = 10$, $SD = 0.32$), of which 90 percent chose a review period of three years. The data was analysed using a frequency table (Table 24). The period of three years is confirmed by the review period currently being used by industry-accepted certifications, namely IACIS and CAWFE. It can therefore be concluded that the re-evaluation period for continued learning in the field of digital/computer forensics should be three years.

Category	Frequency table: Preferable Review period - Select re			
	Count	Cumulative Count	Percent	Cumulative Percent
3 Years	9	9	90.00000	90.0000
5 Years	1	10	10.00000	100.0000
Missing	0	10	0.00000	100.0000

Table 24: Re-evaluation Period (Delphi-Review)

6.2 Responsibility for the Curriculum and Quality of Continued Education Activities

As part of the Delphi review, it was important to examine the experts' opinion on whether a regulatory body should exist, based on the data analysed from the first survey. The question was put in the form of a Likert-type scale question. The analysis was performed by using an ordinal descriptive analysis, and then using the median value to see where the 25-75 percentiles would lie. There were 10 responses ($n = 10$, $median = 2$, $mode = 2$, $frequency = 8$) to the question, with a *median* value of 2. The analysis shows that the responses agreed that a regulatory body should exist, a value of 2 on the 7-point Likert-type scale used for this question indicated "Agree". The *frequency* of responses from the data analysis is 8, which indicates that the majority of answers were in support of this finding. The analysis of the data on a regulatory body from the second research instrument can be seen on the bar-graph in Figure 20, in addition to the statistical analysis in Table 25.

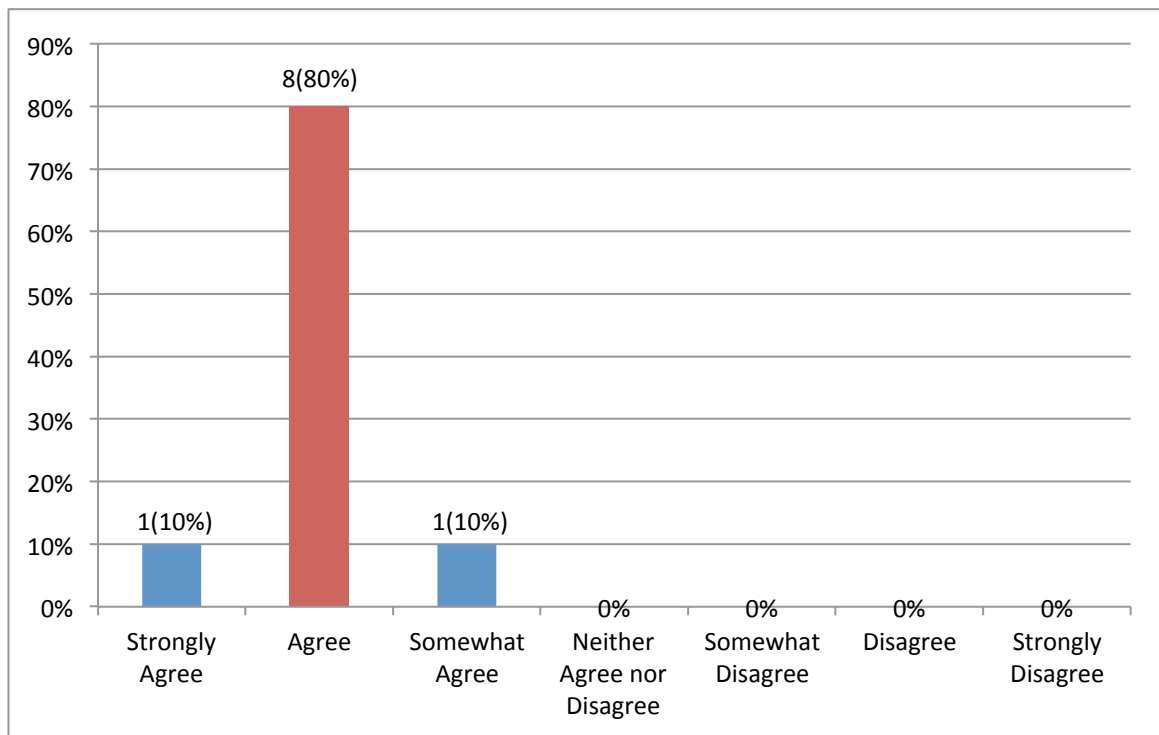


Figure 20: Regulatory Body (Delphi-Review)

Variable	Mean	Valid N	Median	Mode	Frequency of Mode	Minimum	Maximum
Regulation Body overseeing Continued Professional Development	2.000000	10	2.000000	2.000000	8	1.000000	3.000000

Table 25: Regulatory Body (Median, Mode and Frequency etc.)

When a governing body to oversee continuing learning activities exists, it needs to be determined who should be responsible and contribute to the quality and curriculum required for continued learning activities. The research instrument included questions that had the highest weighting from the data analysis from the first research instrument, and the questions were put using a 7-point Likert-type scale. The data was analysed using ordinal descriptive analysis, to determine the median, frequency values, and where the 25-75 percentiles lay.

All participants ($n = 10$) answered the question related to responsibility for the curriculum, and quality of continued learning content in the field of digital/computer forensics. To determine who would be best suited for the responsibility for curriculum content, the research instrument contained three questions looking at different options, namely tertiary institutions, governing bodies and government. The data was analysed for all three questions using

ordinal descriptive analysis to find the median, mode and frequency values. From the analysis regarding tertiary institutions ($n = 10$, $median = 3$, $mode = \text{multiple}$), with a $median$ value of 3, and further the analysis indicating 25-75 percentile, the responses fall between Agree (2) and Somewhat Agree (3) that the responsibility should be with tertiary institutions. The $mode$ was calculated to be multiple; a value of multiple for $mode$ shows that there were multiple selections on the Likert-type scale that had the same number of responses, and as such, no frequency can be calculated. Figure 21 presents a bar-graph showing where the responses to the question lay on the Likert-type scale, mainly showing the agreement responses on the 7-point scale. Further analysis has been included in Table 26.

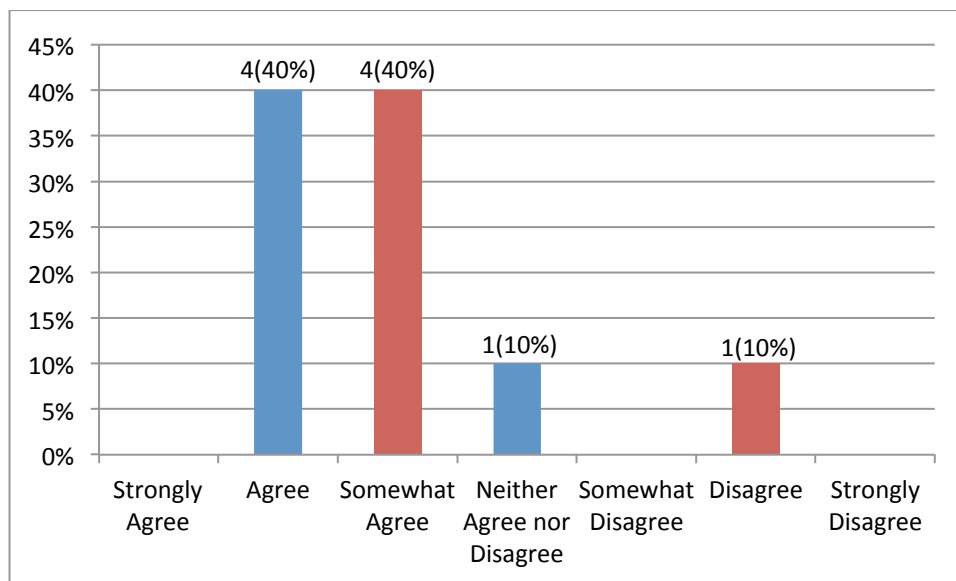


Figure 21: Responsibility for Curriculum (Tertiary Institutions)

The second question relating to where the responsibility lay with regard to curriculum content was to look at the responses about governing bodies. The analysis of the data ($n = 10$, $median = 2$, $mode = 2$, $frequency = 4$) shows a $median$ value of 2, with a $mode$ value of 2 and a $frequency$ value of 4. We can conclude that four responses fell on Agree (2), which indicates that the majority of the responses agreed that governing bodies should have a responsibility towards the content of continued learning activities. Figure 22 shows the analysis of the data on a bar-graph depicting where the responses from the participants lay. Figure 23 shows the analysis of the data on a Box and Whisker plot depicting the median values and where the 25-75 percentiles lay with regard to participants' responses. Additional analysis data has been included in Table 26.

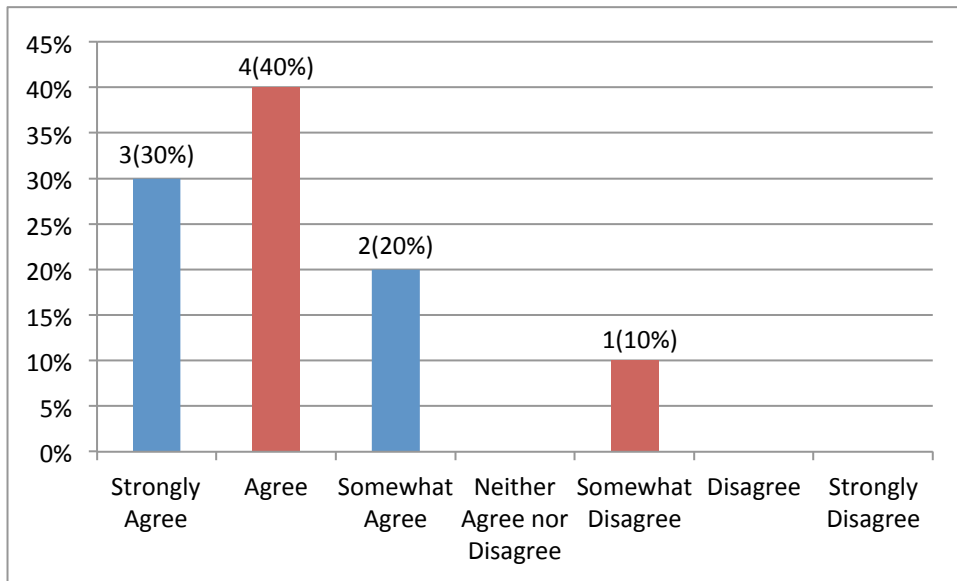


Figure 22: Responsibility for Curriculum-Bar Graph (Governing Bodies)

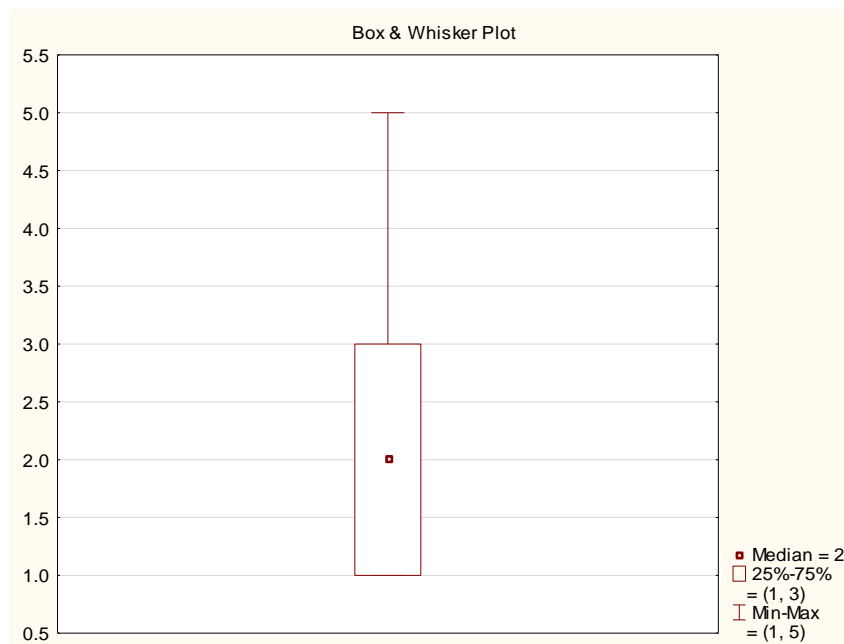


Figure 23: Responsibility for Curriculum-Box and Whisker Plot (Governing Bodies)

The third question was about the government’s involvement towards taking responsibility for the curriculum. The analysis of the Likert-type data was performed using ordinal descriptive analysis to find the median, mode and frequency values. The responses ($n = 10$, $median = 5$, $mode = \text{multiple}$), with a *median* value of 5, show that the 25-75 percentile falls between Strongly Disagree (7) and Neither Agree or Disagree (4) on the government’s involvement with the curriculum used in continued learning activities. We can conclude from the analysis that the experts agree that government should not be involved. The *mode* was calculated to be

multiple. A value of multiple for *mode* shows that multiple selections on the Likert-type scale had the same number of responses, and therefore no frequency can be calculated. Figure 24 shows the results of the responses on a bar-graph against the Likert-type scale lay. Figure 25 showing the analysis on a Box and Whisker plot and where the 25-75 percentiles of the responses lay. Additional analysis is included in Table 26.

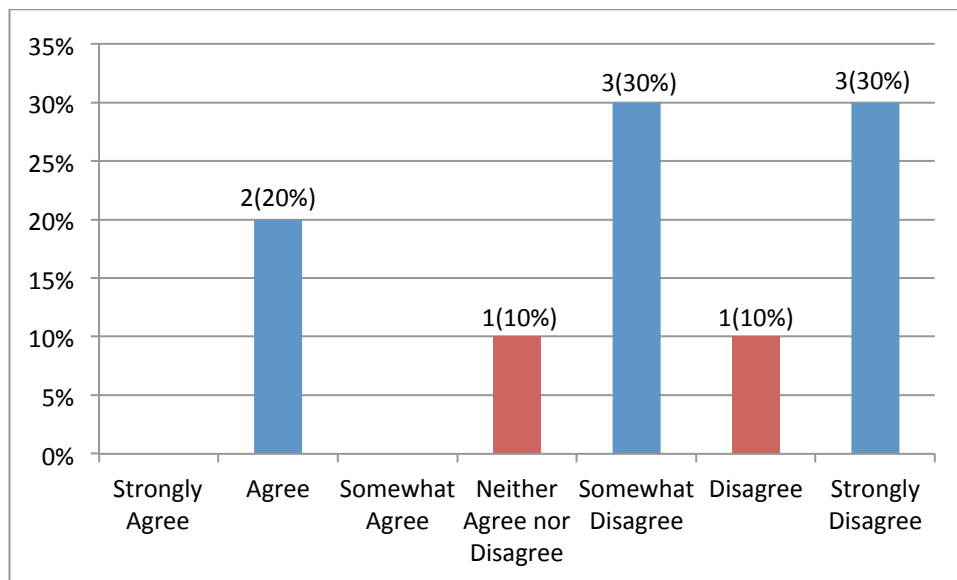


Figure 24: Responsibility for Curriculum-Bar Graph (Government)

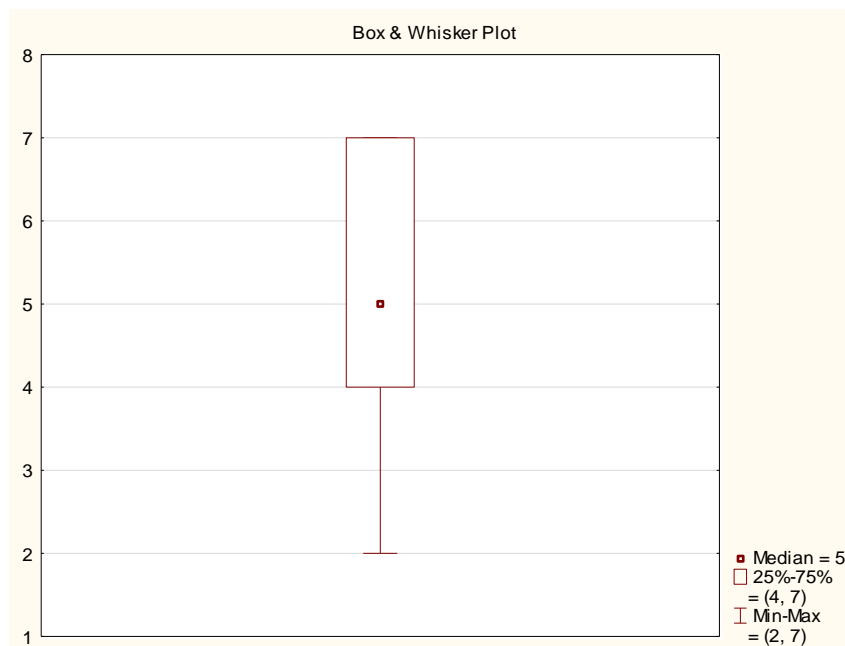


Figure 25: Responsibility for Curriculum-Box and Whisker Plot (Government)

With regard to the questions related to responsibility for quality, the second research instrument contained three questions to put to the experts. All the questions were put using a

7-point Likert-type scale. The questions were intended to examine the experts' opinions regarding the responsibility for the quality of continued learning with tertiary institutions, governing bodies and peer review. From the response to the question of whether tertiary institutions should be responsible for quality, an ordinal descriptive analysis was performed on the Likert-type data ($n = 10$, $median = 2$, $mode = 2$, $frequency = 6$), with a $median$ value of 2, a $mode$ value of 2 and a $frequency$ of 6. This indicates that 60 percent of the responses selected Agree (2); furthermore, the 25-75 percentile lay between Agree (2), and Somewhat Agree (3). From the analysis, we can conclude that on average the experts agreed that responsibility for quality lay with tertiary institutions. Figure 26 shows where the responses lay. Additional analysis of the data has been included in Table 26.

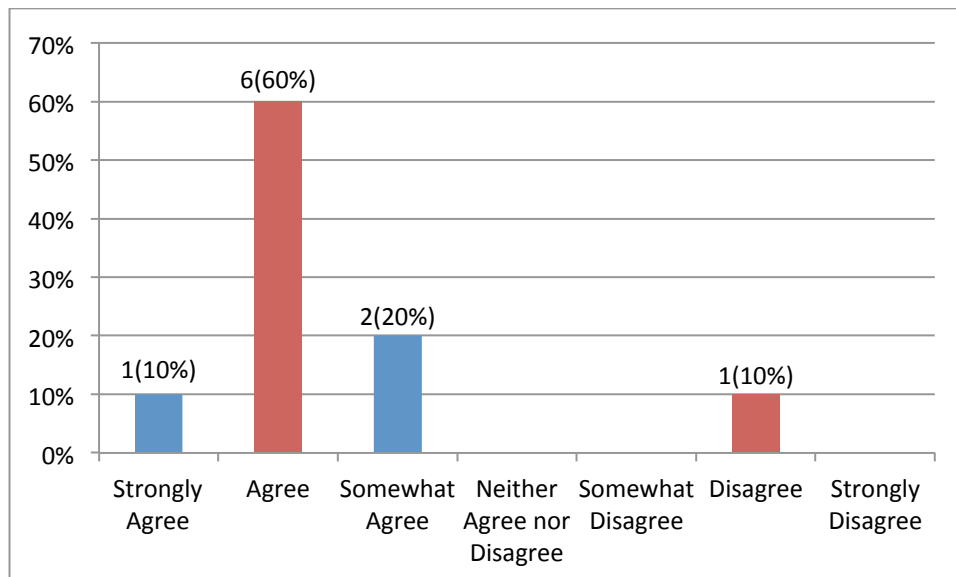


Figure 26: Responsibility for Quality (Tertiary Institutions)

The second question to determine responsibility for quality of continued learning content from the second research instrument, related to governing bodies. From the analysis of the data obtained from an ordinal descriptive analysis to determine the median, mode and frequency values ($n = 10$, $median = 2$, $mode = 1$, $frequency = 4$), with a $median$ value of 2, a $mode$ value of 1, and $frequency$ of 4, we can conclude that there were four responses for Strongly Agree (1); furthermore, the analysis shows that the 25-75 percentile fell between Strongly Agree (1) and Somewhat Agree (3). From this analysis, we can conclude that on average the experts agree that governing bodies can be responsible for quality of continued learning content. The totals for each of the options available on the Likert-type scale for this question can be seen in the form of a bar-graph in Figure 27. The results for the analysis showing the median, and where the 25-75 percentiles lay based on responses can be seen in

Figure 28 on a Box and Whisker plot. Additional analysis of the data has been included in Table 26.

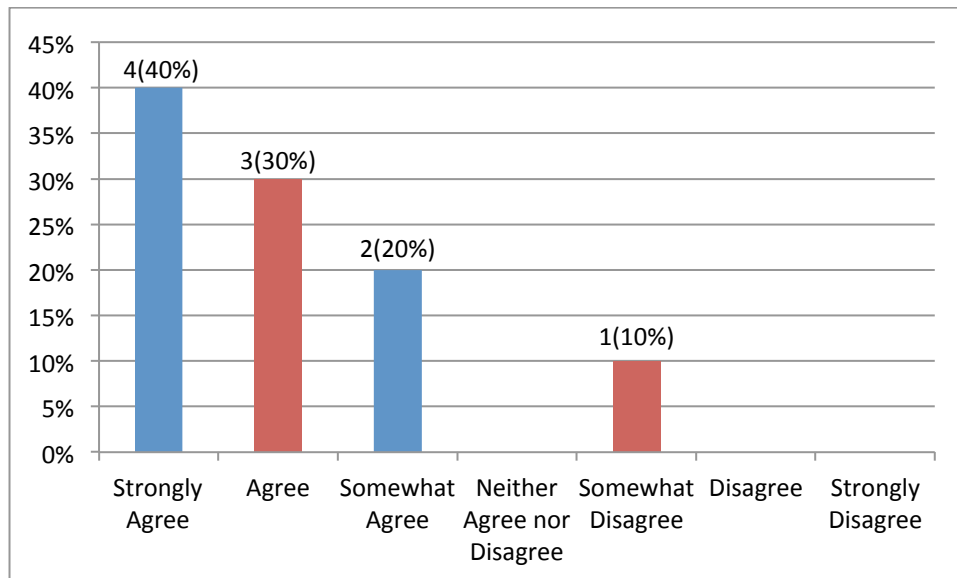


Figure 27: Responsibility for Quality-Bar Graph (Governing Bodies)

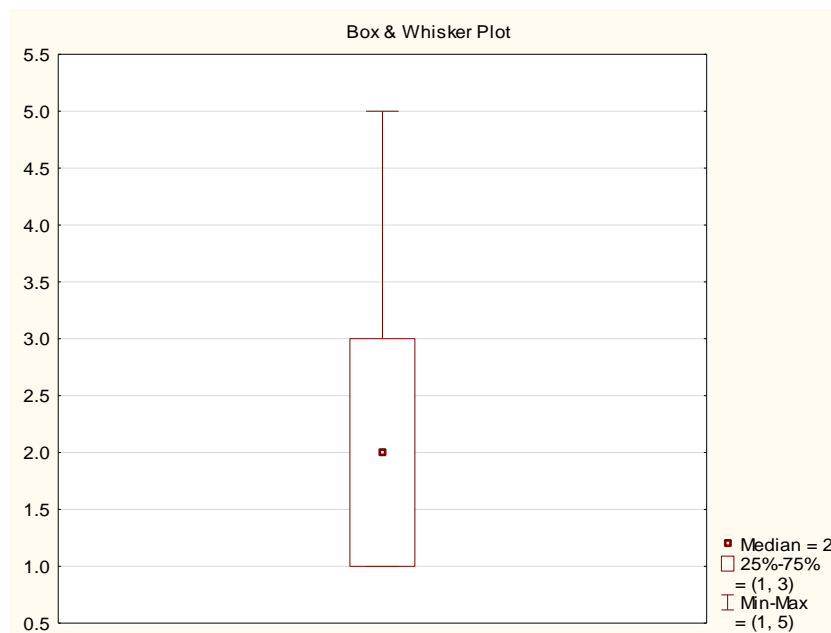


Figure 28: Responsibility for Quality-Box and Whisker Plot (Governing Bodies)

The third question regarding the responsibility for content was about a peer-review group comprising academics and practitioners. The Likert-type data was analysed using an ordinal descriptive analysis. From the responses ($n = 10$, $median = 2$, $mode = 2$, $frequency = 5$), a *median* value of 2, a *mode* value of 2 and a *frequency* of 5, we can conclude that the majority (50%) of the responses fell on Agree (2), further to this the 25-75 percentile is between

Strongly Agree (1) and Agree (2). This shows that the experts agree the responsibility for quality should be determined by a peer-review group consisting of academics and practitioners. Figure 29 shows the totals of the responses for each of the selections made available on the questionnaire in the form of a bar-graph. Additional analysis of the data has been included in Table 26.

Variable	Mean	Valid N	Median	Mode	Frequency of Mode	Minimum	Maximum
Curriculum - Tertiary Institutions	3.00	10	3.00	multiple		2.00	6.00
Curriculum - Governing Bodies	2.20	10	2.00	2.00	4	1.00	5.00
Curriculum - Government	5.00	10	5.00	multiple		2.00	7.00
Quality - Tertiary Institutions	2.50	10	2.00	2.00	6	1.00	6.00
Quality - Governing Bodies	2.10	10	2.00	1.00	4	1.00	5.00
Quality - Peer Review Group	1.70	10	2.00	2.00	5	1.00	3.00

Table 26: Responsibility for Curriculum and Quality (Median, Mode and Frequency etc.)

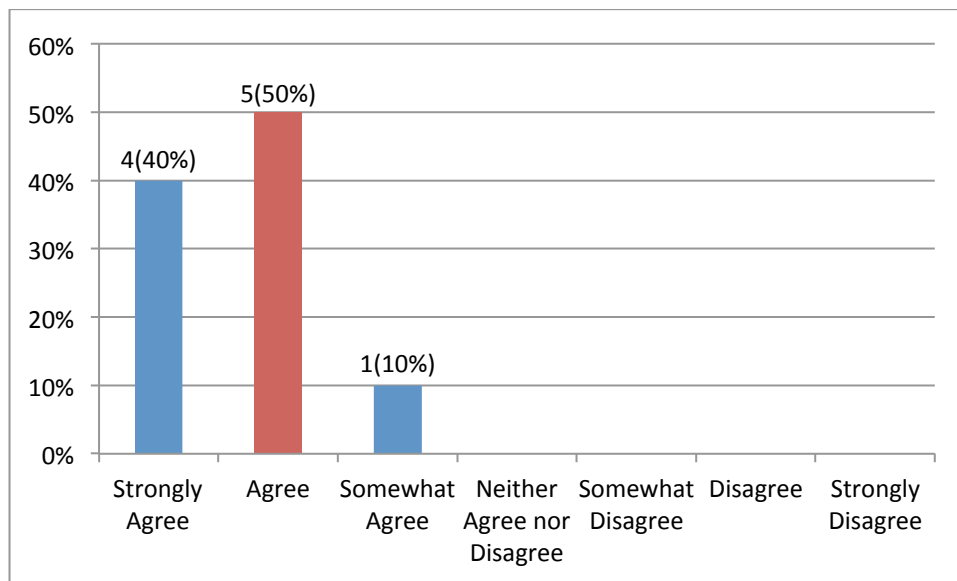


Figure 29: Responsibility for Quality (Peer-Review)

6.3 Biggest Contributors to Continued Education

The second research instrument contained four questions based on the highest weighting of the data analysis from the first research instrument. The questions were put to the experts to see what the biggest contributors to continued learning were – reading, Internet sources, colleagues in the industry and university or industry conferences. All questions were asked

using a 7-point Likert-type scale. For the first question on the biggest contributor being reading, the data was analysed using an ordinal descriptive analysis to determine the median, mode and frequency values. From the analysis ($n = 10$, $median = 1.5$, $mode = 1$, $frequency = 5$), with a $median$ value of 1.5, a $mode$ value of 1 and a $frequency$ value of 5, we can conclude that the highest number of expert responses (50%) fell on Strongly Agree (1). Further to this, the 25-75 percentile of responses fell between Strongly Agree (1) and Agree (2). We can conclude from the analysis that reading is a big contributor to continued education content. Figure 30 shows a bar-graph that depicts the total number for each of the selections available on the Likert-type scale made by the respondents. Additional analysis of the data has been included in Table 27.

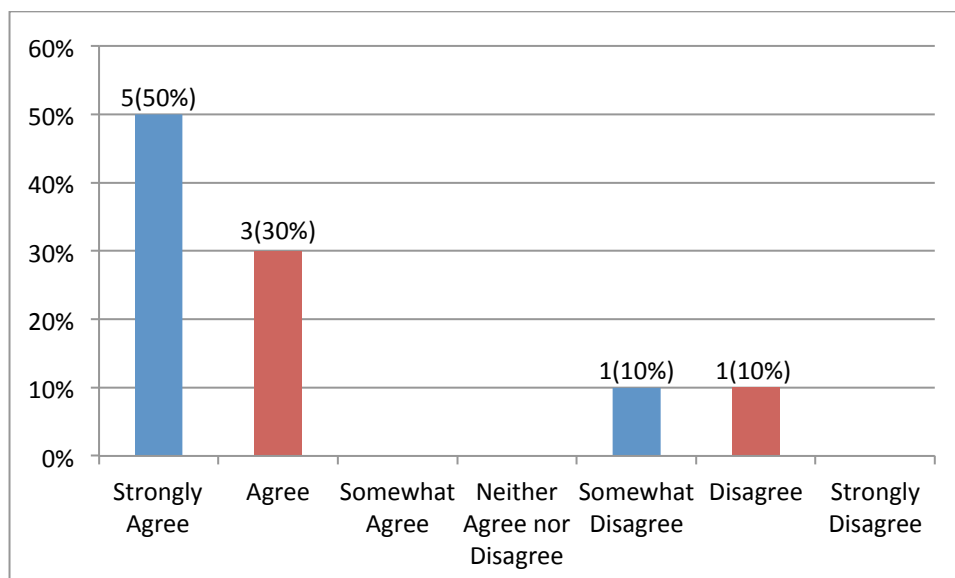


Figure 30: Biggest Contributors (Reading)

The second question on biggest contributors to continued learning was to look at Internet sources. The analysis of the Likert-type data was done using an ordinal descriptive analysis ($n = 10$, $median = 2$, $mode = \text{multiple}$), with a $median$ value of 2 and the 25-75 percentile of the participants' responses on Internet sources between Strongly Agree (1) and Agree (2). The $mode$ was calculated to be multiple; a value of multiple for $mode$ shows that there were multiple selections on the Likert-type scale with the same number of responses, and hence no frequency can be calculated. We can conclude from the analysis of the data that on average the experts agree with specific reference to contributions from Internet sources. Selections made by the respondents are shown as a total for each selection available on the Likert-type scale used in the questionnaire and can be seen in the form of a bar-graph in Figure 31. Additional analysis of the data has been included in Table 27.

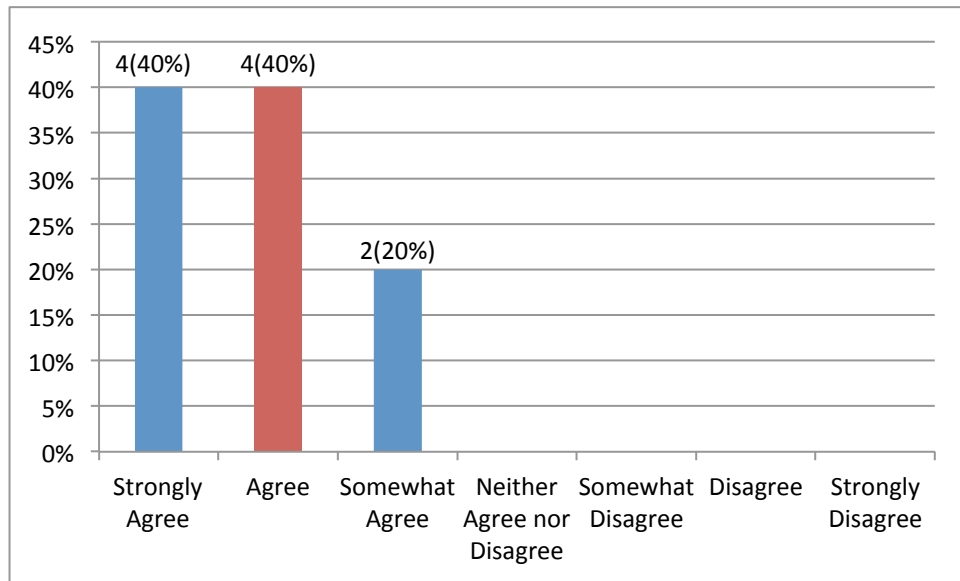


Figure 31: Biggest Contributors (Internet Sources)

The third question in the second research instrument was to see the contributions from colleagues in the industry towards continued learning content. The Likert-type data was analysed using an ordinal descriptive analysis. From the analysis of the data ($n = 10$, $SD = 0.84$, $median = 2$, $mode = 2$, $frequency = 5$), with a *median* value of 2, a *mode* value of 2 and a *frequency* value of 5, we can conclude that the highest number of responses (5) fell on Agree (2). Furthermore, the 25-75 percentile falls between Agree (2) and Somewhat Agree (3). We can conclude from the analysis that the experts agree that talking to colleagues in the industry contributes to continued learning. The options chosen by the respondents for this question can be seen in Figure 32 showing the total number of responses for each of the selections available on the Likert-type scale. Additional analysis of the data has been included in Table 27.

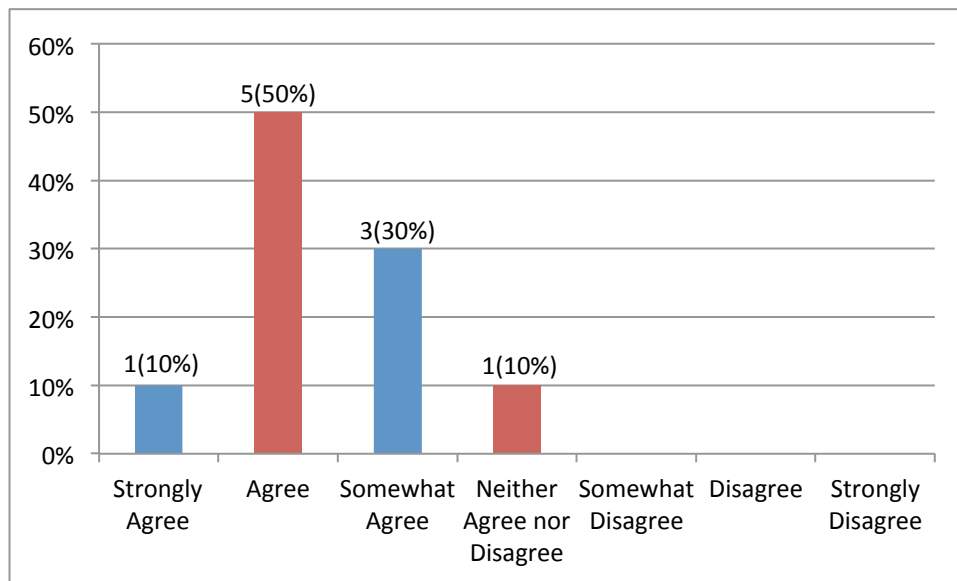


Figure 32: Biggest Contributors (Colleagues in the Industry)

The fourth question concerning biggest contributors to continued learning was to look at universities and industry conferences. The Likert-type data was analysed using an ordinal descriptive analysis to determine the median, mode and frequency values. From the analysis ($n = 10$, median 3, mode = 3, frequency = 6), with a median value of 3, a mode value of 3, and a frequency of 6, we can conclude that 60 percent of the responses fell on Somewhat Agree (3), and the 25-75 percentile fell between Agree (2), and Somewhat Agree (3). The conclusion can be drawn that on average the experts somewhat agree that universities and industry conferences play a role in continued learning. The responses from the survey is shown as a total number for each of the selections on the Likert-type scale can be seen in Figure 33. Additional analysis of the data has been included in Table 27.

Variable	Mean	Valid N	Median	Mode	Frequency of Mode	Minimum	Maximum
Reading	2.20	10.00	1.50	1.00	5.00	1.00	6.00
Internet Sources	1.80	10.00	2.00	multiple		1.00	3.00
Colleagues in the industry	2.40	10.00	2.00	2.00	5.00	1.00	4.00
Universities/Industry Conferences	2.80	10.00	3.00	3.00	6.00	1.00	6.00

Table 27: Biggest Contributors (Median, Mode and Frequency etc.)

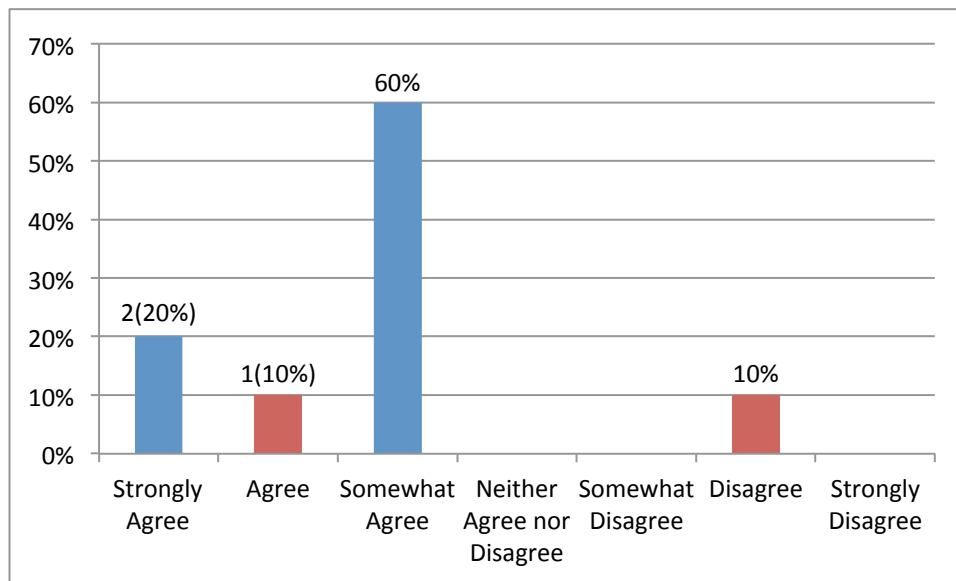


Figure 33: Biggest Contributors (Universities/Industry Conferences)

6.4 Best Approaches

To find out what the best approaches to continued learning would be, the second research instrument included seven Likert-type scale questions that would then be put to the experts. The questions would find out the best approaches to continued learning and included work experience, talking to colleagues, reading, Internet sources, lectures, workshops, and work-based training. The questions were not dependent upon one another and hence the data would be treated as Likert-type data when being analysed, using an ordinal descriptive analysis to determine the median, mode, and frequency values of the responses in the Likert-type scale.

The first question about the best approach specifically concerned work experience. From the analysis of the data using an ordinal descriptive analysis ($n = 10$, $median = 2$, $mode = 2$, $frequency = 6$), the *median* value is shown to be 2, a *mode* value of 2 and a *frequency* of 6, we can conclude that 60 percent of the responses fell on Agree (2). Furthermore, when considering the 25-75 percentiles, we notice they fall between Strongly Agree (1) and Agree (2). From this, we can conclude that the experts agree that work experience is considered a best approach. Figure 34 shows the total number of responses for each selection on the Likert-type scale in the form of a bar-graph. Additional analysis of the data has been included in Table 28.

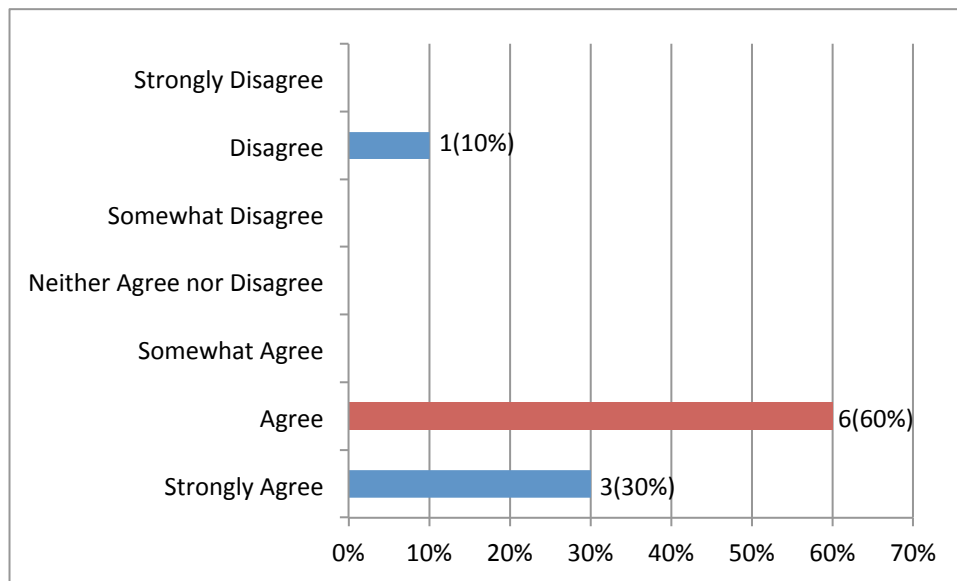


Figure 34: Best Approaches (Work Experience)

The second question dealing with best approaches to continued learning was about talking to professionals in the field, such as colleagues and other industry professionals. The Likert-type data was analysed using an ordinal descriptive analysis to determine the median, mode and frequency values. From the analysis ($n = 10$, $median = 2$, $mode = multiple$), with a *median* value of 2, the *mode* was calculated to be multiple; a value of multiple for *mode* shows that there were multiple selections on the Likert-type scale that had the same number of responses, and hence no frequency can be calculated. When looking at the 25-75 percentiles, the responses fall between Strongly Agree (1) and Agree (2); we can thus conclude that on average the experts agree that talking to professionals in the field of digital/computer forensics is considered a best approach. The total number of responses for each of the selections on the Likert-type scale is shown in the bar-graph on Figure 35. The data analysis results can be seen on a Box and Whisker plot in Figure 36 showing the median value in addition to the 25-75 percentiles. Additional analysis of the data has been included in Table 28.

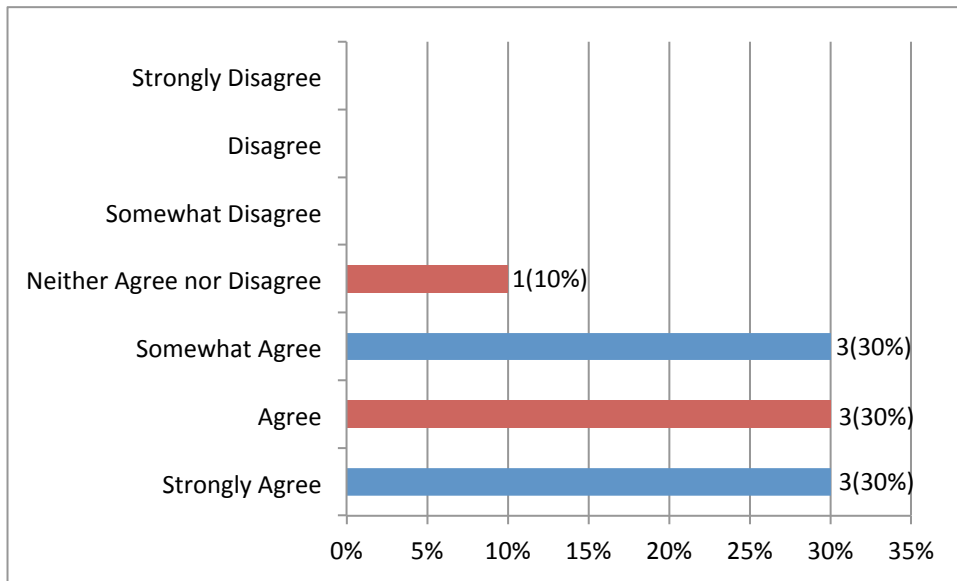


Figure 35: Best Approaches-Bar Graph (Professionals in the Field)

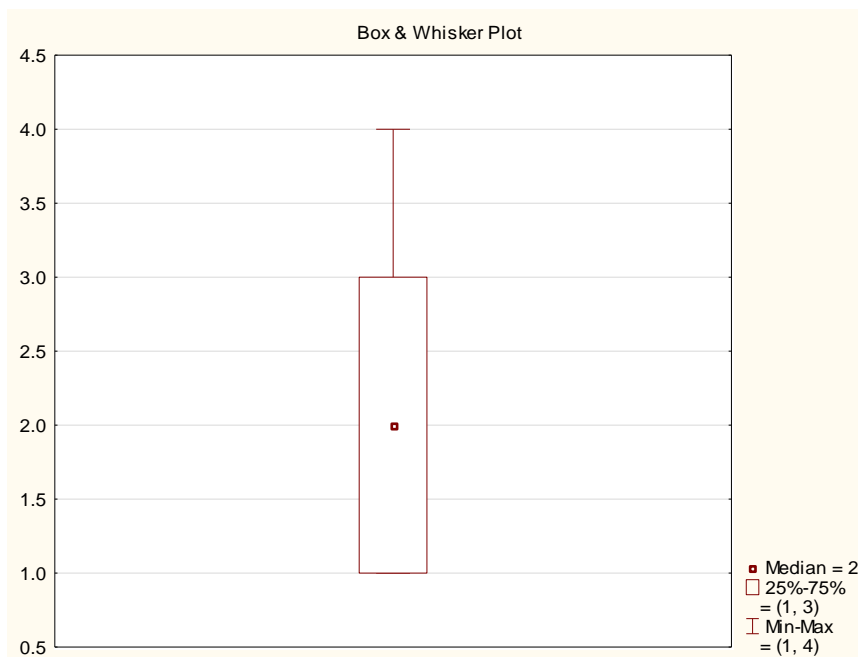


Figure 36: Best Approaches-Box and Whisker Plot(Professionals in the Field)

The third question looking at best approaches for continued learning was about reading books, journals, articles, and/or research conducted in the forensic field. The Likert-type data was analysed by the use of an ordinal descriptive analysis in order to find the media, mode and frequency values. From the analysis ($n = 10$, $median = 2$, $mode = 2$, $frequency = 6$), with a *median* value of 2, a *mode* value of 2 and a *frequency* of 6, we can conclude that the highest number of responses (6) fell on Agree (2) on the Likert-type scale. When analysing the 25-75

percentile, we see that the responses fell between Strongly Agree (1) and Agree (2). From the analysis, we can conclude that the experts agree that reading is a best approach to continued learning. Figure 37 shows the total number of responses for each of the selections on the Likert-type scale. Additional analysis of the data has been included in Table 28.

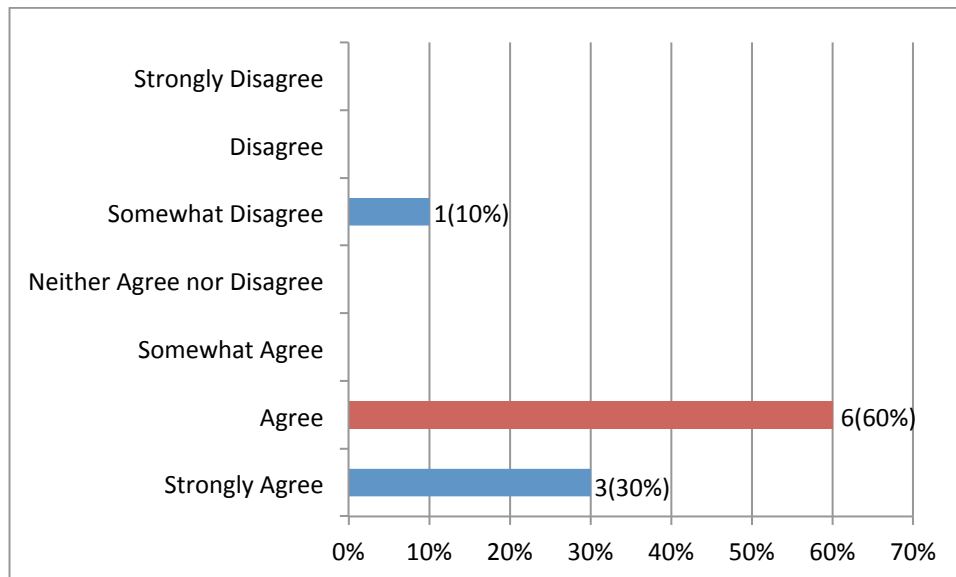


Figure 37: Best Approaches (Reading)

The fourth question about best approaches examined the contribution of Internet sources to continued learning. The data was analysed using an ordinal descriptive analysis in order to find the median, mode and frequency values. From the findings ($n = 10$, $median = 2$, $mode = 2$, $frequency = 5$), with a *median* value of 2, a *mode* value of 2 and a *frequency* of 5 we can conclude that the highest number of responses (50%) fell on Agree (2). The 25-75 percentile places findings between Strongly Agree (1), and Agree (2). From the findings, we can conclude that the experts agree that Internet sources are considered a best approach to continued learning. The number of the respondents choices on the Likert-type scale is shown on the bar-graph in Figure 38. Additional analysis of the data has been included in Table 28.

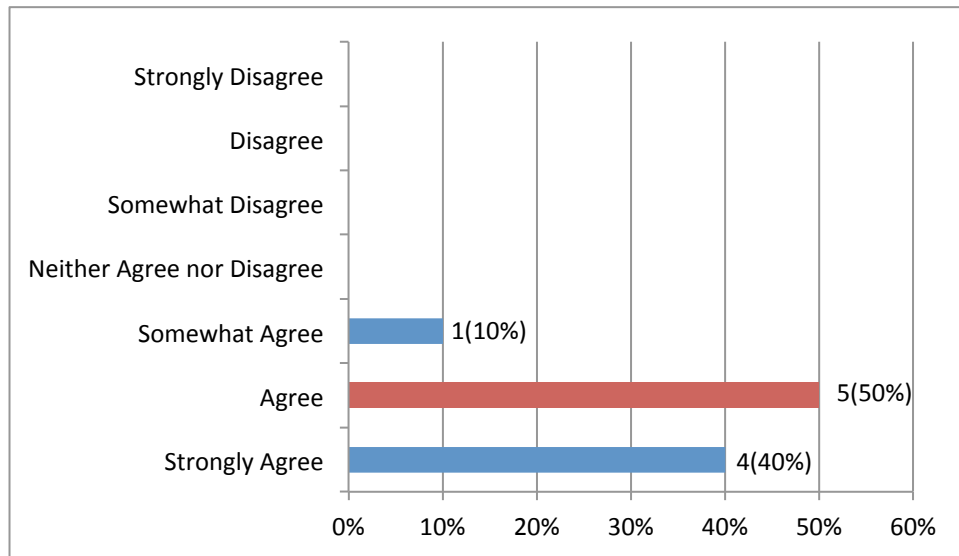


Figure 38: Best Approaches (Internet Sources)

The fifth question about best approaches to continued education considered lectures that are delivered in either a classroom or conference setting. The data obtained from the second research instrument was analysed using an ordinal descriptive analysis in order to obtain the median, mode and frequency values. The analysis ($n = 10$, $median = 2$, $mode = 2$, $frequency = 5$) shows a *median* value of 2, a *mode* value of 2 and a *frequency* of 5. We can conclude that the highest number of responses (50%) fell on Agree (2). The analysis of the 25-75 percentile falls between Agree (2) and Somewhat Agree (3). From the analysis, it can be concluded that on average lectures are agreed upon to be a best approach. The number of respondents selections against the Likert-type scale can be seen in Figure 39. Additional analysis of the data has been included in Table 28.

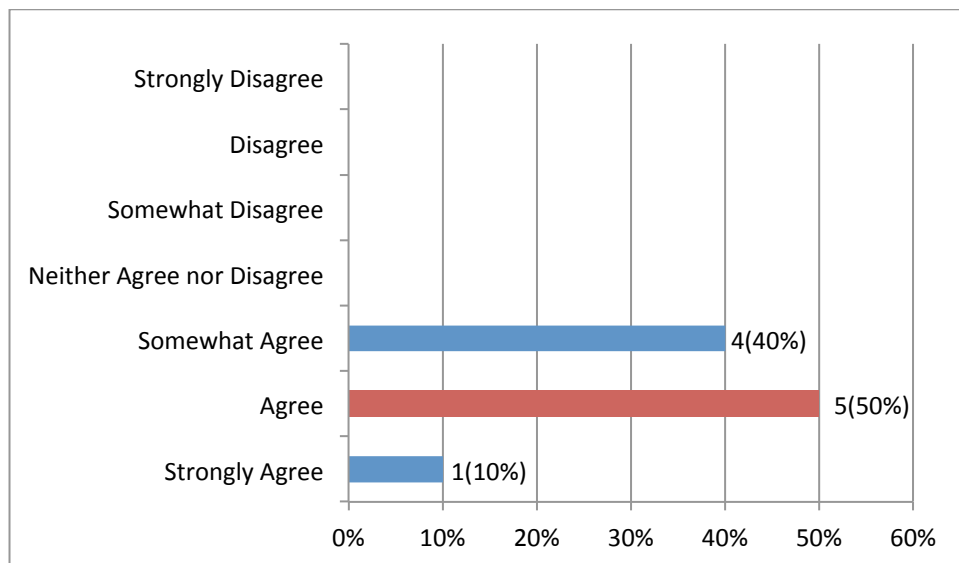


Figure 39: Best Approaches (Lectures)

The sixth question to look at best approaches dealt with workshops contributing to continued learning. The data obtained from the second research instrument was analysed using an ordinal descriptive analysis. From the analysis ($n = 10$, *median* 2, *mode* = 2, *frequency* =5) there is a *median* value of 2, a *mode* value of 2 and a *frequency* of 5. We can conclude that the highest number of responses (50%) fell on Agree (2). The analysis places the 25-75 percentiles between Strongly Agree (1) and Agree (2). From the analysis, we can therefore conclude that the experts agree that workshops are considered as a best approach to continued learning. The respondents choices can be seen on the bar-graph depicting the number of responses against the Likert-type scale can be seen in Figure 40.. Additional analysis of the data has been included in Table 28.

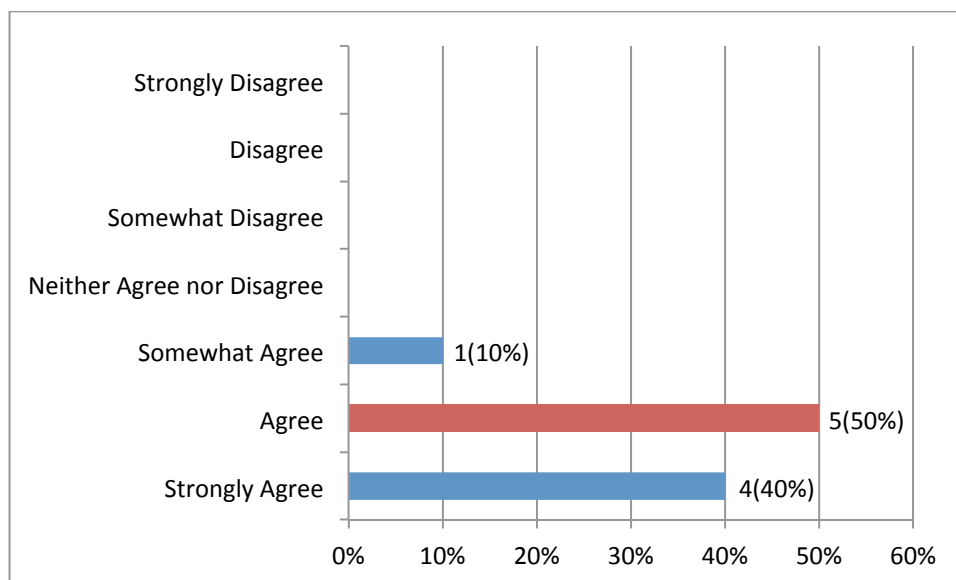


Figure 40: Best Approaches (Workshops)

The seventh question looking at the best approaches to continued learning was work-based training. The data collected during the second research instrument was analysed using an ordinal descriptive analysis in order to determine the median, mode and frequency values. The findings from the analysis ($n = 10$, *median* = 2, *mode* = 2, *frequency* =7) gave a *median* value of 2, a *mode* value of 2 and a *frequency* of 7. We can conclude that the highest number of responses (70%) fell on Agree (2). When studying the 25-75 percentiles, we notice the values fell between Strongly Agree (1) and Agree (2). This allows us to conclude that the participants agree that work-based training is considered a best approach. The number of responses against the Likert-type scale can be seen in the bar-graph in Figure 41. Additional analysis of the data has been included in Table 28.

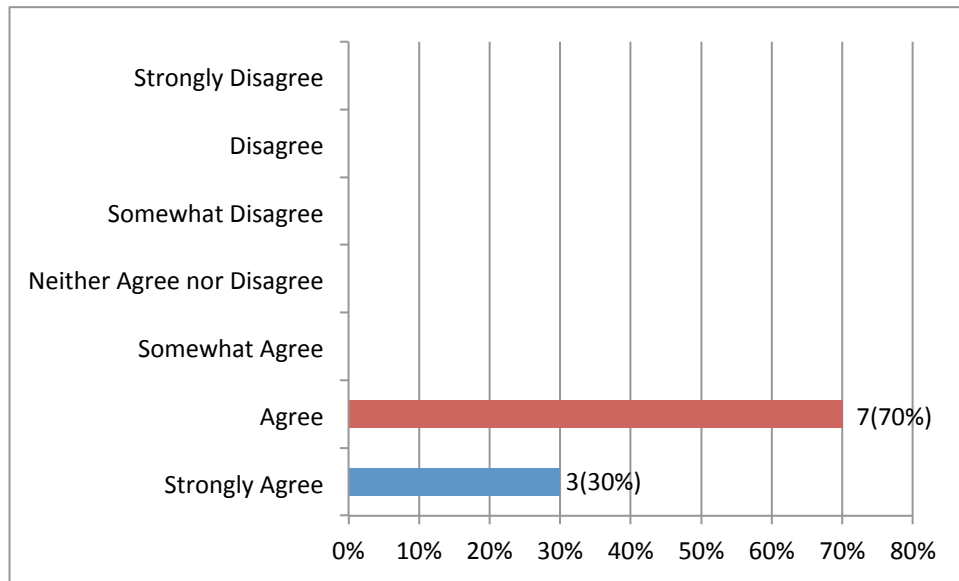


Figure 41: Best Approaches (Worked-Based Training)

Variable	Mean	Valid N	Median	Mode	Frequency of Mode	Minimum	Maximum
Work Experience	2.10	10	2.00	2.00	6	1.00	6.00
Talking to Professionals in the Field	2.20	10	2.00	multiple		1.00	4.00
Reading Books, Journals, Articles and/or Research in Field	2.00	10	2.00	2.00	6	1.00	5.00
On-line, Web Blogs, User Forums etc.	1.70	10	2.00	2.00	5	1.00	3.00
Lectures (Conferences or Classroom)	2.30	10	2.00	2.00	5	1.00	3.00
Workshops	1.70	10	2.00	2.00	5	1.00	3.00
Work Based Training	1.70	10	2.00	2.00	7	1.00	2.00

Table 28: Best Approaches (Median, Mode and Frequency etc.)

6.5 Summary of Delphi-Review Analysis

The second research instrument was compiled in order to perform a Delphi review. There were four distinct sections in the research instrument, namely re-evaluation period, responsibility for quality and curriculum, biggest contributors, and best approaches for continued learning activities and/or content. The data obtained from the second survey was analysed in order to be able to draw conclusions from the findings. The conclusion has been drawn that the re-evaluation period for continued learning in the field of digital/computer forensics should be three years. The analysis of the data also shows that there is a need for a regulatory body to exist to oversee continued learning activities.

The data showed that, specifically concerning the responsibility for curriculum content, the experts agreed that the governing body should have responsibility, the experts only somewhat agreed that tertiary institutions should take responsibility, and lastly the experts somewhat disagreed to government having any responsibility for the curriculum for continued learning activities. When analysing the data regarding responsibility for quality, the experts somewhat agreed that tertiary institutions and governing bodies could play a role, and lastly, that peer-reviews by academics and forensic practitioners could play a role in ensuring the quality of continued learning content.

The second research instrument also contained four questions with regard to the biggest contributors to continued learning content. The analysis of the data concludes that the experts agreed that reading, Internet sources and colleagues in the industry were the biggest contributors, but only somewhat agreed that universities and industry conferences were.

The final section of the second research instrument was to gather data regarding best approaches towards continued learning. From the data analysis, it was concluded that the experts agreed on average that work experience, talking to professionals, reading, Internet sources, lectures, workshops and work-based training were all best approaches to continued learning activities.

7. Proposed Approach for Digital Forensic Practitioners

The analysis of the data obtained from the first research instrument was used to compile a second research instrument, which then tested certain findings with experts. This verification was done using the Delphi-review. Delphi-reviews can go through any number of iterations. For the purpose of this research area, the review was to test the conclusions drawn from the first data analysis. The Delphi-review was grouped into four distinct sections, namely re-evaluation period, responsibility of quality and curriculum, biggest contributors, and best approaches to continued learning.

The re-evaluation period based on the responses should typically be three years. The period of three years is required in current certification such as IACISs, Certified Forensic Computer Examiner (CFCE), and Certified Advanced Windows Forensic Examiner (CAWFE). Other certification in the information technology field also has a three-year review period. The analysis of the responses on whether or not there should be an overseeing regulatory body showed that the experts agreed that one should exist.

Upon completion of the data analysis of the Delphi-review responses regarding where the responsibility lay in terms for quality of continued learning activities, the experts agreed that the governing body or peer-review consisting of academics and practitioners should take responsibility and the experts somewhat agreed that tertiary institutes should take responsibility. When analysing the data about where the responsibility lay for curriculum used for continued learning activities, the experts agreed that Government should have no role and that the governing body should take responsibility, while the experts somewhat agreed that tertiary institutions should take responsibility.

To understand how current practitioners conduct their own continued learning, it was deemed important to understand what the biggest contributors were to each individual participating in the research. The responses from the first research instrument were analysed and then the highest ranking (based on highest number of responses) were put to the experts to see how much they agreed with the findings. The biggest contributors to continued learning were agreed upon by the experts to be reading, Internet sources and colleagues in the industry, but the experts only somewhat agreed that universities and industry conferences were.

The Delphi-review also concluded that the experts agreed that the best approaches to continued learning activities were work experience, talking to professionals, reading, Internet sources, lectures, workshops and work-based training. When looking at the responses received from the Delphi review, many approaches are actually required for continued learning activities in the field of digital/computer forensics. When looking at the methods used in other professions, it can be concluded that for digital/computer forensics, a blended learning approach is required that includes knowledge sharing, the use of ICT, and classroom attendance to keep up to date with changes in the field.

The conclusion from the data analysis of data obtained during this research study is that at the present the approach of continued learning is very much self-driven. The findings concerning the best approaches and biggest contributors to continued learning activities published in this paper are based on, and verified by, experts in the field. When looking at the approaches used in other industries or disciplines, the findings can prove to be a good approach to any individual wanting to gain knowledge on changes in the digital/computer forensic discipline.

8. Conclusion

The study of the literature undertaken in this paper highlighted that one first needed to look at how other professions address continuous education, as this information can either aid or hinder the objectives of this study into continuous education of practitioners in the digital forensics profession. In addition to studying how other professions approach continued learning through various CPD programs, by studying other professions and research conducted in this regard, the questionnaire used to gather the quantitative data was identified and compiled. From the analysis of the data from the first research instrument, a follow-up Delphi-review questionnaire was compiled in order to verify the findings.

As the literature review has shown, there are no formal continued learning activities other than those required in order to maintain certification in the digital/computer forensic field, which for the most part is vendor specific. It was therefore important to understand what the driving force was behind digital/computer forensic practitioners continuing their own individual education, and what the biggest driving forces were. The analysis of the data showed the biggest driving forces to be changes in the industry (operating system, mobile device advancements etc.), career progression, skills gap (personal development), and changes in tools used in investigations. Studies in other areas also showed that an individual's involvement in continued learning activities was dependent on what barriers they faced. As a result, it was important to establish whether there were similar barriers faced by digital/computer forensic practitioners. The analysis of the data revealed that the biggest barriers were high workloads, cost of available learning initiatives, and availability of study leave.

Some conclusions could be drawn from the analysis of the data obtained from the first research instrument. There were hypotheses that required testing, as they had been proven to play a role in studies conducted in other professions in continued learning activities. As part of the data analysis, testing of the hypotheses included looking at whether or not factors such as age, gender, or location have any effect on continued learning, involvement obtaining tertiary education, or having formal training in digital/computer forensics. In terms of whether location played any role, the conclusions from tests showed that location had both an effect on tertiary education being obtained, and had an effect on involvement in continued

learning activity in the past five years. The hypothesis on location playing a role was proven for both South African as well as internationally-based participants.

Another hypothesis that was tested was to determine if the age group that participants belonged to played a role in whether or not they had obtained tertiary education, formal education or involvement in continued learning activities. In this instance, the analysis showed that age group was playing a role in whether or not they had received tertiary education or formal training in the field of digital/computer forensics. However, when testing the case of the role age played on continued learning activities in the past five years, thereby showing that age did not have any influence on the participants' involvement in continued learning activities.

When looking at the role of gender in tertiary education, formal education and continued learning activities in the past five years, no conclusions were drawn as part of the analysis. The number of female respondents was too low to gain any conclusive analysis on the participants.

When looking at the type of tertiary education or formal education that had been obtained by the participants, the majority had obtained tertiary qualifications in digital/computer forensics from a university, while some of the respondents had obtained formal qualifications from various institutions, namely BSides, IACIS, SANS institute, FBI, and the Canadian Police College.

8.1 Limitations

The only limitation that can be highlighted is that when conducting research of this nature, it would be possible to make the findings more conclusive with a higher number of participants. As this is the first research conducted looking specifically at continued learning approaches in digital/computer forensics, it has been noticed that a clear understanding is required regarding definitions; other studies looking specifically at continued learning in well-established disciplines have highlighted that the definition of continued education itself is unclear.

8.2 Recommendations for Further Studies

Based on the literature and looking at current initiatives in both the European Union and the United States of America, it is evident that in the field of forensic science there is significant focus on accreditation as well as certification. From a South African perspective, these efforts should be noted and possibly integrated in the way practitioners conduct investigations, in addition to ensuring a higher level of quality for practitioners testifying in a court of law. Research should be conducted into the recommendations that have come from the international initiatives and how they can be implemented in South Africa. Research should be done into the establishment of a governing body in South Africa for accrediting forensic practitioners to improve the level of quality from when evidence has been collected, to when it is analysed and documented and finally where it is presented in a court of law.

From the research conducted as part of this study, it is evident that experts in the field agree that a governing body should exist to oversee continued learning activities; research should be done to see how a governing body could be established; and funding, procedures, and accreditation of institutes that can give continued learning training need to be considered. The research conducted as part of this study has shown that experts agree that quality of content should be in consultation with academics and industry professionals, and research needs to be conducted to establish what is required to allow this to happen, should a governing body ever be established.

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Appendix A: Survey Instrument Including Logic

Continued Education: Digital Forensic Practitioners

OVERVIEW The purpose of this research is to analyse current methods being used for continued education within the field of digital/computer forensics. The survey consists of 20 questions in total, some of which will be displayed based on yes/no responses.

Background Section

Q1 Gender:

- Male (1)
- Female (2)

Q2 Geographic Location:

- South Africa (1)
- International(Other) Please Specify: (2) _____

Q3 Age Group:

- 20-29 (1)
- 30-39 (2)
- 40-49 (3)
- 50-59 (4)
- 60+ (5)

Q4 Are you currently practicing as a Digital/Computer Forensic Examiner, this could include fraud investigations?

- Yes (1)
- No (2)

Answer If Are you currently practicing as a Digital/Computer Forensic Examiner, this could include fraud investigations? Yes Is Selected

Q5 If you answered Yes to Question 4. Years in the Industry:

- Click to write Choice 1 (1)
- 1-5 Years (2)
- 5-10 Years (3)
- Longer than 10 Years (4)

Answer If Are you currently practicing as a Digital/Computer Forensic Examiner, this could include fraud investigations? No Is Selected

Q6 If you answered No to Question 4

- Currently a Student (1)
- Currently employed in another industry (2)
- Other (Please Specify) (3) _____

Q7 Formal Training or Tertiary Education in Digital/Computer Forensics:

- Yes (1)
- No (2)

Answer If Formal Training or Tertiary Education in Digital/Computer Forensics: Yes Is Selected

Q8 If Question 7 is Yes Please select appropriate:

- University (1)
- Technikon/University of Technology (2)
- College (3)
- Vendor Specific (4)
- Other (Please Specify) (5) _____

Continued Learning Involvement Section

Q9 Have you completed any continuous learning activities in the past 5 Years since completing your studies? Please select time band:

- Not Been Involved in Continued learning in the last 5 years (1)
- Last 12 Months (2)
- 12-24 Months (3)
- 24-36 Months (4)
- 36-48 Months (5)
- 48 – 60 Months (6)

Q10 Please select all applicable methods used for Continuous learning activities:

- CD ROM/DVD learning (1)
- Conference attendance (2)
- Vendor training or Vendor Documentation (3)
- Teaching (Classroom) (4)
- Conducting Research (5)
- Reading journals/articles (6)
- Reading Research conducted in Forensic Field (7)
- On-line Modules (Virtual Classroom) (8)
- On-line conferences (9)
- In-house Training (10)
- Court Proceedings (e.g. Case Law) (11)
- Reading books published in Forensics (12)
- Web-based subject content (such as Web Blogs or User Forums) (13)
- Other (Please Specify) (14) _____

Q11 What is the driving force behind your need to engage in continued learning? Please select all that applies

- Appraisals in the work place (1)
- Career Progression (2)
- Employer Requirement (Department/Section) (3)
- Discussions with colleagues (4)
- Customer feedback (5)
- Outcomes from investigations (6)
- Change in Case Law (7)
- Change in Legislation (8)
- Changing Tools used for investigations (9)
- Vendor Certification Requirement (Software/Hardware manufacturers) (10)
- Changes in Technology i.e. Operating Systems, mobile devices advancements (11)
- Industry Best Practice (12)
- Skills Gap (Personal Development) (13)
- Other (Please Specify) (14) _____

Approaches and Barriers to Continued Learning and Individual Approach

Q12 In your opinion which methods could be a valuable source that could be useful to aid with continued learning in the field of Digital/Computer Forensics? Please select all applicable methods:

- CD ROM/DVD learning (1)
- Conference attendance (2)
- Vendor training or Vendor Documentation (3)
- Teaching (Classroom) (4)
- Conducting Research (5)
- Reading journals/articles (6)
- Reading Research conducted in Forensic Field (7)
- On-line Modules (Virtual Classroom) (8)
- On-line conferences (9)
- In-house Training (10)
- Court Proceedings (e.g. Case Law) (11)
- Reading books published in Forensics (12)
- Web-based subject content (such as Web Blogs or User Forums) (13)
- Other (Please Specify) (14) _____

Q13 What approaches to learning work best for you?

- Work Experience (1)
- Work Based Training (2)
- Working in a group environment (3)
- Lectures (Conferences or Classroom) (4)
- On-line Course Work (5)
- Workshops (6)
- Reading (7)
- Simulation (8)
- Talking to professionals in the Field (e.g. Colleagues) (9)
- One-on-one training (10)
- Other (Please Specify) (11) _____

Q14 What Barriers affect your approach to Continued Learning? Select all that apply

- Availability of Study Leave (1)
- Cost of Available Learning Initiatives (2)
- Motivation (3)
- Past experiences (4)
- Workload too high (5)
- Other (Please Specify) (6) _____

Q15 Who or what contributes the most to your Continued Education?

- University/Industry Conferences (1)
- Vendor Training/Documentation (2)
- On-line Training (3)
- Other Internet Sources (4)
- Colleagues in the Industry (5)
- Reading (6)
- Other (Please Specify) (7) _____

Continued Learning Opinions

Q16 In your opinion should there be a regulatory body overseeing Continued Education in Computer Forensics (Similar to that done in field of Medicine)?

- Yes (1)
- No (2)

Answer If In your opinion should there be a regulatory body overseeing Continued Education in Computer Forensics (Similar to that done in field of Medicine)? Yes Is Selected

Q17 If you answered Yes to Question 16: What should the review period be?

- Ever year (1)
- Every 2 Years (2)
- Every 5 Years (3)
- Other Time Period in years (4) _____

Q18 Who should be responsible for the quality of Continued Learning in the field of Digital/Computer Forensics?

- Tertiary Institutions (Universities/Colleges) (1)
- Local training providers (such as software/hardware vendors, accredited training centers) (2)
- Specialist Institutions (3)
- Other (Please Specify) (4) _____

Q19 Who should decide on the Curriculum for Continued Learning in the field of Digital/Computer Forensics?

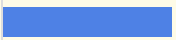

- Tertiary Institutions (Universities/Colleges) (1)
- Self-directed (training as required or desired) (2)
- Employers (3)
- Government (4)
- Governing Bodies (5)
- Other (Please Specify) (6) _____

Further Participation

Q20 If you would like to possibly participate in a follow-up survey or possible interview based on the findings of this survey, please enter in your email address. If you do not wish to participate in further surveys on this topic please leave the field blank.



Appendix B: Initial Report Generated by Qualtrics

1. Gender:

#	Answer		Response	%
1	Male		32	89%
2	Female		4	11%
	Total		36	100%






Statistic	Value
Min Value	1
Max Value	2
Mean	1.11
Variance	0.10
Standard Deviation	0.32
Total Responses	36

2. Geographic Location:



#	Answer		Response	%
1	South Africa		13	36%
2	International(Other) Please Specify:		23	64%
	Total		36	100%

International(Other) Please Specify:
Australia
Ireland
United Kingdom
Wales
Canada
Dublin Ireland
UK
EU
Ireland
The Netherlands
Netherlands
Europe
USA
UK
Ireland
Germany
Caribbean
Netherlands
Canada
Namibia
united states
Asia
India




Statistic	Value
Min Value	1
Max Value	2
Mean	1.64
Variance	0.24
Standard Deviation	0.49
Total Responses	36

3. Age Group:				
#	Answer		Response	%
1	20-29		4	11%
2	30-39		12	33%
3	40-49		10	28%
4	50-59		9	25%
5	60+		1	3%
	Total		36	100%



Statistic	Value
Min Value	1
Max Value	5
Mean	2.75
Variance	1.11
Standard Deviation	1.05
Total Responses	36

4. Are you currently practicing as a Digital/Computer Forensic Examiner, this could include fraud investigations?				
#	Answer		Response	%
1	Yes		18	50%
2	No		18	50%
	Total		36	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.50
Variance	0.26
Standard Deviation	0.51
Total Responses	36

5. If you answered Yes to Question 4. Years in the Industry:				
#	Answer		Response	%
1	Click to write Choice 1		0	0%
2	1-5 Years		4	22%
3	5-10 Years		6	33%
4	Longer than 10 Years		8	44%
	Total		18	100%

Statistic	Value
Min Value	2
Max Value	4
Mean	3.22
Variance	0.65
Standard Deviation	0.81
Total Responses	18

6. If you answered No to Question 4				
#	Answer		Response	%
1	Currently a Student		0	0%
2	Currently employed in another industry		10	56%
3	Other (Please Specify)		8	44%
	Total		18	100%

Other (Please Specify)
linux sysadmin / tester
Software Developer
Forensic Researcher (ADF Solutions Inc)
Seeking work
Academia
Research and Development
academic
Instructor for digital forensics examinations

Statistic	Value
Min Value	2
Max Value	3
Mean	2.44
Variance	0.26
Standard Deviation	0.51
Total Responses	18

7. Formal Training or Tertiary Education in Digital/Computer Forensics:

#	Answer	Response	%
1	Yes	26	72%
2	No	10	28%
	Total	36	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.28
Variance	0.21
Standard Deviation	0.45
Total Responses	36

8. If Question 7 is Yes Please select appropriate:

#	Answer	Response	%
1	University	21	81%
2	Technikon/University of Technology	3	12%
3	College	0	0%
4	Vendor Specific	10	38%
5	Other (Please Specify)	4	15%

Other (Please Specify)
DEFCON, BSides
IACIS, SANS, FBI
IACIS
Canadian Police College

Statistic	Value
Min Value	1
Max Value	5
Total Responses	26

9. Have you completed any continuous learning activities in the past 5 Years since completing your studies? Please select time band:

#	Answer	Response	%
1	Not Been Involved in Continued learning in the last 5 years	2	6%
2	Last 12 Months	19	61%
3	12-24 Months	3	10%
4	24-36 Months	1	3%
5	36-48 Months	3	10%
6	48 – 60 Months	3	10%
	Total	31	100%

Statistic	Value
Min Value	1
Max Value	6
Mean	2.77
Variance	2.18
Standard Deviation	1.48
Total Responses	31

10. Please select all applicable methods used for Continuous learning activities:				
#	Answer		Response	%
1	CD ROM/DVD learning		4	13%
2	Conference attendance		21	68%
3	Vendor training or Vendor Documentation		13	42%
4	Teaching (Classroom)		21	68%
5	Conducting Research		19	61%
6	Reading journals/articles		26	84%
7	Reading Research conducted in Forensic Field		18	58%
8	On-line Modules (Virtual Classroom)		11	35%
9	On-line conferences		5	16%
10	In-house Training		13	42%
11	Court Proceedings (e.g. Case Law)		7	23%
12	Reading books published in Forensics		17	55%
13	Web-based subject content (such as Web Blogs or User Forums)		25	81%
14	Other (Please Specify)		2	6%

Other (Please Specify)
Security related, but not forensics
Facebook Forensic Groups

Statistic	Value
Min Value	1
Max Value	14
Total Responses	31

**11. What is the driving force behind your need to engage in continued learning?
Please select all that applies**

#	Answer	Response	%
1	Appraisals in the work place	6	19%
2	Career Progression	20	65%
3	Employer Requirement (Department/Section)	10	32%
4	Discussions with colleagues	12	39%
5	Customer feedback	3	10%
6	Outcomes from investigations	13	42%
7	Change in Case Law	4	13%
8	Change in Legislation	7	23%
9	Changing Tools used for investigations	18	58%
10	Vendor Certification Requirement (Software/Hardware manufacturers)	8	26%
11	Changes in Technology i.e. Operating Systems, mobile devices advancements	23	74%
12	Industry Best Practice	15	48%
13	Skills Gap (Personal Development)	18	58%
14	Other (Please Specify)	5	16%

Other (Please Specify)
personal development
Knowing what threats are out there.
CISSP Requirement
I enjoy learning.
Professional Requirement

Statistic	Value
Min Value	1
Max Value	14
Total Responses	31

12. In your opinion which methods could be a valuable source that could be useful to aid with continued learning in the field of Digital/Computer Forensics? Please select all applicable methods:

#	Answer	Response	%
1	CD ROM/DVD learning	5	17%
2	Conference attendance	20	69%
3	Vendor training or Vendor Documentation	11	38%
4	Teaching (Classroom)	17	59%
5	Conducting Research	23	79%
6	Reading journals/articles	23	79%
7	Reading Research conducted in Forensic Field	18	62%
8	On-line Modules (Virtual Classroom)	17	59%
9	On-line conferences	11	38%
10	In-house Training	16	55%
11	Court Proceedings (e.g. Case Law)	10	34%
12	Reading books published in Forensics	20	69%
13	Web-based subject content (such as Web Blogs or User Forums)	21	72%
14	Other (Please Specify)	2	7%

Other (Please Specify)

shadowing existing Forensics to get on the job learnings and experiences (learning from what they are doing)

Mentoring

Statistic	Value
Min Value	1
Max Value	14
Total Responses	29

13. What approaches to learning work best for you?				
#	Answer		Response	%
1	Work Experience		23	79%
2	Work Based Training		12	41%
3	Working in a group environment		10	34%
4	Lectures (Conferences or Classroom)		15	52%
5	On-line Course Work		11	38%
6	Workshops		13	45%
7	Reading		19	66%
8	Simulation		9	31%
9	Talking to professionals in the Field (e.g. Colleagues)		22	76%
10	One-on-one training		7	24%
11	Other (Please Specify)		1	3%





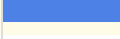


Other (Please Specify)
Performing my own research.

Statistic	Value
Min Value	1
Max Value	11
Total Responses	29

14. What Barriers affect your approach to Continued Learning? Select all that apply				
#	Answer		Response	%
1	Availability of Study Leave		11	38%
2	Cost of Available Learning Initiatives		14	48%
3	Motivation		4	14%
4	Past experiences		2	7%
5	Workload too high		19	66%
6	Other (Please Specify)		4	14%

Other (Please Specify)
Too little time for too many interesting things (subjects).
That should be "too high" (two Os)
None.
I don't really have any barriers.

Statistic	Value
Min Value	1
Max Value	6
Total Responses	29

15. Who or what contributes the most to your Continued Education?				
#	Answer		Response	%
1	University/Industry Conferences		11	38%
2	Vendor Training/Documentation		6	21%
3	On-line Training		4	14%
4	Other Internet Sources		13	45%
5	Colleagues in the Industry		13	45%
6	Reading		15	52%
7	Other (Please Specify)		2	7%

Other (Please Specify)
Conducting my own research.
Professional training events

Statistic	Value
Min Value	1
Max Value	7
Total Responses	29

16. In your opinion should there be a regulatory body overseeing Continued Education in Computer Forensics (Similar to that done in field of Medicine)?

#	Answer		Response	%
1	Yes		21	72%
2	No		8	28%
	Total		29	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.28
Variance	0.21
Standard Deviation	0.45
Total Responses	29

17. If you answered Yes to Question 16: What should the review period be?

#	Answer		Response	%
1	Ever year		4	19%
2	Every 2 Years		6	29%
3	Every 5 Years		9	43%
4	Other Time Period in years		2	10%
	Total		21	100%

Other Time Period in years
3
3

Statistic	Value
Min Value	1
Max Value	4
Mean	2.43
Variance	0.86
Standard Deviation	0.93
Total Responses	21

18. Who should be responsible for the quality of Continued Learning in the field of Digital/Computer Forensics?

#	Answer	Response	%
1	Tertiary Institutions (Universities/Colleges)	16	55%
2	Local training providers (such as software/hardware vendors, accredited training centers)	4	14%
3	Specialist Institutions	17	59%
4	Other (Please Specify)	6	21%

Other (Please Specify)
external professionals (consultants of high calibre)
Peer-review group comprised of academics and practitioners
Certification body.
Forensics Association
Self
Professional Body

Statistic	Value
Min Value	1
Max Value	4
Total Responses	29

19. Who should decide on the Curriculum for Continued Learning in the field of Digital/Computer Forensics?

#	Answer	Response	%
1	Tertiary Institutions (Universities/Colleges)	14	48%
2	Self-directed (training as required or desired)	8	28%
3	Employers	8	28%
4	Government	11	38%
5	Governing Bodies	17	59%
6	Other (Please Specify)	3	10%

Other (Please Specify)
 external professionals (consultants of high calibre)
 Peer-review group comprised of academics and practitioners
 Whomever is paying for it.

Statistic	Value
Min Value	1
Max Value	6
Total Responses	29

20. If you would like to possibly participate in a follow-up survey or possible interview based on the findings of this survey, please enter in your email address. If you do not wish to participate in further surveys on this topic please leave the field blank.

Statistic	Value
Total Responses	15

Appendix C: Continued Education-Delphi Review

Note Instructions: This is the Follow-up Survey for Continued Education for Digital Forensic Practitioners. The aim of the questions in this survey is to verify the findings from the initial survey. The majority of the questions use a Likert scale with 7 options ranging from "Strongly Agree" to "Strongly Disagree". Please select the one most suitable based on the question. Survey is best suited to be completed in a web browser, it can be attempted on a mobile device, but may not display correctly, depending on the devices display resolution. There are 19 Questions in this survey, should take approximately 10 minutes to complete.

Contributors for Individual Education-Delphi

Q1 Biggest Contributors Continued Education - Reading

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q2 Biggest Contributors to Continued Education - Internet Sources

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q3 Biggest Contributors to Continued Education - Colleagues in the industry

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q4 Biggest Contributors to Continued Education - Universities/Industry Conferences

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Continued Education Section-Delphi

Q5 Regulation Body overseeing Continued Professional Development. Majority (72%) of respondents from previous survey stated that there should be a regulatory body overseeing Continued Education in the Digital/Computer Forensic Field

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q6 Responsibility for Continued Education Curriculum - Tertiary Institutions

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q7 Responsibility for Continued Education Curriculum - Governing Bodies

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q8 Responsibility for Continued Education Curriculum - Government

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q9 Responsibility for Continued Education Quality - Tertiary Institutions

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q10 Responsibility for Continued Education Quality - Governing Bodies

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q11 Responsibility for Continued Education Quality - Peer Review Group comprised of Academics and Practitioners

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q12 Preferable Review period - Select review period you agree with the most

- Every 3 Years (1)
- Every 5 years (2)

Best Approaches for Continued Learning

Q13 Best approaches to Continued Learning - Work Experience

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q14 Best approaches to Continued Learning - Talking to Professionals in the Field (e.g. Colleagues)

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q15 Best approaches to Continued Learning - Reading Books, Journals, Articles and/or Research Conducted in the forensic field

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q16 Best approaches to Continued Learning - On-line, Web Blogs, User Forums etc.

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

Q17 Best approaches to Continued Learning - Lectures (Conferences or Classroom)

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

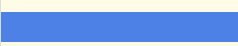



Q18 Best approaches to Continued Learning - Workshops

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)

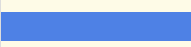


Q19 Best approaches to Continued Learning - Work Based Training

- Strongly Agree (1)
- Agree (2)
- Somewhat Agree (3)
- Neither Agree nor Disagree (4)
- Somewhat Disagree (5)
- Disagree (6)
- Strongly Disagree (7)



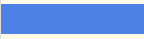

Appendix D: Continued Education-Delphi Review (Report)

1. Biggest Contributors Continued Education - Reading				
#	Answer		Response	%
1	Strongly Agree		5	50%
2	Agree		3	30%
3	Somewhat Agree		0	0%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		1	10%
6	Disagree		1	10%
7	Strongly Disagree		0	0%
	Total		10	100%



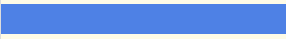

Statistic	Value
Min Value	1
Max Value	6
Mean	2.20
Variance	3.29
Standard Deviation	1.81
Total Responses	10

2. Biggest Contributors to Continued Education - Internet Sources				
#	Answer		Response	%
1	Strongly Agree		4	40%
2	Agree		4	40%
3	Somewhat Agree		2	20%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.80
Variance	0.62
Standard Deviation	0.79
Total Responses	10




3. Biggest Contributors to Continued Education - Colleagues in the industry				
#	Answer		Response	%
1	Strongly Agree		1	10%
2	Agree		5	50%
3	Somewhat Agree		3	30%
4	Neither Agree nor Disagree		1	10%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.40
Variance	0.71
Standard Deviation	0.84
Total Responses	10

4. Biggest Contributors to Continued Education - Universities/Industry Conferences				
#	Answer		Response	%
1	Strongly Agree		2	20%
2	Agree		1	10%
3	Somewhat Agree		6	60%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		1	10%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	6
Mean	2.80
Variance	1.96
Standard Deviation	1.40
Total Responses	10

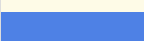



5. Regulation Body overseeing Continued Professional Development. Majority (72%) of respondents from previous survey stated that there should be a regulatory body overseeing Continued Education in the Digital/Computer Forensic Field

#	Answer		Response	%
1	Strongly Agree		1	10%
2	Agree		8	80%
3	Somewhat Agree		1	10%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	2.00
Variance	0.22
Standard Deviation	0.47
Total Responses	10

6. Responsibility for Continued Education Curriculum - Tertiary Institutions				
#	Answer		Response	%
1	Strongly Agree		0	0%
2	Agree		4	40%
3	Somewhat Agree		4	40%
4	Neither Agree nor Disagree		1	10%
5	Somewhat Disagree		0	0%
6	Disagree		1	10%
7	Strongly Disagree		0	0%
	Total		10	100%





Statistic	Value
Min Value	2
Max Value	6
Mean	3.00
Variance	1.56
Standard Deviation	1.25
Total Responses	10

7. Responsibility for Continued Education Curriculum - Governing Bodies				
#	Answer		Response	%
1	Strongly Agree		3	30%
2	Agree		4	40%
3	Somewhat Agree		2	20%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		1	10%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

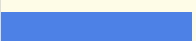



Statistic	Value
Min Value	1
Max Value	5
Mean	2.20
Variance	1.51
Standard Deviation	1.23
Total Responses	10

8. Responsibility for Continued Education Curriculum - Government				
#	Answer		Response	%
1	Strongly Agree		0	0%
2	Agree		2	20%
3	Somewhat Agree		0	0%
4	Neither Agree nor Disagree		1	10%
5	Somewhat Disagree		3	30%
6	Disagree		1	10%
7	Strongly Disagree		3	30%
	Total		10	100%

Statistic	Value
Min Value	2
Max Value	7
Mean	5.00
Variance	3.56
Standard Deviation	1.89
Total Responses	10

9. Responsibility for Continued Education Quality - Tertiary Institutions				
#	Answer		Response	%
1	Strongly Agree		1	10%
2	Agree		6	60%
3	Somewhat Agree		2	20%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		1	10%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	6
Mean	2.50
Variance	1.83
Standard Deviation	1.35
Total Responses	10

10. Responsibility for Continued Education Quality - Governing Bodies				
#	Answer		Response	%
1	Strongly Agree		4	40%
2	Agree		3	30%
3	Somewhat Agree		2	20%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		1	10%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	5
Mean	2.10
Variance	1.66
Standard Deviation	1.29
Total Responses	10

11. Responsibility for Continued Education Quality - Peer Review Group comprised of Academics and Practitioners

#	Answer	Response	%
1	Strongly Agree	4	40%
2	Agree	5	50%
3	Somewhat Agree	1	10%
4	Neither Agree nor Disagree	0	0%
5	Somewhat Disagree	0	0%
6	Disagree	0	0%
7	Strongly Disagree	0	0%
	Total	10	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.70
Variance	0.46
Standard Deviation	0.67
Total Responses	10

12. Preferable Review period - Select review period you agree with the most

#	Answer	Response	%
1	Every 3 Years	9	90%
2	Every 5 years	1	10%
	Total	10	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.10
Variance	0.10
Standard Deviation	0.32
Total Responses	10

13. Best approaches to Continued Learning - Work Experience

#	Answer	Response	%
1	Strongly Agree	3	30%
2	Agree	6	60%
3	Somewhat Agree	0	0%
4	Neither Agree nor Disagree	0	0%
5	Somewhat Disagree	0	0%
6	Disagree	1	10%
7	Strongly Disagree	0	0%
	Total	10	100%

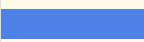


Statistic	Value
Min Value	1
Max Value	6
Mean	2.10
Variance	2.10
Standard Deviation	1.45
Total Responses	10

14. Best approaches to Continued Learning - Talking to Professionals in the Field (e.g. Colleagues)

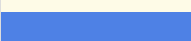


#	Answer	Response	%
1	Strongly Agree	3	30%
2	Agree	3	30%
3	Somewhat Agree	3	30%
4	Neither Agree nor Disagree	1	10%
5	Somewhat Disagree	0	0%
6	Disagree	0	0%
7	Strongly Disagree	0	0%
	Total	10	100%

Statistic	Value
Min Value	1
Max Value	4
Mean	2.20
Variance	1.07
Standard Deviation	1.03
Total Responses	10



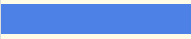
15. Best approaches to Continued Learning - Reading Books, Journals, Articles and/or Research Conducted in the forensic field

#	Answer		Response	%
1	Strongly Agree		3	30%
2	Agree		6	60%
3	Somewhat Agree		0	0%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		1	10%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

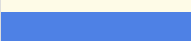


Statistic	Value
Min Value	1
Max Value	5
Mean	2.00
Variance	1.33
Standard Deviation	1.15
Total Responses	10

16. Best approaches to Continued Learning - On-line, Web Blogs, User Forums etc.				
#	Answer		Response	%
1	Strongly Agree		4	40%
2	Agree		5	50%
3	Somewhat Agree		1	10%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%



Statistic	Value
Min Value	1
Max Value	3
Mean	1.70
Variance	0.46
Standard Deviation	0.67
Total Responses	10

17. Best approaches to Continued Learning - Lectures (Conferences or Classroom)				
#	Answer		Response	%
1	Strongly Agree		1	10%
2	Agree		5	50%
3	Somewhat Agree		4	40%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	2.30
Variance	0.46
Standard Deviation	0.67
Total Responses	10

18. Best approaches to Continued Learning - Workshops				
#	Answer		Response	%
1	Strongly Agree		4	40%
2	Agree		5	50%
3	Somewhat Agree		1	10%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	3
Mean	1.70
Variance	0.46
Standard Deviation	0.67
Total Responses	10

19. Best approaches to Continued Learning - Work Based Training				
#	Answer		Response	%
1	Strongly Agree		3	30%
2	Agree		7	70%
3	Somewhat Agree		0	0%
4	Neither Agree nor Disagree		0	0%
5	Somewhat Disagree		0	0%
6	Disagree		0	0%
7	Strongly Disagree		0	0%
	Total		10	100%

Statistic	Value
Min Value	1
Max Value	2
Mean	1.70
Variance	0.23
Standard Deviation	0.48
Total Responses	10

Appendix E: Ethics Approval Request



UNIVERSITY OF CAPE TOWN
FACULTY OF COMMERCE
 Igniting Knowledge and Opportunity



Commerce Faculty Ethics in Research Committee

Any individual in the Faculty of Commerce at the University of Cape Town undertaking any research that involves the use of human subjects, or research that may hold ethical consequences for the University of Cape Town, is required to complete this form and obtain approval before conducting research. The completed form should be submitted as an electronic document to departmental Ethics Committee representatives for submission to the Commerce Faculty Ethics in Research Committee. Please also submit electronic copies of your research proposal, informed consent form or other information used to obtain consent, and any questionnaires other material shown to subjects.

1. PROJECT DETAILS

Project title: Continued Forensic Development-Investigation into Current Trends and Proposed Model for Digital Forensic Practitioners

Principal Researcher/s: Paul van Ramesdonk	Email address(es): Alberteinsteinza@gmail.com
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Research Supervisor: Adrie Stander	Email address(es): Adrie.Stander@uct.ac.za
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Brief description of the project:

The projects main objective is to look at how Continued Professional Development is being conducted in other industries where it may or may not be a legal requirement, also to see how practitioners of Digital/Computer Forensics currently approach continued learning/development if at all in order to draw up a framework to approach continued learning/development for Digital/Computer Forensic Practitioners.

Data collection: (please select)

Interviews Questionnaire Experiment Secondary data Observation

Other (please specify): _____

Procedure: (please describe)

Data will primarily be gathered through the use of an anonymous online survey. The conclusions deduced from the data collected will then be used to draw up a framework as a best way to approach continued learning in the field of Digital/Computer Forensics.

2. PARTICIPANTS

Characteristics of participants:

Gender:	<input type="text" value="Any"/>
Race / Ethnicity:	<input type="text" value="Any"/>
Age range:	<input type="text" value="Adults working or studied in the Dicipline of Digital/Computer Forensics"/>
Location:	<input type="text" value="South Africa/International"/>
Other:	<input type="text"/>

Race / Ethnicity:

Have you included a "**Prefer not to Answer**" response category in your questionnaire? (please select)

Yes No Not applicable

If you answered 'No' why not?

No questions will be asked regarding race or ethnicity

Affiliations of participants: (please select)

Company employees UCT staff General public UCT Students

Other (please specify): Digital Forensic practitioners and Experts

If your sample includes children (aged 18 and below), mentally incompetent persons, or legally restricted groups please explain below why it is necessary to use these particular groups. If subjects are minors or mentally incompetent, please describe how and by whom permission will be granted? If you are including children under the age of 18 and are not getting parental consent, please explain why you believe that their parents would consent if it was possible to contact them.

3. ORGANISATIONAL PERMISSION

If your research is being conducted within a specific organisation, please provide organisational permission or explain how permission will be obtained.

Are you making use of UCT students as respondents for your research? (please select) Yes No

If yes, have you contacted Executive Director: Student Affairs for permission? (please select) Yes No

Was approval granted? (please select) Yes No Awaiting a response

Are you making use of UCT staff as respondents for your research? (please select) Yes No

If yes, have you contacted Executive Director: Human Resources for permission? (please select) Yes No

Was approval granted? (please select) Yes No Awaiting a response

Contact Emails: Executive Director: Human Resources (Miriam.Hoosain@uct.ac.za)
Executive Director: Student Affairs (Moonira.Khan@uct.ac.za)

4. INFORMED CONSENT

What type of consent will be obtained from study participants?

- written consent
- anonymous survey
- oral consent (please justify)
- other (please specify)
- Oral Consent
- Written Consent
- Anonymous survey questionnaire (covering letter required, no consent form needed)
- Other (please specify) Anonymous Survey (No consent required) / Interviews
(Consent form to be completed)/ Covering Letter to be supplied for Both

How and where will consent/permission be recorded?

For the online survey, there will be a question for consent. When the research is conducted on the finding of the research is conducted in person with the forensic experts a written consent will be obtained.

5. CONFIDENTIALITY OF DATA

What precautions will be taken to safeguard identifiable records of individuals? Please describe specific procedures to be used to provide confidentiality of data by you and others, in both the short and long run. This question also applies if you are using secondary sources of data that is not anonymous.

The Survey to be conducted will be done anonymously and voluntary.

6. RISK TO PARTICIPANTS

Does the proposed research pose any physical, psychological, social, legal, economic, or other risks to study participants you can foresee, both immediate and long range? (please select)

Yes No

If yes, answer the following questions:

1. Describe in detail the nature and extent of the risk and provide the rationale for the necessity of such risks
2. Outline any alternative approaches that were or will be considered and why alternatives may not be feasible in the study

1.

What authorship agreement have you reached with your co-researchers or supervisor?

This research is not intended for publication

Standard authorship agreement (principal researcher first author, co-researcher(s) and supervisor(s) co-authors)

Customised agreement (please specify below):

I certify that we have read the the UCT Authorship Policy, and Commerce Faculty Authorship Guidelines (<http://www.commerce.uct.ac.za/Commerce/Information/research.asp>)


I certify that that the material contained herein is truthful and that all co-researchers and supervisors are **aware of the contents thereof.**

I understand that it is my responsibility to conduct research in accordance with the ethical requirements of **UCT.**

Applicant's signature:

Date: 26 October 2014

CHECKLIST	SELECT
A full copy of a research proposal or a literature review with methodology is attached	<input checked="" type="checkbox"/>
Research proposal/ interview schedules / cover letters / questionnaires / forms and other materials used in the study are attached/ consent form	<input checked="" type="checkbox"/>

Organisational consent letter / UCT student or staff approval letter	<input type="checkbox"/>
<p>On your cover letter to your questionnaire have you included the following?</p> <p>1. The following UCT Logo </p> <p>2. A sentence explaining the aim of the research</p> <p>3. Sentences of a similar nature to below must be included in the cover letter or consent form:</p> <p>This research has been approved by the Commerce Faculty Ethics in Research Committee.</p> <p>Your participation in this research is voluntary. You can choose to withdraw from the research at any time.</p> <p>The questionnaire will take approximately X minutes to complete</p> <p>You will not be requested to supply any identifiable information, ensuring anonymity of your responses.</p> <p>Due to the nature of the study you will need to provide the researchers with some form of identifiable information however, all responses will be confidential and used for the purposes of this research only.</p> <p>Should you have any questions regarding the research please feel free to contact the researcher (insert contact details).</p> <p>4. Have you scanned in your signature for the last section of the form?</p>	<p>NA <input type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p>OR</p> <p><input type="checkbox"/></p> <p><input checked="" type="checkbox"/></p> <p><input checked="" type="checkbox"/></p>

For Ethics committee representative only

Recommendation(s):

Signature:

Date:

For Ethics committee chairperson only

Recommendation:

Signature:

Date:

Appendix F: Covering 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/>

1 February 2015

Dear Sir/Madam,

I am currently enrolled as a part-time Masters student at the University of Cape Town (UCT) in the Department of Commerce: Information systems. A requirement of the course curriculum is that I need to complete a technical report on research. The research topic and data collection method has been approved by the UCT's Commerce Faculty Ethics in Research Committee.

The purpose of this research is to analyse current methods being used for continued education within the field of Digital/Computer Forensics. The data collected will then be used to compile a framework which could be used to improve and to assist with continued learning in this field.

Your participation in the research would be greatly appreciated. Any participation in this research is voluntary and all information provided as part of the research will be treated with the strictest confidentiality. No individual names will be recorded or 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 findings obtained from the research topic will be compiled in a technical report and presented to the University of Cape Town for academic purposes. None of the participant's details or the company that they represent will be published in any part of the paper. Copies of this research paper will be made available to all participants should they so desire.

Link or QR code to participate in the research survey is below, the survey should not take longer than 10 minutes to complete.



https://uccommerce.eu.qualtrics.com/SE/?SID=SV_06vozwUYBwm3TRb

Should you wish to receive a copy of the research paper please select the link or QR code below to add your email address.



https://ucpcommerce.eu.qualtrics.com/SE/?SID=SV_1Xjd0YIRHRRSst

Should you have any questions regarding this research, please feel free to contact me on +27 82 997 2058 or email: alberteinsteinza@gmail.com

Thank you for your valuable time and participation. Please feel free to distribute the survey to your colleagues, or people who you may think would like to participate in this research.

Sincerely,

Paul van Ramesdonk

Masters Student
Department of Information Systems
University of Cape Town

Adrie Stander

Research Supervisor
Department of Information Systems
University of Cape Town

Appendix G: Covering Letter Slide used at Conference

Continued Forensic Development-Investigation into Current Trends and Proposed Model for Digital Forensic Practitioners



University of Cape Town • (Yunivesithi yaseKapa • Universiteit van Kaapstad

Researcher: Paul van Ramesdonk (email: alberteinsteinza@gmail.com)

Supervisor: Adrie Stander

Institution: University of Cape Town-Master of Commerce, Information Systems Specializing in Computer Forensics

Research Survey Link

URL https://ucpcommerce.eu.qualtrics.com/SE/?SID=SV_06v0zWUYBwm3TRb

Shortened URL <http://goo.gl/VKuWTR>



Technical Report Link

URL https://ucpcommerce.eu.qualtrics.com/SE/?SID=SV_1Xjd0YIRHRRSst

Shortened URL <http://goo.gl/p8VABg>



Appendix H: Consent Form

Research Participant Consent Form

I, _____, consent to participate in the research Continued Forensic Development-Investigation into Current Trends and Proposed Model for Digital Forensic Practitioners.

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

Signature

Date

Appendix I: Ethics Approval

UNIVERSITY OF CAPE TOWN



Faculty of Commerce Ethics in Research Committee

Courier: Room 2.21 Leslie Commerce Building Upper Campus University of Cape Town

Post: University of Cape Town • Private Bag • Rondebosch 7701

Email: Irwin.brown@uct.ac.za

Telephone: +27 21 650-2311

Fax No.: +27 21 689-7570

January 7, 2015

Paul van Ramesdonk

Information Systems

Project title: Continued Forensic Development for Digital Forensic Practitioners

Proposal no. 3-2015

Dear Researcher,

This letter serves to confirm that this project as described in your submitted protocol has been approved. Approval is contingent upon adding information to the cover letter or consent form describing the amount of time the questionnaire will take.

Please note that if you make any substantial change in your research procedure that could affect the experiences of the participants, you must submit a revised protocol to the Committee for approval.

Regards,

Professor Harold Kincaid

Commerce Faculty Ethics in Research Committee