Abstract

There are a number of critical factors that will affect the success of new MSc programs in Digital / Computer Forensics and E-Discovery. This paper presents the idea that there are essential, basic criteria that need to be identified, defined and addressed from a student’s perspective when examining an MSc program in Digital / Computer Forensics and E-Discovery. This paper makes two contributions. The criteria presented in this paper can be used to help assess an existing MSc program from a student’s perspective and it can also be used as a guide to the development of new MSc programs.

1. Introduction

The digital revolution has had a profound impact on society. The result of this impact is a dependency on data in a digital format. This dependency has created a necessity for businesses, governmental agencies and law enforcement agencies to be able to examine digital evidence in order to prosecute violations of crimes or policy and even, in some situations, to help prevent crimes and acts of terrorism.

The industry need for research in the area of digital forensics is blatantly demonstrated through agency backlogs in both the United Kingdom and the United States. The time pressure, the deluge of data and constantly evolving technology translates into overworked and overloaded digital forensics analysts. This is supported via reports that computing forensic departments within the UK are seriously backlogged [9, 19] which stalls and impedes the progress of cases. This information is validated on the international scene via reports from the Office of the Inspector General on the FBI’s Innocent Images National Initiative (IINI) [16]. The report indicates that there were 353 requests at the end of the 2007 fiscal year not assigned or inventoried [16]. Given the limited resources available to departments and the speed at which technology progresses, there is a clear need for university graduate programs that produce competent and qualified personnel in this field.

This necessity has developed into a profession know as digital forensics. Digital forensics has been defined, according to Zatyko, by the Digital Forensic Research Workshop (http://dfrws.org/) as:

“the use of scientifically derived and proven methods toward the preservation, collection, validation, identification, analysis, interpretation, documentation, and presentation of digital evidence derived from digital sources for the purpose of facilitating or furthering the reconstruction of events found to be criminal, or helping to anticipate unauthorized actions shown to be disruptive to planned operations” [25].

To comply with the definition of digital forensics and respond to industry needs, institutions have implemented graduate programs [3-5, 8, 17, 21, 22]. Different programs have slightly different perspectives on the subject. As Taylor, et. al., [21] noted, there is no standard curriculum for MS programs. They identified a range of emphasis that included general forensics, legal aspects and computing aspects. Champlain’s program is an example that is heavily focused on business [11] while Portsmouth examines the psychological perspective [23].

The question that emerges for the development and instantiation of these new programs is their acceptance and perceived value from the student’s perspective. This paper summarizes the good, the bad and the ugly results of a focus group exercise identifying initial criteria that can be used to aid in the development of future programs and critique existing programs in the field of Digital / Computer Forensics and E-Discovery.

2. Program overview

As is described on the MSc in Computer Forensics and E-Discovery (CFED) Web site, sophisticated digital crimes put globally networked societies at risk. The increasing impact of computer crimes coupled with governmental backlogs highlights the need for highly skilled Digital Forensic Analyst (DFA). The
MSc programme in Computer Forensics and E-Discovery (CFED) tackles this problem through a blend of computer, legal and forensics tool expertise. This realistic unification provides the computer forensic analyst with the specialized knowledge necessary to analyze data in context, while adhering to the highest professional and ethical standards. The MSc environment is a fusion of taught courses, group projects, and stimulating research opportunities.

The University of Glasgow has successfully engineered and implemented the first year of an interdisciplinary Master of Science program in Computer Forensics and E-Discovery program. The degree is a collaborative effort between both the Humanities Advanced Technology and Information Institute (HATII) and the Department of Computer Science (DCS). It also incorporates staff in the legal profession from the University and neighboring institutions. The very nature of the field requires that students have a working knowledge of an array of topics that includes computer science topics, legislative topics, applied computer forensic topics and industry specific forensics tools.

2.1. Course paths and objectives

As described and taken verbatim from the program’s Web site [22], the core objectives and following information are provided as follows:

- Students are provided with the technical skills to investigate a variety of computer forensic problems and issues through the use of a dedicated lab and a variety of industry-grade computer forensic software tools.
- Students are not only exposed to current practices and processes; they are also encouraged to investigate new approaches and processes while questioning the validity and the dependability of their solutions.
- To cultivate research within the fields of Computer Forensics and E-Discovery effectively empowering students to conduct further study through autonomous academic research and/or industry-based practice research.

The course is offered on a full-time basis which is completed in a single year. It is offered on a part-time basis which is completed in two-years. To accommodate professionals who are interested in sharpening their skills in specific areas, specific classes in the program are offered on a Continuing Professional Development (CPD) basis.

2.2. Curriculum

These objectives are met by providing students with interaction from both digital forensics and security professionals. The students must complete ten core requirements totaling 180 credits to be awarded the MSc. These core requirements consist of four core classes, three technical classes, one research-focused class and one industry and research focused seminar. The credit structure for the course is summarized in Table 1 – Semester & Credit Structure.

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The course structure differs, slightly, from the typical masters courses in the United States. Full-time masters programs in the UK are, generally, designed to be completed in a year vs. the US which typically last for two years. An advantage that the US programs offer, resulting from the increased program length, is the ability to allow students to specialize in specific electives. Due to the compressed time schedule, UK MSc programs tend to inundate the student with a higher number of core classes.

On the Master’s level in the US, units are typically assigned in increments of three-hour courses. This, roughly, translates into one hour of lecture and five hours of study [7]. A typical semester on the graduate level requires three, three–hour courses which equates to a total of nine credit hours or fifty-four hours (six study hours times nine course hours) of commitment each week [7].

The United Kingdom subscribes to the idea of Notional Learning Hours. Notional Learning Hours (NLH) include everything from lectures, to labs, to study time [12]. Typically, one credit hour is equivalent to ten NLHs [18]. Hence, in the UK system the total credits for one CFED semester is sixty credits.
or six-hundred NLHs. The semester for this program runs for eleven weeks. Six-hundred hours over eleven weeks translates into fifty-four and a half NLHs per week. In theory, the overall UK commitment is equivalent to the estimated hours of commitment in the US. The difference is the overall number of subjects that students have to assimilate in a semester.

The CFED course stresses the basics needed to be a professional in the field by exposing students to the technical side of computer forensics, security and the legal aspects. This is achieved through the various classes culminating in the Research Methods and Professional Studies Seminars (RMPSS). RMPSS provides students with the opportunity to interact with industry professionals and academics in order to acquire a real world perspective on industry and research issues. The course exam is a blend of theory and practice, drawing information from everything they have experienced during the academic year. The aim is to help synthesize all of the information they have encountered throughout the year.

The individual class information that follows and the core information previously mentioned are both taken broadly from the University of Glasgow Web site [22]. It should be noted that the development of the majority of the information provided on the Web site was also the responsibility of one of the authors (Glisson). The class information is as follows:

### 2.2.1. Introduction to CFED

The introductory course provides students with the foundational knowledge necessary to conduct computer forensic investigations. The course will examine subjects along the lines of Basic Computer Information, IT concepts, PC Hardware, Disk Geometry, and various File Systems. It will also provide a broad overview of the legal and ethical issues. The course aims to develop the necessary technical skills while raising awareness of the ethical and moral implications presented to the analyst.

### 2.2.2. Legal and regulatory frameworks

Technical ability is not enough. Computer forensic practitioners need to understand the legal and regulatory framework. This includes seeing opportunities for computer forensic examinations, understanding evidential requirements and avoiding the legal pitfalls. This module offers a lawyer's perspective of the legal and regulatory framework relevant to the computer forensics industry.

### 2.2.3. Introduction to security

This course presents basic security concepts. The goal is to acquire an understanding of theories and the importance of concept application in developing both secure software and distributed applications. It is important to understand standard techniques used to solve security problems, to evaluate their effectiveness and make sensible choices among the alternatives. The class also examines the value of the human factors involved in security and security processes. This knowledge, taken in its entirety, contributes to the ability of students to access, analyze and report on security issues.

### 2.2.4. Systems & networks

The Systems and Networks module introduces the main levels of abstractions in a computer system. These include the underlying hardware and digital circuits; the instruction set architecture; the operating system and its interaction with the architecture; and computer networks, including the five-layer Internet architecture. The focus of the module is on how fundamental concepts work, providing a deeper understanding of the behavior of computer systems. Many characteristics of programming languages, operating systems and the web are derived from the foundational concepts covered in the module.

### 2.2.5. Computer forensics processes & investigative techniques

This course provides students with the necessary computer forensics processes and techniques knowledge to conduct an investigation. This will enable them to lead a forensic team, and liaise between computer engineers, clients and the legal profession. This interaction reinforces the technical skill learned in the first semester while providing students with the necessary management and administrative skills required to succeed.

### 2.2.6. Managing and presenting digital evidence

Managing and Presenting Digital Evidence (MPDE) gives the student both general and specific forensic project management experience. MPDE also imparts courtroom skills providing students with the ability to manage the complete forensic investigatory process from seizure to reporting.
2.2.7. Security & cryptography

The aim of the course is to develop an understanding of areas in which security and cryptography are important. This includes developing an understanding of standard protocols used to solve security problems. The evaluation of their effectiveness in various situations allows the analyst to make rational investigative decisions. This requires an understanding of the theoretical basis of standard cryptographic algorithms along with the critical analysis of similar algorithms. The course discusses the human factors involved in security and examines current trends in security and cryptography.

2.2.8. Advanced research readings in computing science

This course immerses students in research topics in computer forensics and related areas. In doing so, the course enables students to develop critical thinking and group discussion competence while providing them with the opportunity to practice presentation skills. Advanced research reading in computer science helps to sharpen their analytical skills and to prepare students for future research.

2.2.9. Research methods & professional studies seminars in computer forensics

The Research Methods and Professional Studies Seminars expose students to a wide range of researchers and research topics in an effort to expand their awareness of both theoretical and practical issues. This exposure prompts research idea discussions and places these ideas in the wider subject area context. Presenters typically consist of University researchers, relevant staff and industry professionals such as police, lawyers, forensics professionals, and security professionals.

2.2.10. Dissertation

In the summer session, students intending to pursue the MSc will complete a dissertation. The students chose a topic with a practical element and critically analyze the results in a 12,000 to 15,000 word dissertation.

3. Research strategy

The overall objective of this research is to elicit responses from the current students on the good, the bad and the ugly aspects of the newly implemented MSc program in Computer Forensics and E-Discovery at the University of Glasgow. The research strategy followed in this particular case is that of the case study.

A case study has been defined as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” [15, 24]. The types of case study that this proposal will utilize can be classified as both exploratory and descriptive [15]. The exploratory generally strives to understand a problem through real-life investigations. The results of which can be used in subsequent studies. The descriptive study leads to an analysis of a situation or environment which takes into account multiple perspectives.

The idea is to attempt to acquire a detailed insight into the successful aspects of the program, the aspects perceived not to be successful and to identify aspects deemed to be missing. Hence, the research needs to specifically cover course content from a breadth and depth perspective. It needs to examine the teaching format in terms of the balance of lectures and labs including teaching styles for the lectures, labs, and assignment feedback, as well as the course from a dissertation perspective.

3.1. Methodology

Data generation is defined as the “means by which you produce empirical data”[15]. The methods defined by Oates include observations, interviews, questionnaires and documents. Interviews provide researchers with the opportunity to obtain detailed information, pose questions that are complex and open-ended, and/or used to investigate information that responders may not want in writing, i.e., due to sensitivity. What Oates defines as group interviews could also be seen as focus groups. There are advantages and disadvantages to the collection of qualitative or quantitative data in any data generation method. The advantages and disadvantages noted by Oates [15] are echoed by Stewart, et. al., [20] in his discussion of focus groups.

As Stewart, et. al., notes, the results from focus groups have the potential to provide a balanced validity not always found in structured surveys and questionnaires [20]. The drawback is that there is the potential for a single individual to heavily influence the opinions of the group, coupled with the fact that qualitative results can be difficult to distill into generalizations or hard recommendations [20].

The purpose for conducting this research is the collection of qualitative data. The primary reasons for using a focus group vs. another vehicle for gathering
data is highlighted by the fact that focus groups have the potential to “…produce a very rich body of data expressed in the respondents’ own words and context” [20]. Student input is critical in the evaluation of the course content, teaching format, teaching style, assessment and feedback, and a dissertation preparation perspective. The idea is to deliver the content of the course in an effective and enjoyable manner. Hence, input from the students in the format of a focus group will allow them to speak openly about practices that they feel should be continued, eliminated and initiated.

The focus group was convened near the end of the second semester in March, 2009. Ideally, multiple focus groups should be implemented; one for each semester. However, due to time constraints and to avoid the real risk of focus group burnout, only one focus group was organized. The convening of multiple focus groups is deemed out-of-scope. Focus groups and group interviews generally have between six and twelve participants [15, 20] and last between one-and-a-half to two-and-a-half hours [20]. The focus group lasted two and one-half-hours. The participants were current students. Focus group participation was discussed in a lecture and held during an open research seminar time slot. The specific approach used to elicit information from the participants in the focus group consisted of asking general eliminate, initiate and continue styles of questions across the categories outlined in Table 2.

3.2. Focus group details and demographics

Even though the focus group took place during the last research seminar time slot, it was stressed to the participants that participation was voluntary. It was also stressed that the exercise was to obtain the participants perspective of the program, that they were not being examined and that only their opinions were being sought. The participants were offered a copy of the participant consent form, if they desired one. The participants were assured that the write-up would protect their anonymity by not disclosing personally identifiable information nor allow answers provided to influence individual interaction in the current program. The session was voice recorded for transcription and analysis purposes only.

In order to provide the reader with basic demographics, four questions were asked which included their age, sex, whether they have industry experience in computer forensics and whether they have industry experience in the legal field of E-Discovery. The results are summarized in Table 3 – Participant Information. For the purpose of this study, the total class size for the first year of this graduate program consisted of six students. There was one other part-time student who took specific classes throughout the year and is also a staff member. Since he/she did not take the entire program and is a staff member, he/she was excluded from this particular research exercise. The undergraduate degree backgrounds of the six students were in computing science, computer engineering, arts and media informatics, information technology, management and forensic science.

3.3. Focus group findings

The raw findings have been summarized in the areas of content, teaching format, teaching style, assessment and feedback and dissertation preparation.
3.3.1. Course content

When the group was asked if anything should be added to the course content, there were three main points surfaced. The first is that there needs to be more of an emphasis on different operating systems like Mac and UNIX. The second is an earlier introduction to mobile devices like phones, mp3 players, Global Positioning System (GPS) and Subscriber Identity Module (SIM) card recovery. The third point that appeared was the desire for work placements during the summer to help with the generation of dissertation ideas.

When the participants were asked about things that were being done well, in terms of content, the point that they really discussed was their enjoyment of the computer forensics research seminars. They really like hearing from industry practitioners, their perspective on relevant issues, their experiences and general advice. They also expressed approval of the exposure to the various tools and equipment throughout the class.

When asked what should be removed from a course content perspective, they indicated that the advanced reading class was too security focused and that they would like to see more of a forensics focus in terms of discussed articles.

They also indicated there was substantial overlap between the ‘Introduction to Security’ class offered in the first semester and the security and cryptography class offered in the second term. They also indicated that, from a format perspective, they would like to receive more information on the dissertation in the second semester vs. the first semester. One of the suggestions that came from this conversation is that they would like to see the technical content covered in the first semester and the integration of theory and practice in the second semester. Regarding the technical content, the participants took this opportunity to raise their frustrations with the poor performance of the current hardware and the negative impact on their ability to complete lab work.

3.3.2. Teaching format

When asked if we have the right balance of lectures and labs the students responded with a desire for more and longer labs. They also asked that the classes and the labs be blocked together as much as possible in the future. They requested that the labs be available twenty-four hours a day, seven days a week.

When asked about the lecturing format they indicated that they like the two-hour lecture schedule. When the inquiry was made about anything else we should be doing they asked for field trips that focus on company visits, working digital forensics labs and academic conferences.

3.3.3. Teaching style

When the participants were asked about things we should continue to do in reference to the teaching style, they indicated that they like being provided copies of the slides prior to the start of class. They also indicated that they liked the discussion atmosphere between the lecturer and the students. They liked the fact that questions posed during classes, that could not be answered immediately, were answered at the beginning of future classes. They also indicated that they like a specific essay assignment on live forensics.

In terms of what we should start doing in the delivery of classes, they indicated that we should use more analogies in the delivery of the teaching. They wanted to be told what material should be “highlighted” in relation to what is really important from an exam perspective. They wanted more visual aids in class and they asked for a tighter coordination between the introduction of the theory and the specific lab work.

3.3.4. Assessment and feedback

The things that the program should continue to do in terms of assessment and feedback include continuing to assign essays that complement lectures. The students also indicated that they liked the timed online quizzes that were given in the first semester. There was nothing mentioned specifically that the department should stop doing.

Students clearly expressed a desire to have departmental lecturers start to turn assignments around quicker; to have entire documents returned versus a mark sheet with comments; to outline explicit assignment expectations and to provide narrative feedback rather than bullet point structured feedback. They noted that the books listed in the library always seemed to be unavailable.

3.3.5. Dissertation preparation

When queried about the activities that currently support dissertation preparation they indicated that they like being forced to focus on a dissertation topic in the first semester. They also indicated that they like discussing conferences and information that was related to the discipline throughout various classes over the year. They indicated that there was nothing to eliminate, but there were several things they would like to see initiated. These included the creation of a
specific area so that students could upload relevant documents for others to read. They asked for a list of topics up front instead of having to go find one themselves. They asked for a broader exposure to topics in computing science. They asked for more support in the second semester through activities like required meetings with the supervisor. They also expressed concern about summer support.

4. Graduate student criteria for digital forensics academic programs

One of the quandaries with the development and instantiation of academic programs is that they serve many masters. This is especially true with programs that have a firm foundation in practical applications. Programs have to fulfill the academic perspective by pursuing relevant research and successfully acquiring research grants. In order to keep their graduates competitive in the market, programs also have to ensure that they are providing accurate and up-to-date information from a practitioner’s perspective. To keep the administration happy, programs have to keep enrollment at a certain minimum number of students.

As Biggs and Tang note, education has become a product evolving universities into large corporations that respond to market needs [2]. Hence, just as any business is governed by supply and demand, so are universities. Therefore, keeping the administration happy from a financial perspective makes a very important point. Academic programs cannot forget that they are now bound to the basic rules of business. These programs are providing a service to the customer. That customer in the academic environment is, obviously, the student. Hence, student perception of the programs has to be considered when examining an existing or starting a new curriculum. As Biggs and Tang pointed out, students are going to “demand assurance as to the quality of the product” [2].

The question then becomes what does an academic program use as a guide to help them effectively critique new and existing programs? The answer to this question is starting to be derived from the focus group for a new Computer Forensics and E-Discovery program. While the criteria are derived from a focus group held to investigate a new program in Digital / Computer Forensics and E-Discovery, it does not mean that they are not applicable to other academic programs. However, for the purpose of this discussion, the application of these criteria to other programs is considered out of scope. Graduate Student Criteria for Digital Forensics Academic Programs (GSC- DFAP) identifies four criteria as follows:

1. Resource and availability
2. Management of expectations
3. Practitioner and practical interactions
4. Subject focus

4.1. Resources and availability

In order for the students to maximize their potential grasp of the knowledge being presented in forensics programs, they need to be exposed to as much as possible from an academic, conceptual and an industrial tool perspective. Part of this exposure includes providing the students with hardware and software resources that are sufficient to do the required work within a reasonable time period. This may mean scaling back images and assignments so that you are working within available resources in order to get your point across to the students [2].

Addressing resources and availability also includes providing the students with the necessary resources from a library perspective and a facilities perspective. It was stressed in the focus group that students strongly desired more powerful lab machines and after-hours access to the labs in order to facilitate the development of their knowledge. They also expressed a desire to have classes and labs clustered together as much as possible during the week. They indicated that this would provide more coherent lab time.

It should be noted that as a result of the focus group’s frustration over the machines provided for the course work, coupled with first hand observation of the problems experienced, a new high specification machine is being prototyped during July for use in next year’s class. The prototype specifications include a dual boot machine with Windows XP, version 2002, service pack 3 and Ubuntu, version 9.04. The hardware specifications on the prototype consist of a 2.66 GHz Intel Nehalem processor with 8 GB of RAM, and a 1 TB hard drive.

It should also be mentioned that complete syllabi will be available at the beginning of each semester through Moodle. Moodle [13] is an open source course management tool that is utilized by the University of Glasgow. In an attempt to address library resource issues, multiple copies of some of the library books that were heavily utilized in the first semester have been requested along with certain books being moved to the reference only section. This will, hopefully, keep certain text books from leaving the library.

4.2. Management of expectations

Managing expectations of students and staff is critical in this environment to the overall success of the program. From the student’s perspective, the amount of support needs to be explicitly explained up-front. In
order to achieve this, there needs to be open communication between the department and the students. This can take the form of policies, procedures, or stated practices. However, if this is to be accomplished, it needs to be effectively communicated to the students. There also needs to be open communication between the individual lecturers and the students. This transmission of information can take place via handbooks, individual course syllabi, information posted on departmental Web sites or combinations of those distribution channels.

Management of expectations also encompasses assessment and feedback. The idea has been put forth that learning is “conceptualised as a process whereby students actively construct their own knowledge and skills” [1, 14] Another thought that has been put forth is that “Students interact with subject content transforming and discussing it with others in order to internalize meaning and make connections with what is already known” [14]. So, it stands to reason, the feedback students receive during the course of the program impacts their internalization process. The fact that students are requesting this information lends support to the idea that students assimilate this information in order to improve their learning. Research has also shown that feedback of information not only affects a student’s assimilation of the information but also has an impact on their motivation and beliefs [14].

This information leads to a very important point. The communication around the specifics of the feedback is significant. This is due to the fact that the feedback could potentially be complex in a digital forensics environment. Hence, as Higgins noted, students may need an opportunity to actively understand and construct meanings from the feedback through viewing feedback as a “process of communication” [10]. This would also include having a verbal conversation explaining the University grading system and making sure that they know where to find relevant documents on the subject.

Overall, this translates into a need for clear, concise, and timely communication of feedback with the students. It stresses the need to maintain open communication between lecturers and students regarding the amount of support they will be receiving for assignments.

4.3. Practitioner and practical interaction

The focus group revealed that even though the students were receiving two to three hours of lab work a week they desired to have more work. The group also asked for field trips and internships to go along with the research seminars where practitioners were brought in to discuss specific topics. This result supports two points raised by Biggs and Tang when discussing student motivation. They state that “1. It has to be important; it must have some value to the learner” [2] and “2 the learner needs to expect success when engaging the learning task” [2].

The majority of the labs in the first semester were not specifically graded. This allowed students to expect success in resolving the assigned task. Instead, the class was given two multiple choice quizzes during the course of semester that pertained to class work and lab work. The idea behind purposefully not grading individual lab work in the first semester was an attempt to encourage deep learning. They needed to understand the problem assigned to them and the relevant solutions in order to be able to apply the knowledge to another problem in the future. Some individual lab work was graded in the second semester; however, not all of it for the previously mentioned reasons.

Understanding the context of the lab work and points made by Biggs and Tang, above, complements the idea discussed in 4.2 Management of Expectations. Biggs and Tang [2] note that the concept they mentioned in reference to student motivation is known as the expectancy-value theory which was put forth by Feather [6]. Hence, you need to demonstrate the importance of the knowledge and set the expectations for success as part of the management of expectations. Then reinforce the point through practical interaction.

The research seminar course had a total of nineteen guest speakers. Out of that group, eleven were academicians discussing relevant research that they were conducting, one discussed necessary university procedures for ethical approval for research and seven were from industry. Of those seven, three were from various police departments, including the National High-Tech Crime Unit in Scotland, and the Strathclyde Police Department. Two practitioners discussed security in large organizations, one of which was the University of Glasgow. One of the practitioners runs his own digital forensics company in Scotland and the other is a Procurator Fiscal. In addition to the seminars, three guest speakers spoke during class times; two of which were from prominent companies that specialize in digital forensics or have entire departments that specialize in digital forensics. The third practitioner who spoke to the class specialized in training police officers in the field of forensics.

The students clearly see value in having a lot of hands-on experience in the labs. They also perceived value in the interactions with practitioners through the research seminars.
4.4. Subject focus

The need to specify subject focus, probably, surfaces due to the fact that the program is a cross-disciplinary effort. The program draws on resources available in the Department of Computing Science along with adjunct staff from the legal profession.

The students pointed out in the focus group that there was, in their opinion, too much cross over between the security classes. They also pointed out that they wanted more links between the labs and the lectures. The importance of highly integrated lectures and labs in digital forensics is echoed in a discussion of the digital forensics course offered at the Air Force Institute of Technology (AFIT) [17]. This response supports the idea and implementation of constructive alignment in higher education. In this case, lectures and labs are coordinated and implemented to “systematically align the teaching/learning activities, and the assessment task to the intended learning outcomes,”[2].

Two points that received rave reviews were discussions about conferences and practitioner exposure. The conversations and the encouragement to think about publishing in relevant conferences facilitates student thinking in a broader context. The industry exposure helps to keep the course grounded in reality. Both the industry exposure and the practitioner exposure help to encourage a deeper approach to learning which can create a range of positive feelings like interest, excitement, importance and exhilaration [2]. As an example, conferences can be used as a tool to spark a student’s interest, to help attach a sense of importance to their work, to present a challenge and, generally, make the learning activity exciting. The deep learning occurs in this scenario due to the students’ need to reflect on their activities and apply this knowledge to a conference scenario or to a discussion with a practitioner.

5. Conclusion and future work

Currently, the MSc in Computer Forensics and E-Discovery starts in September and runs for an entire year. The first year has been challenging and successful. Even though one of the students in the program has already been offered a position, prior to completion, as a forensic digital analyst in a large United Kingdom police force, there is an ongoing effort to stay congruent with practitioner, academic and student requirements. This includes continually assessing the relevance and realistic nature of lecture materials, lab assignments and practitioner exposure. The reality of the digital world is that societal dependence on the digital environment has made radical paradigm shifts in the functionality of societies. This increasing dependency solidifies the need for programs that teach people how to investigate digital issues from a forensics perspective.

Some of the issues identified in this paper have been covered, to some extent, as solitary issues of importance in the field of learning and teaching. However, they have not been identified as a group of criteria specifically pertaining to graduate programs in Digital / Computer Forensics and E-Discovery. The criteria identified present the foundation for additional research in the area of teaching and learning in digital forensics and e-discovery.

Acknowledgement of the obligations placed on academic graduate programs in the field of digital forensics necessitates a discussion focusing on the criteria important from the students’ perspective. The focus group identified four criteria that should be examined when planning a new program or critiquing an existing program in digital forensics. The Graduate Student Criteria for Digital Forensics Academic Programs (GSC-DFAP) are:

1. Resource and availability
2. Management of expectations
3. Practitioner and practical interactions
4. Subject focus.

This does not mean that the list of criteria identified in this research is exhaustive or conclusive or that the criteria are mandatory for a program to operate successfully. However, their presence will potentially improve the students overall program experience. A lack of integration of the student’s perspective into the operations of a program creates an environment that is conducive to alienating the programs client base. The ripple effect of alienation could have potentially damaging ramifications for the viability of programs in Digital Forensics.

Future work in this area should include repeating the focus group with next year’s class. It will be run with the same questions and at approximately the same time during the year. Future work should also examine the needs of the practitioners in order determine the skill sets deem necessary for graduate students in an MSc program. A separate case study should investigate University needs to identify strategic points of synergy and conflict.
6. References


